

Cambridge International O Level Chemistry

Question Papers

Paper #1



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CONTENTS

5070_s21_qp_12

5070_s20_qp_12

5070_s19_qp_12

5070_s18_qp_12

5070_s17_qp_12

5070_s16_qp_12

5070_s15_qp_12

5070_s14_qp_12

5070_s13_qp_12

5070_s12_qp_12

5070_s11_qp_12

5070_s10_qp_12

5070_w21_qp_12

5070_w20_qp_12

5070_w19_qp_12

5070_w18_qp_12

5070_w17_qp_12

5070_w16_qp_12

5070_w15_qp_12

5070_w14_qp_12

5070_w13_qp_12

5070_w12_qp_12

5070_w11_qp_12

5070_w10_qp_12



UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS
General Certificate of Education Ordinary Level

CHEMISTRY

5070/12

Paper 1 Multiple Choice

May/June 2010

1 hour

Additional Materials: Multiple Choice Answer Sheet
 Soft clean eraser
 Soft pencil (type B or HB is recommended)



READ THESE INSTRUCTIONS FIRST

Write in soft pencil.

Do not use staples, paper clips, highlighters, glue or correction fluid.

Write your name, Centre number and candidate number on the Answer Sheet in the spaces provided unless this has been done for you.

There are **forty** questions on this paper. Answer **all** questions. For each question there are four possible answers **A, B, C** and **D**.

Choose the **one** you consider correct and record your choice in **soft pencil** on the separate Answer Sheet.

Read the instructions on the Answer Sheet very carefully.

Each correct answer will score one mark. A mark will not be deducted for a wrong answer.

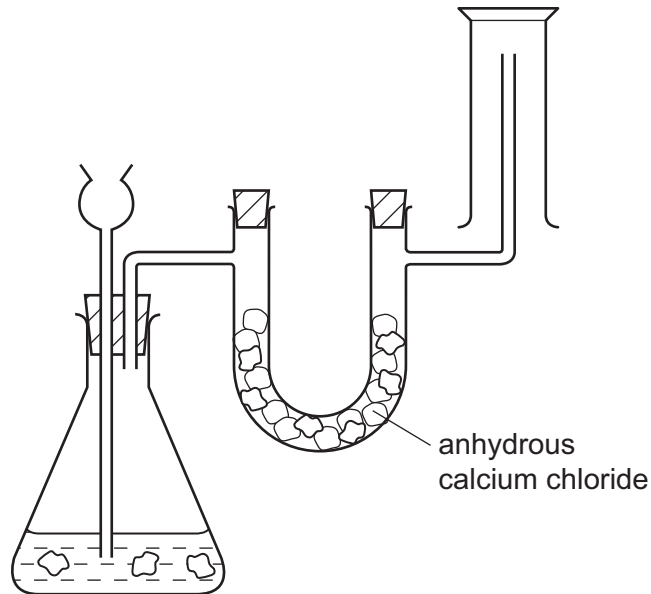
Any rough working should be done in this booklet.

A copy of the Periodic Table is printed on page 16.

This document consists of **16** printed pages.



- 1 The diagram shows a simple laboratory apparatus for the preparation and collection of a dry gas.



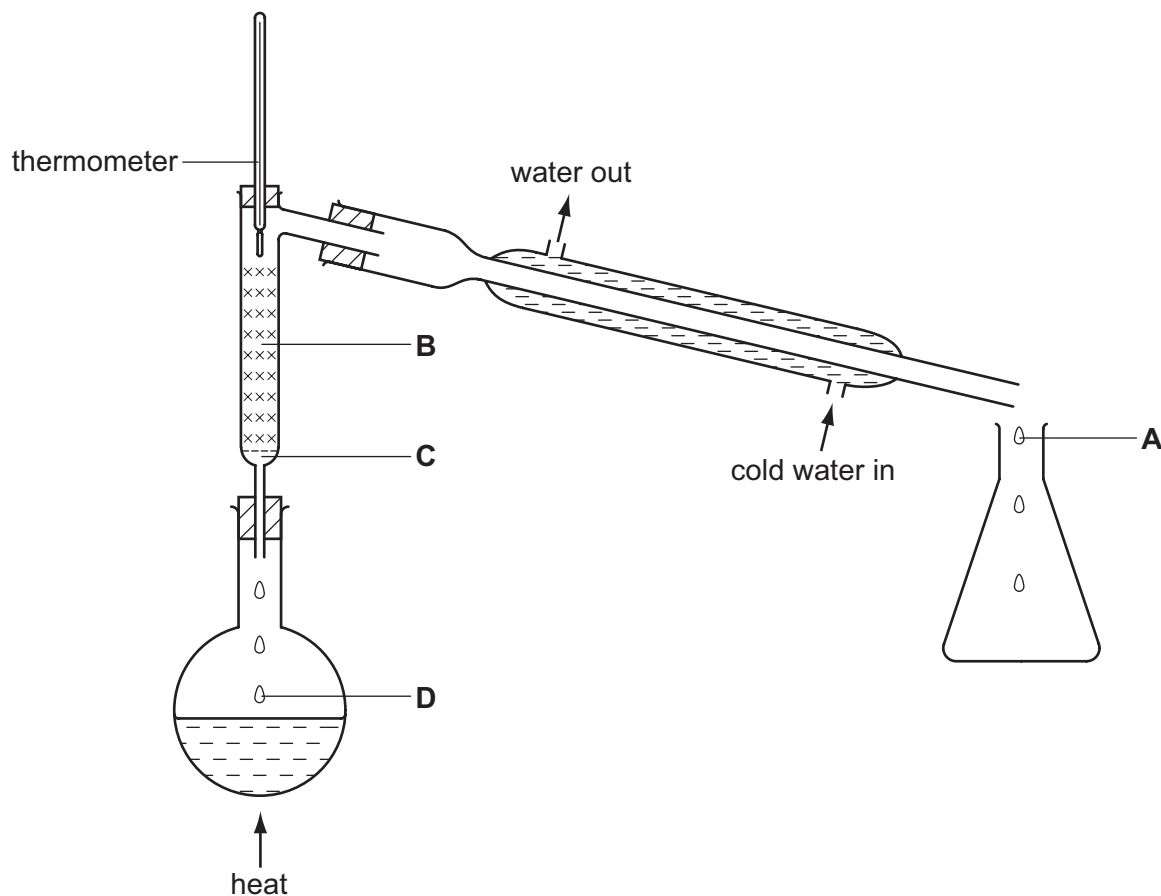
What is the gas?

- A carbon dioxide
 B chlorine
 C hydrogen
 D hydrogen chloride
- 2 What correctly describes the molecules in **very dilute** sugar solution at room temperature?

	sugar molecules	water molecules
A	close together, moving at random	close together, moving at random
B	widely separated, moving at random	close together, moving at random
C	widely separated, moving at random	close together, not moving
D	widely separated, not moving	widely separated, moving at random

- 3 A mixture containing equal volumes of two liquids that mix completely but do not react together is placed in the apparatus shown and heated until the thermometer first shows a steady reading.

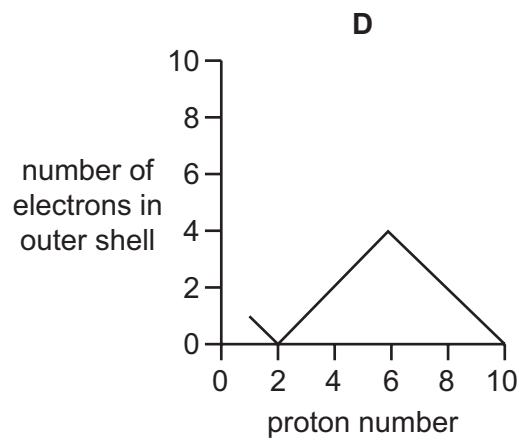
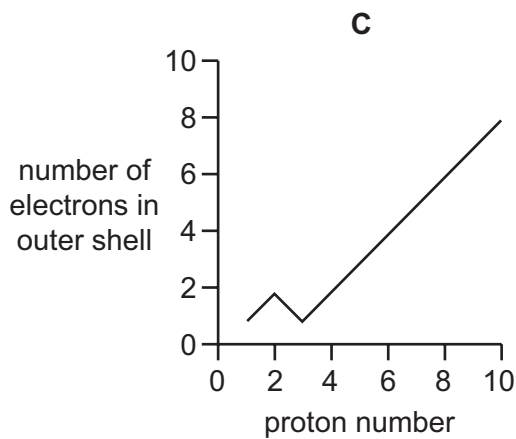
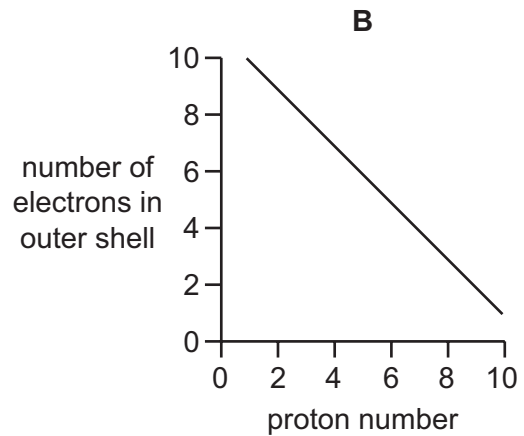
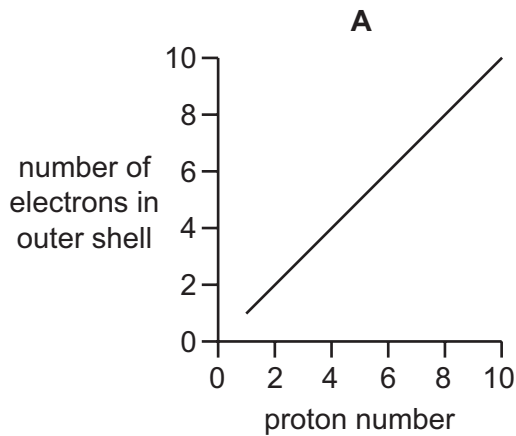
At which position will there be the highest proportion of the liquid with the higher boiling point?



- 4 Which is an anion that is present in the solution formed when an excess of dilute hydrochloric acid is added to calcium carbonate?

A Ca^{2+} B Cl^- C CO_3^{2-} D H^+

- 5 Which graph shows the number of electrons in the outer shell of an atom, plotted against the proton (atomic) number for the first ten elements in the Periodic Table?

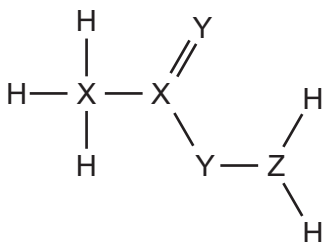


- 6 A metal consists of a lattice of positive ions in a 'sea of electrons'.

What changes, if any, take place to the electrons and positive ions in a metal wire when an electric current is passed through it?

	electrons	positive ions
A	replaced by new electrons	replaced by new ions
B	replaced by new electrons	unchanged
C	unchanged	replaced by new ions
D	unchanged	unchanged

- 7 Which pair of elements, when combined together, do **not** form a covalent compound?
- A** caesium and fluorine
B nitrogen and chlorine
C phosphorus and fluorine
D sulfur and chlorine
- 8 The diagram shows the structure of a covalent compound containing the element hydrogen, H, and the unknown elements X, Y and Z.

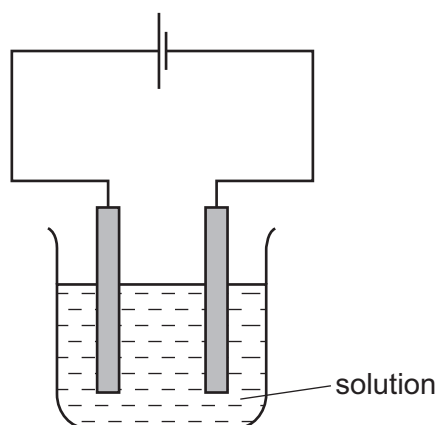


To which groups of the Periodic Table do these three elements, X, Y and Z, belong?

	X	Y	Z
A	1	5	6
B	4	5	1
C	4	6	5
D	5	1	4

- 9 Two different hydrocarbons each contain the same percentage by mass of hydrogen. It follows that they have the same
- A** empirical formula.
B number of isomers.
C relative molecular mass.
D structural formula.
- 10 What is the mass of one mole of carbon-12?
- A** 0.012g **B** 0.024g **C** 1g **D** 12g

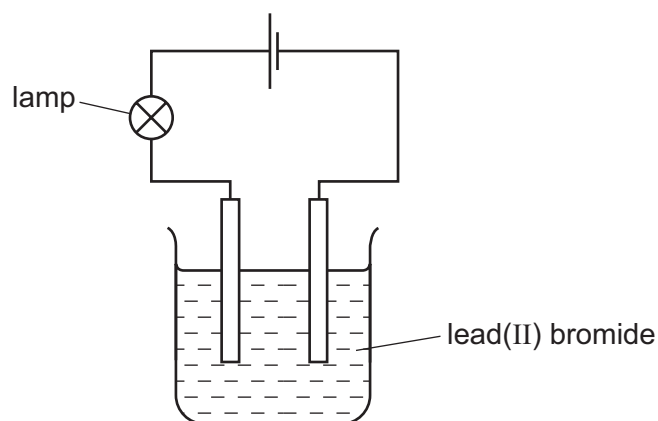
- 11 The diagram shows the electrolysis of a concentrated aqueous solution containing both copper(II) ions and sodium ions.



Which metal is deposited at the negative electrode and why?

	metal deposited	reason
A	copper	copper is less reactive than sodium
B	copper	copper is more reactive than hydrogen
C	sodium	copper is less reactive than hydrogen
D	sodium	copper is more reactive than sodium

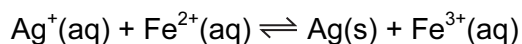
- 12 The diagram shows the apparatus used to electrolyse lead(II) bromide using inert electrodes.



Why does the lamp light up only when the lead(II) bromide is melted?

- A** Bromine atoms in the lead(II) bromide are converted to ions when it is melted.
B Electrons flow through the lead(II) bromide when it is melted.
C The ions in lead(II) bromide are free to move only when the solid is melted.
D There are no ions in solid lead(II) bromide.

- 13 When a solution containing silver ions is added to a solution containing iron(II) ions, an equilibrium is set up.



The addition of which substance would **not** affect the amount of silver precipitated?

- A $\text{Ag}^+(\text{aq})$ B $\text{Fe}^{2+}(\text{aq})$ C $\text{Fe}^{3+}(\text{aq})$ D $\text{H}_2\text{O}(\text{l})$
- 14 Which reaction does **not** involve either oxidation or reduction?

- A $\text{CH}_4(\text{g}) + 2\text{O}_2(\text{g}) \rightarrow \text{CO}_2(\text{g}) + 2\text{H}_2\text{O}(\text{g})$
 B $\text{Cu}^{2+}(\text{aq}) + \text{Zn}(\text{s}) \rightarrow \text{Cu}(\text{s}) + \text{Zn}^{2+}(\text{aq})$
 C $\text{CuO}(\text{s}) + \text{H}_2\text{SO}_4(\text{aq}) \rightarrow \text{CuSO}_4(\text{aq}) + \text{H}_2\text{O}(\text{l})$
 D $\text{Zn}(\text{s}) + \text{H}_2\text{SO}_4(\text{aq}) \rightarrow \text{ZnSO}_4(\text{aq}) + \text{H}_2(\text{g})$

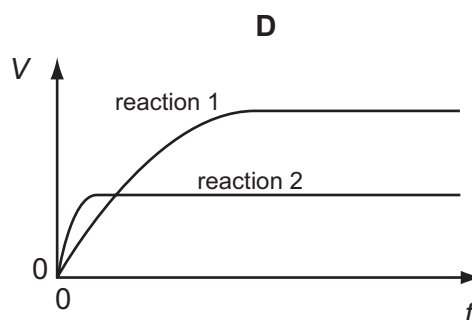
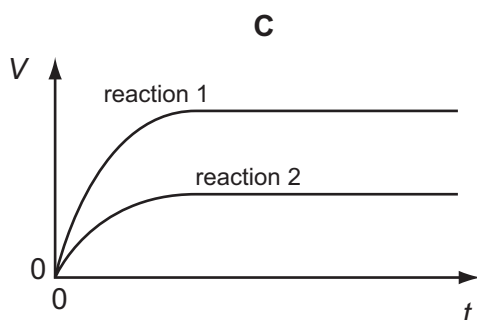
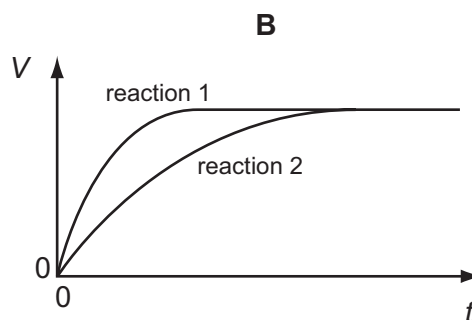
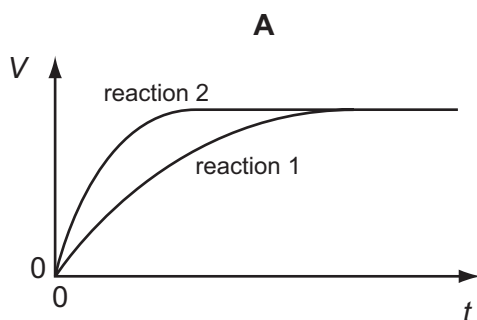
- 15 A student performs two reactions.

reaction 1 10 g of magnesium ribbon with excess 2.0 mol/dm^3 dilute hydrochloric acid

reaction 2 5 g of magnesium powder with excess 2.0 mol/dm^3 dilute hydrochloric acid

In both experiments, the volume of hydrogen produced, V , is measured against time, t , and the results plotted graphically.

Which set of graphs is correct?



16 Which statement about catalysts is correct for a typical equilibrium reaction?

- A A catalyst can be either an inorganic or an organic species.
- B A catalyst does not take part in the reaction.
- C A catalyst only speeds up the forward reaction.
- D A catalyst provides the energy required to start a reaction.

17 Which pair of compounds could be used in the preparation of calcium sulfate?

- A calcium carbonate and sodium sulfate
- B calcium chloride and ammonium sulfate
- C calcium hydroxide and barium sulfate
- D calcium nitrate and lead(II) sulfate

18 Titration of an acid against a base is a method often used in the preparation of salts.

Which properties of the acid, the base and the salt are required if this method is to be used?

	acid	base	salt
A	insoluble	insoluble	insoluble
B	soluble	insoluble	insoluble
C	soluble	soluble	insoluble
D	soluble	soluble	soluble

19 A metal reacts with dilute hydrochloric acid to produce a gas.

What is used to identify this gas?

- A a glowing splint
- B a lighted splint
- C damp blue litmus paper
- D limewater

- 20 The oxide of an element X increases the rate of decomposition of hydrogen peroxide. At the end of the reaction the oxide of X is unchanged.

Which details are those of X?

	proton number	mass number
A	18	40
B	20	40
C	25	55
D	82	207

- 21 Which element is sodium?

	melting point in °C	electrical conduction	density in g/cm ³
A	1535	good	7.86
B	1083	good	8.92
C	113	poor	2.07
D	98	good	0.97

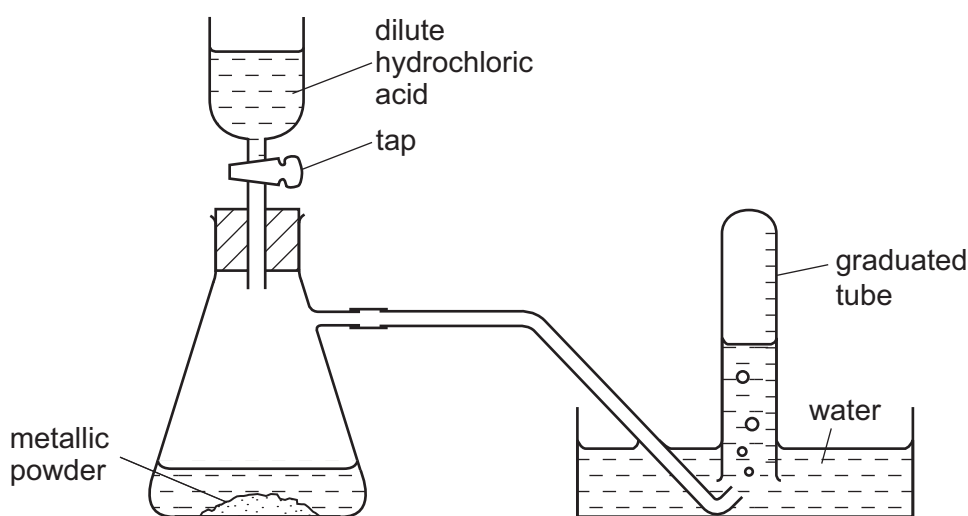
- 22 Which row shows the correct number of protons and electrons in the ion of an element in Group II of the Periodic Table?

	number of protons	number of electrons
A	9	10
B	12	10
C	14	14
D	16	18

27 Which substances react together to give hydrogen?

- A calcium oxide and water
- B copper and dilute sulfuric acid
- C copper and steam
- D magnesium and steam

28 The diagram shows apparatus for measuring the volume of hydrogen given off when an excess of dilute hydrochloric acid is added to powdered metal. The volume of gas is measured at room temperature and pressure.



The experiment is carried out three times, using the same mass of powder each time but with different powders:

- pure magnesium
- pure zinc
- a mixture of magnesium and zinc

Which powder gives the greatest volume of hydrogen and which the least volume?

	greatest volume of H ₂	least volume of H ₂
A	magnesium	zinc
B	magnesium	the mixture
C	zinc	magnesium
D	zinc	the mixture

- 29 Which gas burns in air to form only one product?
- A ammonia
 - B carbon monoxide
 - C hydrogen chloride
 - D methane
- 30 Why is carbon used in the purification of drinking water?
- A It desalinates the water.
 - B It disinfects the water.
 - C It filters out solids.
 - D It removes tastes and odours from the water.
- 31 Which compound will **not** produce ammonia when heated with ammonium sulfate?
- A calcium oxide
 - B magnesium oxide
 - C sodium hydroxide
 - D sulfuric acid
- 32 These reactions are used in the manufacture of sulfuric acid.
- P $S + O_2 \rightarrow SO_2$
- Q $2SO_2 + O_2 \rightleftharpoons 2SO_3$
- R $SO_3 + H_2O \rightarrow H_2SO_4$
- Which reactions are speeded up by using a catalyst?
- A P only B Q only C R only D Q and R
- 33 Which substances will burn in air and give carbon dioxide amongst the combustion products?
- 1 calcium carbonate
 - 2 ethane
 - 3 ethanol
 - 4 methanol
- A 1 and 2 only B 2 and 3 only C 1, 2 and 3 only D 2, 3 and 4 only

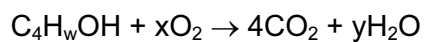
- 34 The two statements are about the fractional distillation of crude oil. The statements may or may not be correct. They may or may not be linked.

statement 1 Fractional distillation is used to separate crude oil into useful fractions.

statement 2 The fractions with lower boiling points are found at the top of the fractionating column.

What is correct about these two statements?

- A** Both statements are correct and statement 2 explains statement 1.
B Both statements are correct but statement 2 does not explain statement 1.
C Statement 1 is correct but statement 2 is incorrect.
D Statement 1 is incorrect but statement 2 is correct.
- 35 When butanol, represented by C_4H_wOH , burns in air, carbon dioxide and water are formed.

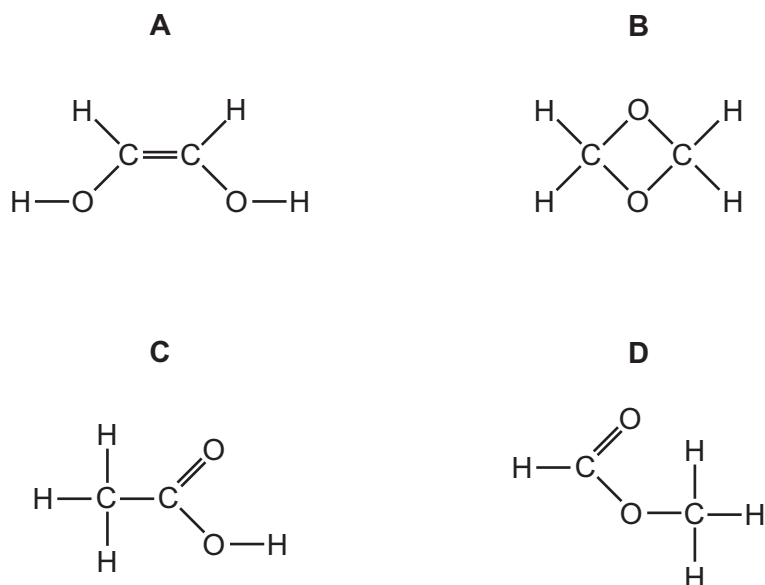


Which values of w, x and y balance the equation?

	w	x	y
A	8	6	4
B	9	6	4
C	9	6	5
D	10	7	5

- 36 An aqueous solution of a compound of formula $C_2H_4O_2$ reacts with sodium carbonate, liberating carbon dioxide.

What is the structural formula of the compound?



- 37 How does the number of carbon, hydrogen and oxygen atoms in an ester differ from the total number of carbon, hydrogen and oxygen atoms in the alcohol and carboxylic acid from which the compound was derived?

	carbon atoms	hydrogen atoms	oxygen atoms
A	less	less	less
B	less	same	less
C	same	less	less
D	same	same	same

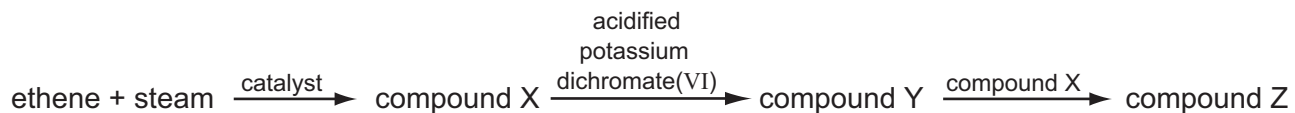
- 38 The list shows three chemical reactions.

- 1 combustion of ethanol
- 2 fermentation of glucose
- 3 reaction of ethanol with ethanoic acid to give an ester

In which reactions is water a product?

- A** 1 and 2 only **B** 1 and 3 only **C** 2 and 3 only **D** 1, 2 and 3

39 The diagram shows a reaction scheme.



What is the final compound, Z?

- A a carboxylic acid
 - B an alcohol
 - C an alkene
 - D an ester
- 40 The macromolecules of proteins, fats and carbohydrates can all be broken down into their simple units by a similar process.

What is the process called?

- A esterification
- B hydrolysis
- C oxidation
- D reduction

DATA SHEET
The Periodic Table of the Elements

		Group																																					
		I	II	III	IV	V	VI	VII	VIII	IX	X	XI																											
		1 H Hydrogen 1										4 He Helium 2																											
7 Li Lithium 3	9 Be Beryllium 4											19 F Fluorine 9																											
23 Na Sodium 11	24 Mg Magnesium 12	27 Al Aluminium 13	28 Si Silicon 14	31 P Phosphorus 15	32 S Sulfur 16	35.5 Cl Chlorine 17	36 Ar Argon 18						40 Ne Neon 10																										
39 K Potassium 19	40 Ca Calcium 20	51 V Vanadium 23	48 Ti Titanium 22	56 Fe Iron 26	59 Co Cobalt 27	59 Ni Nickel 28	64 Cu Copper 29	70 Ga Gallium 31	73 Ge Germanium 32	75 As Arsenic 33	79 Se Selenium 34	84 Kr Krypton 36																											
85 Rb Rubidium 37	88 Sr Strontium 38	93 Nb Niobium 41	91 Zr Zirconium 40	101 Ru Ruthenium 44	103 Rh Rhodium 45	106 Pd Palladium 46	108 Ag Silver 47	115 In Indium 49	119 Sn Tin 50	122 Sb Antimony 51	128 Te Tellurium 52	131 Xe Xenon 54																											
133 Cs Caesium 55	137 Ba Barium 56	181 Ta Tantalum 73	178 Hf Hafnium 72	190 Os Osmium 76	192 Ir Iridium 77	195 Pt Platinum 78	197 Au Gold 79	204 Tl Thallium 81	207 Pb Lead 82	209 Bi Bismuth 83	210 Po Polonium 84	210 Rn Radon 86																											
226 Fr Francium 87	226 Ra Radium 88	227 Ac Actinium 89											227 At Astatine 85																										
*58-71 Lanthanoid series													175 Lu Lutetium 71																										
†90-103 Actinoid series													102 No Nobelium 102																										
<table border="0" style="width: 100%; text-align: center;"> <tr> <td style="width: 10%;"></td> <td style="width: 10%;">a</td> <td style="width: 10%;">X</td> <td style="width: 10%;">b</td> <td style="width: 10%;"></td> <td style="width: 10%;"></td> <td style="width: 10%;"></td> <td style="width: 10%;"></td> <td style="width: 10%;"></td> <td style="width: 10%;"></td> <td style="width: 10%;"></td> <td style="width: 10%;"></td> <td style="width: 10%;"></td> </tr> <tr> <td>Key</td> <td></td> <td>a = relative atomic mass</td> <td></td> <td>X = atomic symbol</td> <td></td> <td>b = proton (atomic) number</td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> </tr> </table>														a	X	b										Key		a = relative atomic mass		X = atomic symbol		b = proton (atomic) number							169 Tm Thulium 69
	a	X	b																																				
Key		a = relative atomic mass		X = atomic symbol		b = proton (atomic) number																																	
													167 Er Erbium 68																										
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													162 Dy Dysprosium 66																										
													159 Tb Terbium 65																										
													157 Gd Gadolinium 64																										
													152 Eu Europium 63																										
													150 Sm Samarium 62																										
													144 Nd Neodymium 60																										
													141 Pr Praseodymium 59																										
													140 Ce Cerium 58																										
													238 U Uranium 92																										
													232 Th Thorium 90																										
													94 Pu Plutonium 94																										
													95 Am Americium 95																										
													96 Cm Curium 96																										
													97 Bk Berkelium 97																										
													98 Cf Californium 98																										
													99 Es Einsteinium 99																										
													100 Fm Fermium 100																										
													101 Md Mendelevium 101																										
													102 No Nobelium 102																										

The volume of one mole of any gas is 24 dm³ at room temperature and pressure (r.t.p.).

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UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS
General Certificate of Education Ordinary Level

CHEMISTRY

5070/12

Paper 1 Multiple Choice

October/November 2010

1 hour

Additional Materials: Multiple Choice Answer Sheet
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Soft pencil (type B or HB recommended)



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A copy of the Periodic Table is printed on page 20.

This document consists of **18** printed pages and **2** blank pages.



- 1 The boiling points of various gases found in the air are shown below.

	°C
argon	-186
carbon dioxide	-78
nitrogen	-198
oxygen	-183

If the air is cooled, the first substance to condense is water.

If the temperature is lowered further, what is the next substance to condense?

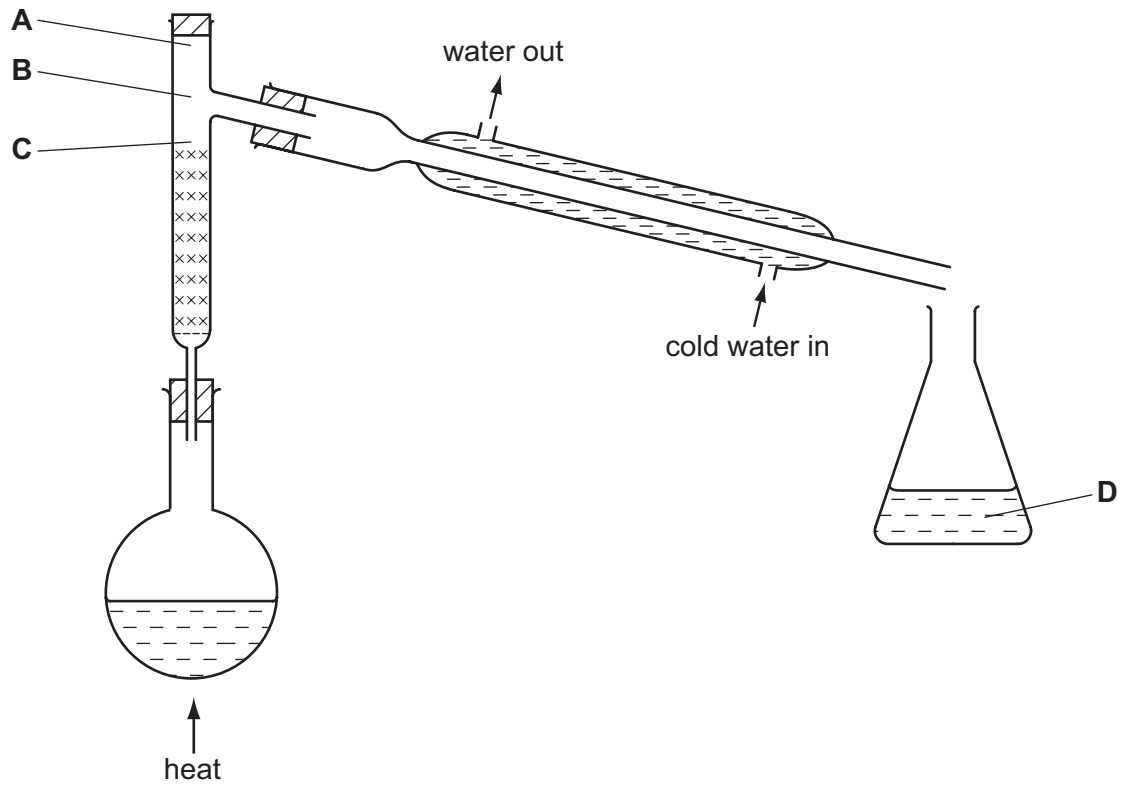
- A argon
 - B carbon dioxide
 - C nitrogen
 - D oxygen
- 2 Substance X dissolves in water to form a colourless solution. This solution reacts with aqueous lead(II) nitrate in the presence of dilute nitric acid to give a yellow precipitate.

What is substance X?

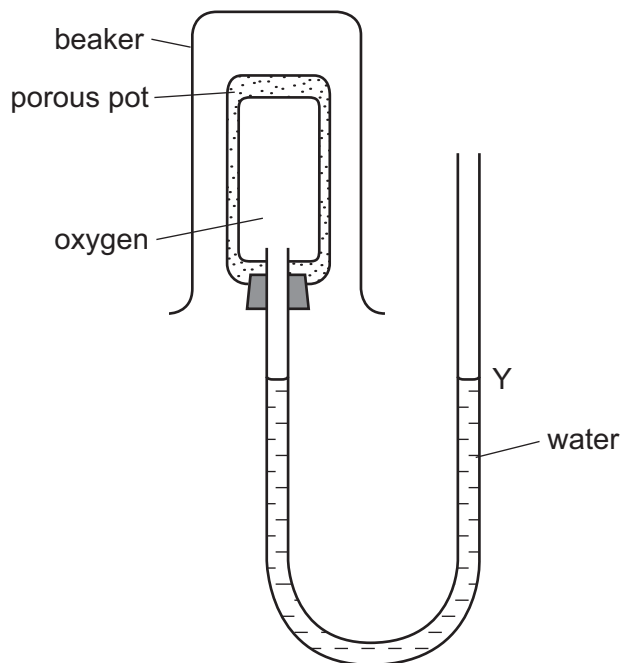
- A calcium iodide
- B copper(II) chloride
- C iron(II) iodide
- D sodium chloride

- 3 The fractional distillation apparatus shown is to be used for separating a mixture of two colourless liquids. A thermometer is missing from the apparatus.

Where should the bulb of the thermometer be placed?



4 The diagram shows a diffusion experiment.



Which gas, when present in the beaker over the porous pot, will cause the water level at Y to rise?

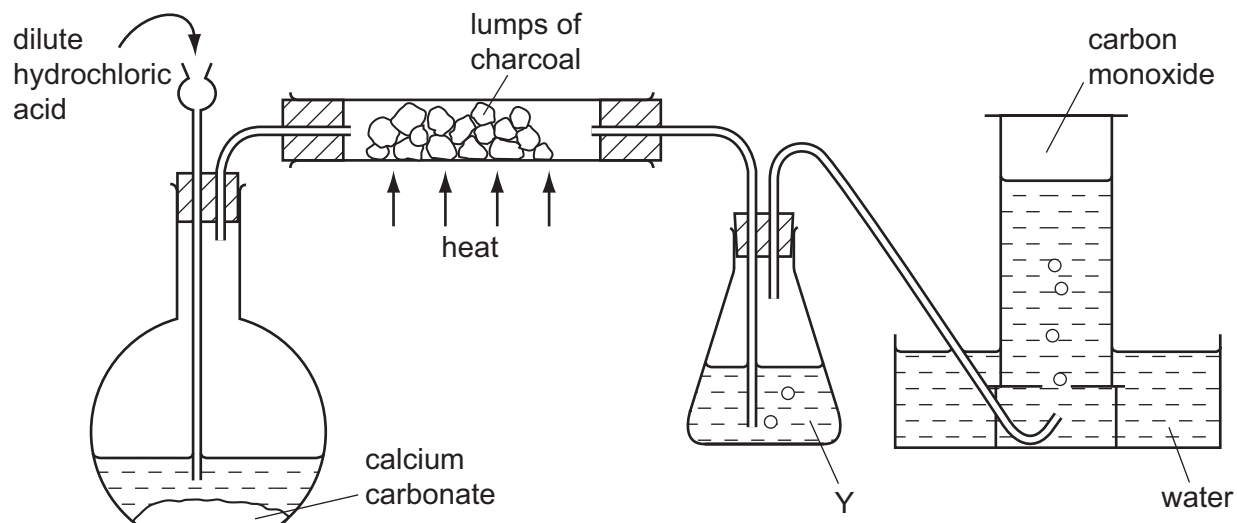
- A carbon dioxide, CO_2
- B chlorine, Cl_2
- C methane, CH_4
- D nitrogen dioxide, NO_2

5 Hydrogen can form both H^+ ions and H^- ions.

Which one of the statements below is correct?

- A An H^+ ion has more protons than an H^- ion.
- B An H^+ ion has no electrons.
- C An H^- ion has one more electron than an H^+ ion.
- D An H^- ion is formed when a hydrogen atom loses an electron.

- 6 The diagram shows apparatus used to obtain carbon monoxide.



What is the main purpose of Y?

- A to dry the gas
 - B to prevent water being sucked back on to the hot carbon
 - C to remove carbon dioxide from the gas
 - D to remove hydrogen chloride from the gas
- 7 A dark, shiny solid, X, conducts electricity.

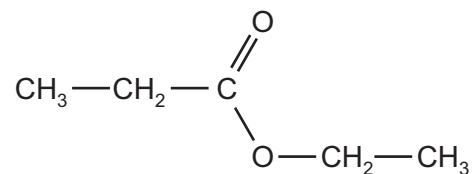
Oxygen combines with X to form a gaseous oxide.

What is X?

- A graphite
 - B iodine
 - C iron
 - D lead
- 8 Which substance could be sodium chloride?

	melting point / °C	conduction of electricity	
		when liquid	in aqueous solution
A	-114	nil	good
B	180	nil	nil (insoluble)
C	808	good	good
D	3550	nil	nil (insoluble)

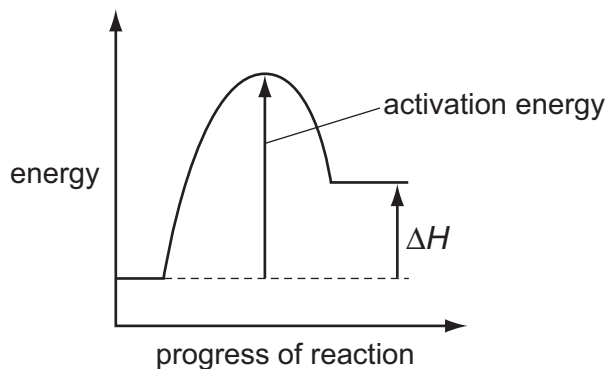
- 9 The diagram shows the molecule ethyl propanoate.



How many bonding pairs of electrons are there in the molecule?

- A** 13 **B** 16 **C** 17 **D** 20
- 10 The conduction of electricity by metals is carried out by the movement of
- A** electrons only.
B electrons and positive ions.
C negative ions only.
D negative ions and positive ions.
- 11 What is the concentration of iodine molecules, I_2 , in a solution containing 2.54 g of iodine in 250 cm^3 of solution?
- A** 0.01 mol/dm^3
B 0.02 mol/dm^3
C 0.04 mol/dm^3
D 0.08 mol/dm^3

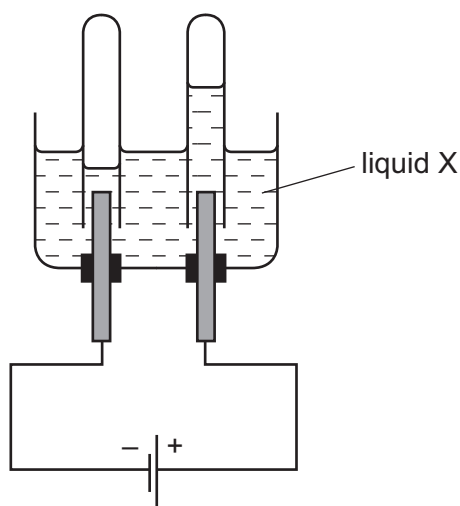
12 The energy profile for the forward direction of a **reversible** reaction is shown.



Which row correctly shows the sign of both the activation energy and the type of the enthalpy change for the **reverse** reaction?

	sign of activation energy	type of enthalpy change
A	negative	endothermic
B	negative	exothermic
C	positive	endothermic
D	positive	exothermic

13 The diagram shows the results of an electrolysis experiment using inert electrodes.



Which could be liquid X?

- A** aqueous copper(II) sulfate
- B** concentrated aqueous sodium chloride
- C** dilute sulfuric acid
- D** ethanol

14 In which reaction is nitric acid acting as an oxidising agent?

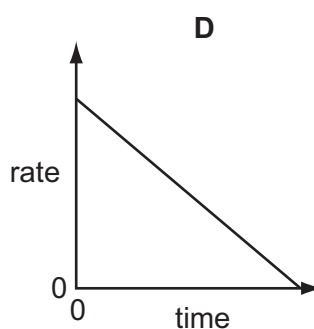
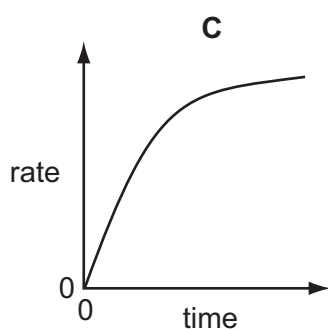
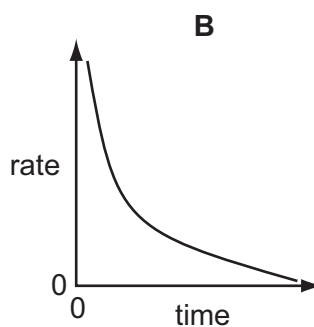
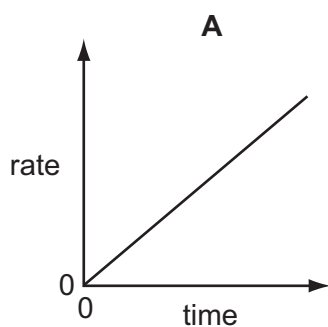
- A $\text{Cu} + 4\text{HNO}_3 \rightarrow \text{Cu}(\text{NO}_3)_2 + 2\text{H}_2\text{O} + 2\text{NO}_2$
- B $\text{CuO} + 2\text{HNO}_3 \rightarrow \text{Cu}(\text{NO}_3)_2 + \text{H}_2\text{O}$
- C $\text{Na}_2\text{CO}_3 + 2\text{HNO}_3 \rightarrow 2\text{NaNO}_3 + \text{H}_2\text{O} + \text{CO}_2$
- D $\text{NaOH} + \text{HNO}_3 \rightarrow \text{NaNO}_3 + \text{H}_2\text{O}$

15 The equation shows the formation of sulfur trioxide in the Contact process.



What would **decrease** the yield of sulfur trioxide in a given time?

- A addition of more oxygen
 - B an increase in pressure
 - C an increase in temperature
 - D removal of $\text{SO}_3(\text{g})$ from the reaction chamber
- 16 Which graph represents how the rate of reaction varies with time when an excess of calcium carbonate reacts with dilute hydrochloric acid?



17 The tests below were carried out on a solution containing ions of the metal X.

test	observation
add sodium chloride solution	no change
add sodium sulfate solution	no change
add sodium hydroxide solution	a precipitate was formed, soluble in excess of the hydroxide

What is metal X?

- A calcium
- B iron
- C lead
- D zinc

18 A student mixed together aqueous solutions of Y and Z. A white precipitate formed.

Which could **not** be solutions Y and Z?

	solution Y	solution Z
A	hydrochloric acid	silver nitrate
B	hydrochloric acid	sodium nitrate
C	sodium chloride	lead(II) nitrate
D	sodium chloride	silver nitrate

19 Sulfur is burnt in air.

Which statement about this reaction is correct?

- A Sulfur is oxidised to sulfur trioxide.
- B The gas formed turns aqueous potassium dichromate(VI) from orange to green.
- C The reaction is reversible.
- D The reaction needs a catalyst.

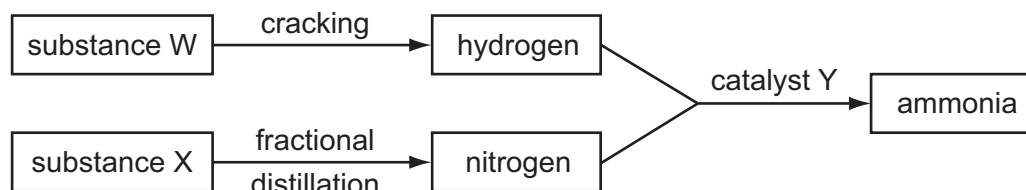
20 Which property is common to calcium, potassium and sodium?

- A Their atoms all lose two electrons when they form ions.
- B They all form carbonates which are insoluble in water.
- C They are all less dense than water.
- D They are all metallic.

21 Which set of the electronic structures are **only** found in metals?

- A** 2, 1 2, 8, 1 2, 8, 8, 1
B 2, 5 2, 6 2, 7
C 2, 7 2, 8, 7 2, 8, 18, 7
D 2, 8, 3 2, 8, 4 2, 8, 5

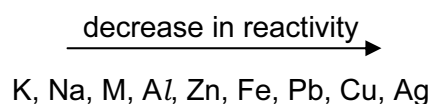
22 The diagram shows processes that take place in the manufacture of ammonia.



What are substances W and X and catalyst Y?

	W	X	Y
A	air	oil	iron
B	air	oil	vanadium(V) oxide
C	oil	air	iron
D	oil	air	vanadium(V) oxide

23 The position of metal M in the reactivity series is shown.



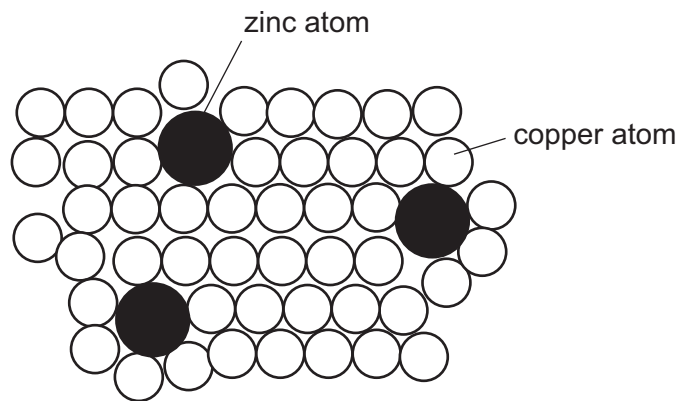
Which method will be used to extract M from its ore?

- A** electrolysis of its aqueous sulfate
B electrolysis of its molten oxide
C reduction of its oxide by heating with coke
D reduction of its oxide by heating with hydrogen

- 24 When zinc is added to a solution of a metal sulfate, the metal is deposited and zinc ions are produced in solution.

Which metal is deposited?

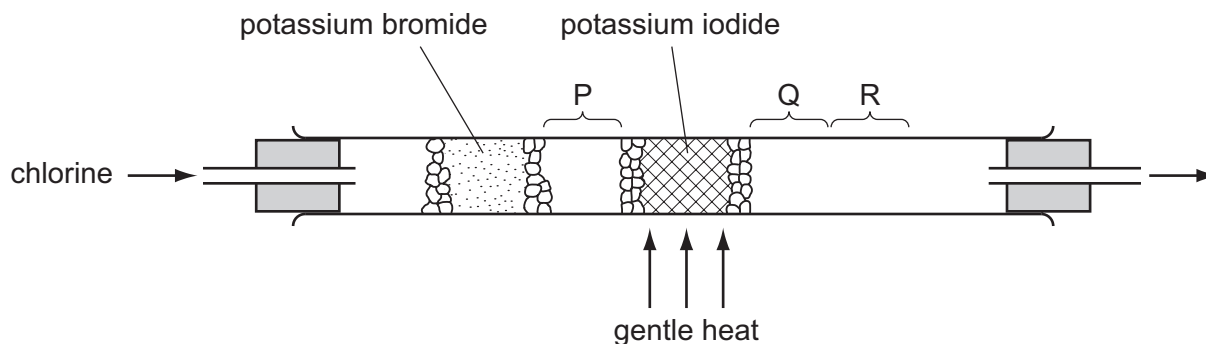
- A calcium
 - B copper
 - C magnesium
 - D potassium
- 25 The diagram shows the structure of brass.



Why is brass harder than pure copper?

- A The zinc atoms form strong covalent bonds with copper atoms.
- B The zinc atoms prevent layers of copper atoms from slipping over each other easily.
- C The zinc atoms prevent the 'sea of electrons' from moving freely in the solid.
- D Zinc atoms have more electrons than copper atoms.

26 Using the apparatus shown, chlorine is passed through the tube.

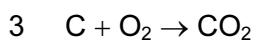
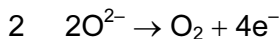
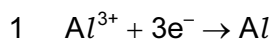


After a short time, coloured substances are seen at P, Q and R.

What are these coloured substances?

	at P	at Q	at R
A	green gas	red brown vapour	violet vapour
B	green gas	violet vapour	black solid
C	red brown vapour	violet vapour	black solid
D	violet vapour	red brown vapour	red brown vapour

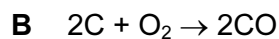
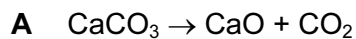
27 In the electrolysis of molten aluminium oxide for the extraction of aluminium, the following three reactions take place.



Which reactions take place at the anode?

- A** 1 only **B** 2 only **C** 1 and 3 **D** 2 and 3

28 Which equation in the blast furnace extraction of iron is **not** a redox reaction?



29 Which statement about the material used for aircraft bodies is correct?

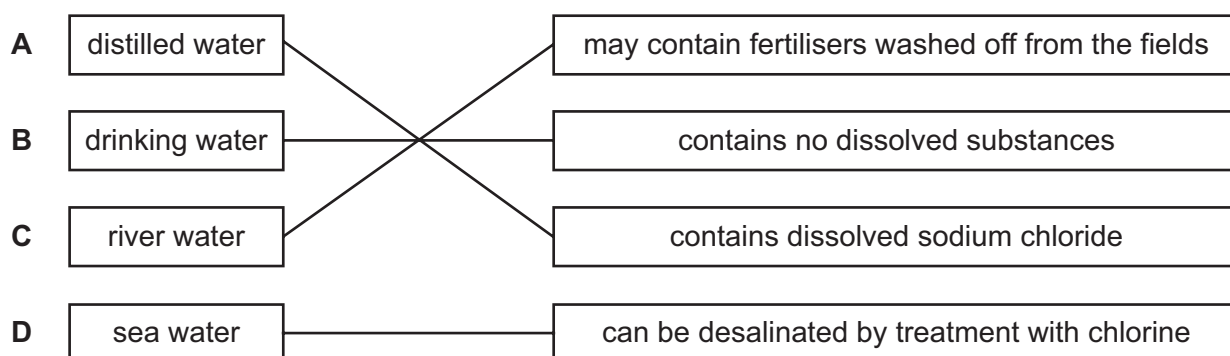
Aircraft bodies are made from

- A an aluminium alloy because pure aluminium is too soft.
- B pure aluminium because of its high melting point.
- C pure aluminium because of its low density.
- D pure aluminium because of its resistance to corrosion.

30 Which natural process can cause nitrogen oxides to be formed in the atmosphere?

- A bacterial decay of plants
- B lightning activity
- C photosynthesis
- D respiration

31 Which type of water in the left hand column is linked correctly to a statement in the right hand column?

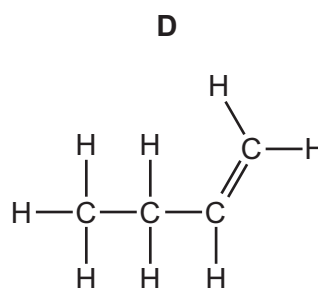
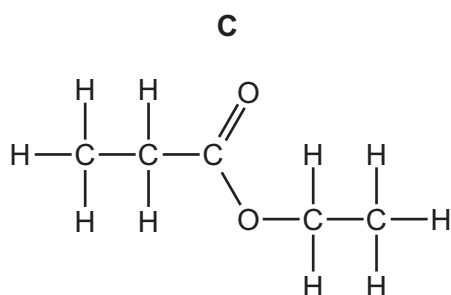
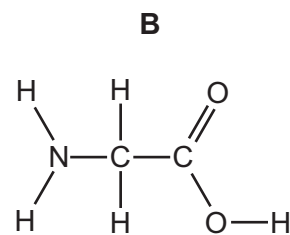
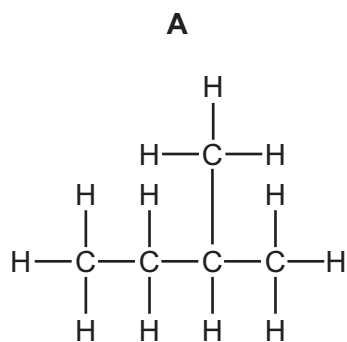


32 A catalytic converter in a car exhaust system speeds up the change of pollutants into less harmful products.

Which change does **not** occur in a catalytic converter?

- A carbon dioxide → carbon
- B carbon monoxide → carbon dioxide
- C nitrogen oxides → nitrogen
- D unburned hydrocarbons → carbon dioxide and water

33 Which formula represents a compound likely to undergo addition polymerisation?



34 Which statement about ethanol is correct?

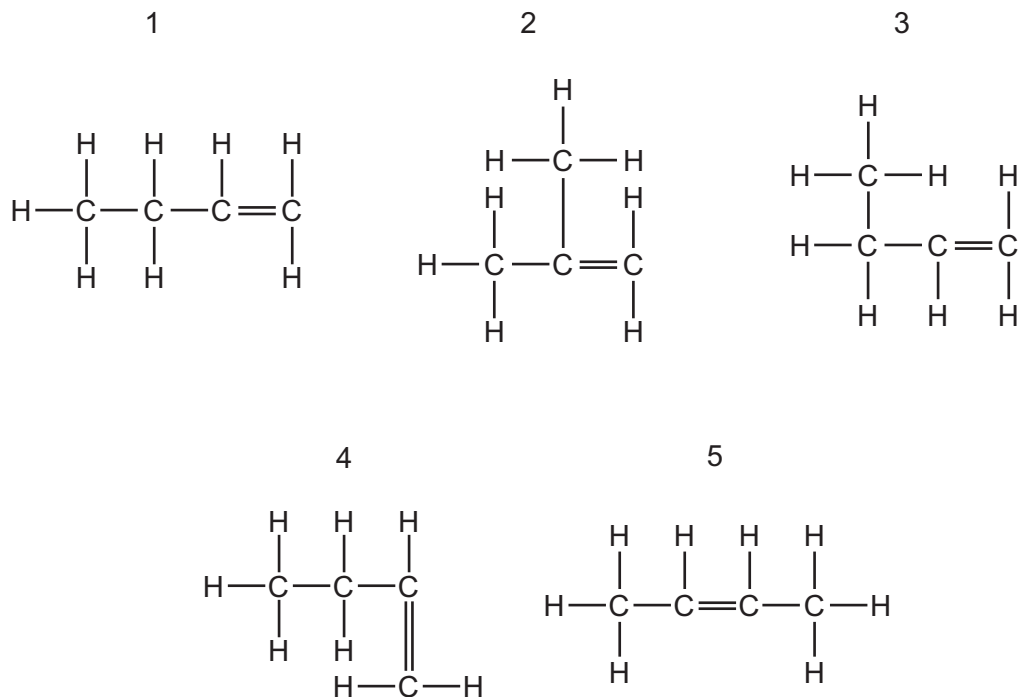
- A** It is an unsaturated compound.
- B** It is formed by the catalytic addition of steam to ethene.
- C** It is formed by the oxidation of ethanoic acid.
- D** It reacts with ethyl ethanoate to form an acid.

35 An organic compound has an empirical formula C_2H_4O .

What is the compound?

- A** butanoic acid
- B** butanol
- C** ethanoic acid
- D** ethanol

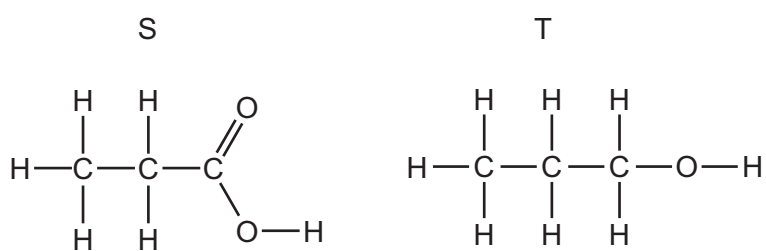
36 Five structures are shown.



Which structures represent identical molecules?

- A 1 and 3 only
- B 2 and 3 only
- C 1, 3 and 4 only
- D 1, 3 and 5 only

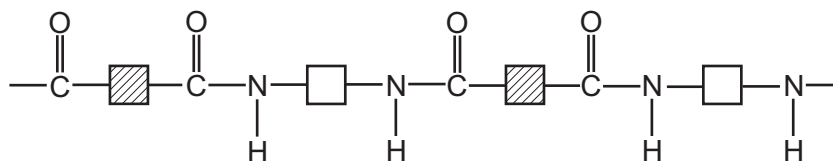
37 The diagrams show two organic compounds.



Which statement about the compounds S and T is correct?

- A Both S and T react with sodium carbonate.
- B S and T react together to form the ester ethyl propanoate.
- C T can be changed into S using acidified potassium dichromate(VI).
- D They are in the same homologous series.

38 Polymer X has the structure shown.



The list shows four terms that can be applied to polymers.

- 1 addition polymer
- 2 condensation polymer
- 3 polyamide
- 4 polyester

Which two terms can be applied to polymer X?

- A** 1 and 3 **B** 1 and 4 **C** 2 and 3 **D** 2 and 4

39 In which reaction is water produced?

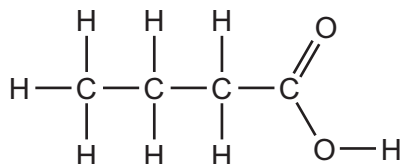
- A** manufacture of ethanol from ethene
- B** manufacture of margarine from vegetable oils
- C** manufacture of poly(ethene) from ethene
- D** manufacture of *Terylene* from a carboxylic acid and an alcohol

40 The results of tests on compound Z are shown.

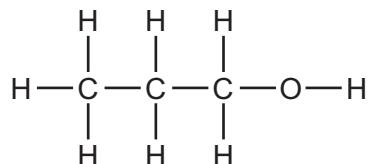
test	result
add bromine water	turns colourless
add aqueous sodium carbonate	carbon dioxide formed

What is compound Z?

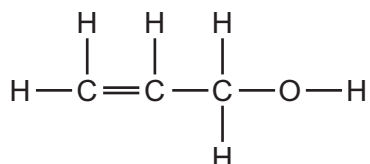
A



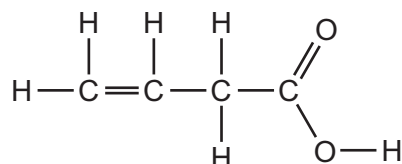
B



C



D



DATA SHEET
The Periodic Table of the Elements

Group		Period																																																																																											
		I	II	III	IV	V	VI	VII	0																																																																																				
		1 H Hydrogen 1										2 He Helium 2																																																																																	
7 Li Lithium 3	9 Be Beryllium 4											10 Ne Neon 10																																																																																	
11 Na Sodium 11	12 Mg Magnesium 12	13 Al Aluminium 13	14 Si Silicon 14	15 P Phosphorus 15	16 S Sulfur 16	17 Cl Chlorine 17	18 Ar Argon 18					19 F Fluorine 9	20 Ne Neon 10																																																																																
19 K Potassium 19	20 Ca Calcium 20	21 Sc Scandium 21	22 Ti Titanium 22	23 V Vanadium 23	24 Cr Chromium 24	25 Mn Manganese 25	26 Fe Iron 26	27 Co Cobalt 27	28 Ni Nickel 28	29 Cu Copper 29	30 Zn Zinc 30	31 Ga Gallium 31	32 Ge Germanium 32	33 As Arsenic 33	34 Se Selenium 34	35 Br Bromine 35	36 Kr Krypton 36				37 Rb Rubidium 37	38 Sr Strontium 38	39 Y Yttrium 39	40 Zr Zirconium 40	41 Nb Niobium 41	42 Mo Molybdenum 42	43 Tc Technetium 43	44 Ru Ruthenium 44	45 Rh Rhodium 45	46 Pd Palladium 46	47 Ag Silver 47	48 Cd Cadmium 48	49 In Indium 49	50 Sn Tin 50	51 Sb Antimony 51	52 Te Tellurium 52	53 I Iodine 53	54 Xe Xenon 54				55 Cs Caesium 55	56 Ba Barium 56	57 La Lanthanum 57	58 Ce Cerium 58	59 Pr Praseodymium 59	60 Nd Neodymium 60	61 Pm Promethium 61	62 Sm Samarium 62	63 Eu Europium 63	64 Gd Gadolinium 64	65 Tb Terbium 65	66 Dy Dysprosium 66	67 Ho Holmium 67	68 Er Erbium 68	69 Tm Thulium 69	70 Yb Ytterbium 70	71 Lu Lutetium 71	72 Hf Hafnium 72	73 Ta Tantalum 73	74 W Tungsten 74	75 Re Rhenium 75	76 Os Osmium 76	77 Ir Iridium 77	78 Pt Platinum 78	79 Au Gold 79	80 Hg Mercury 80	81 Tl Thallium 81	82 Pb Lead 82	83 Bi Bismuth 83	84 Po Polonium 84	85 At Astatine 85	86 Rn Radon 86				87 Fr Francium 87	88 Ra Radium 88	89 Ac Actinium 89	90 Th Thorium 90	91 Pa Protactinium 91	92 U Uranium 92	93 Np Neptunium 93	94 Pu Plutonium 94	95 Am Americium 95	96 Cm Curium 96	97 Bk Berkelium 97	98 Cf Californium 98	99 Es Einsteinium 99	100 Fm Fermium 100	101 Md Mendelevium 101	102 No Nobelium 102	103 Lr Lawrencium 103

*58-71 Lanthanoid series

†90-103 Actinoid series

a	X	a = relative atomic mass
X	b	X = atomic symbol
X	b	b = proton (atomic) number

The volume of one mole of any gas is 24 dm³ at room temperature and pressure (r.t.p.).

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UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS
General Certificate of Education Ordinary Level

CHEMISTRY

5070/12

Paper 1 Multiple Choice

May/June 2011

1 hour

Additional Materials: Multiple Choice Answer Sheet
 Soft clean eraser
 Soft pencil (type B or HB recommended)



READ THESE INSTRUCTIONS FIRST

Write in soft pencil.

Do not use staples, paper clips, highlighters, glue or correction fluid.

Write your name, Centre number and candidate number on the Answer Sheet in the spaces provided unless this has been done for you.

There are **forty** questions on this paper. Answer **all** questions. For each question there are four possible answers **A, B, C** and **D**.

Choose the **one** you consider correct and record your choice in **soft pencil** on the separate Answer Sheet.

Read the instructions on the Answer Sheet very carefully.

Each correct answer will score one mark. A mark will not be deducted for a wrong answer.

Any rough working should be done in this booklet.

A copy of the Periodic Table is printed on page 16.

This document consists of **13** printed pages and **3** blank pages.



- 1 A drop of liquid bromine is placed in the bottom of a gas jar. Brown fumes of bromine vapour slowly spread through the covered gas jar.

Why does this happen?

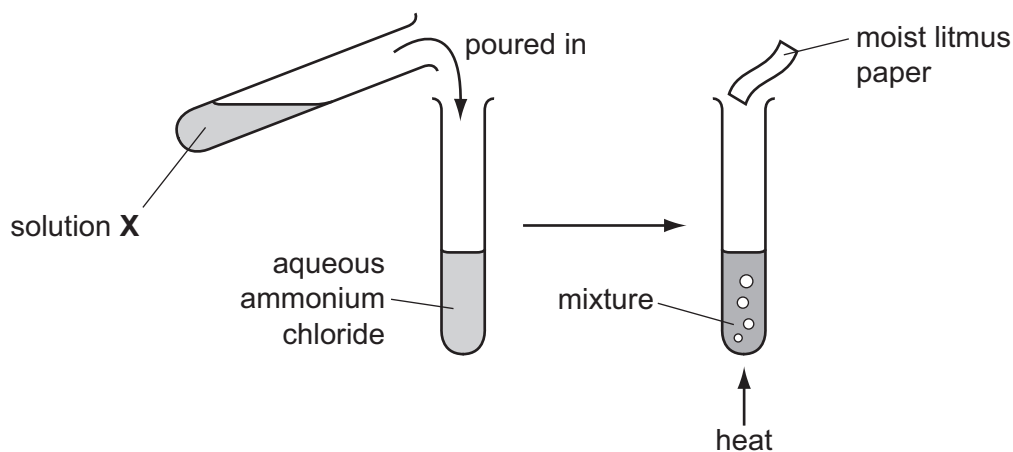
- A** Bromine vapour is less dense than air.
B Bromine molecules and the molecules in air are always moving around.
C Bromine molecules are smaller than the molecules in air.
D Bromine molecules move faster than the molecules in air.

- 2 Copper(II) sulfate crystals are separated from sand using the four processes listed below.

In which order are these processes used?

	1st	2nd	3rd	4th
A	filtering	dissolving	crystallising	evaporating
B	filtering	dissolving	evaporating	crystallising
C	dissolving	evaporating	filtering	crystallising
D	dissolving	filtering	evaporating	crystallising

- 3 The diagrams show an experiment with aqueous ammonium chloride.



A gas, **Y**, is produced and the litmus paper changes colour.

What are solution **X** and gas **Y**?

	solution X	gas Y
A	aqueous sodium hydroxide	ammonia
B	aqueous sodium hydroxide	chlorine
C	dilute sulfuric acid	ammonia
D	dilute sulfuric acid	chlorine

- 4 A student tested a solution by adding aqueous sodium hydroxide. A precipitate was not seen because the reagent was added too quickly.

What could **not** have been present in the solution?

- A Al^{3+} B Ca^{2+} C NH_4^+ D Zn^{2+}

- 5 In which of the following is there a lattice of positive ions in a 'sea of electrons'?

- A liquid potassium chloride
B sand
C solid graphite
D solid magnesium

- 6 What is the mass of oxygen contained in 72 g of pure water?
[Relative atomic masses: H = 1; O = 16]

- A 16 g B 32 g C 64 g D 70 g

- 7 A covalent bond is formed by

- A electron sharing between metals and non-metals.
B electron sharing between non-metals.
C electron transfer between non-metals.
D electron transfer from metals to non-metals.

- 8 Which molecule has the **largest** number of electrons involved in covalent bonds?

- A C_2H_4 B CO_2 C CH_3OH D N_2

- 9 The equation for the reaction between calcium carbonate and hydrochloric acid is shown.



How many moles of calcium carbonate will give 24 cm^3 of carbon dioxide when reacted with an excess of the acid?

(Assume one mole of carbon dioxide occupies 24 dm^3 .)

- A 1 mol B 0.1 mol C 0.01 mol D 0.001 mol

- 10 Element X has the electronic structure 2,8,5. Element Y has the electronic structure 2,8,7.

What is the likely formula of a compound containing only X and Y?

- A XY_3 B X_2Y_3 C X_3Y D X_3Y_2

11 The empirical formula of a liquid compound is C_2H_4O .

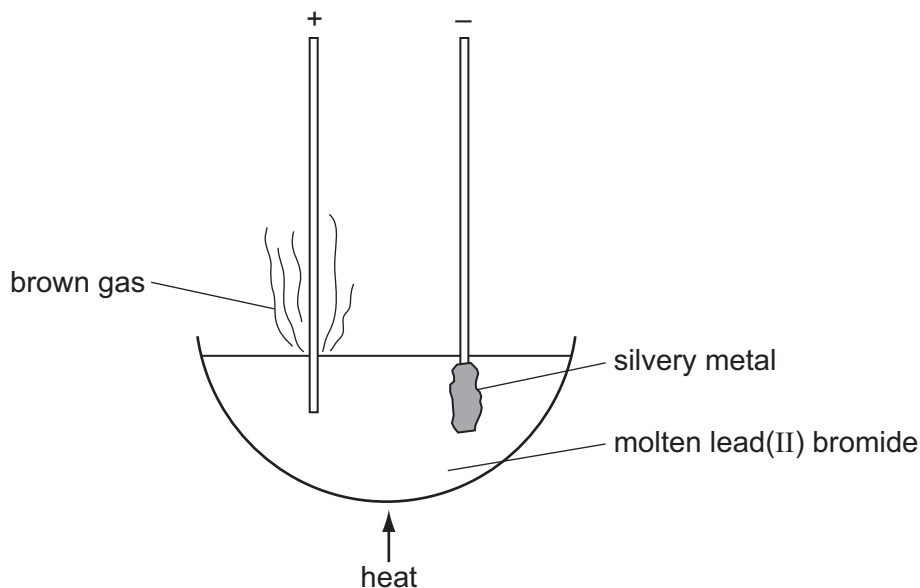
To find the empirical formula, it is necessary to know the

- A density of the compound.
- B percentage composition of the compound.
- C relative molecular mass of the compound.
- D volume occupied by 1 mole of the compound.

12 Which statement about both chlorine atoms and chloride ions is correct?

- A They are chemically identical.
- B They are isotopes of chlorine.
- C They have the same number of protons.
- D They have the same physical properties.

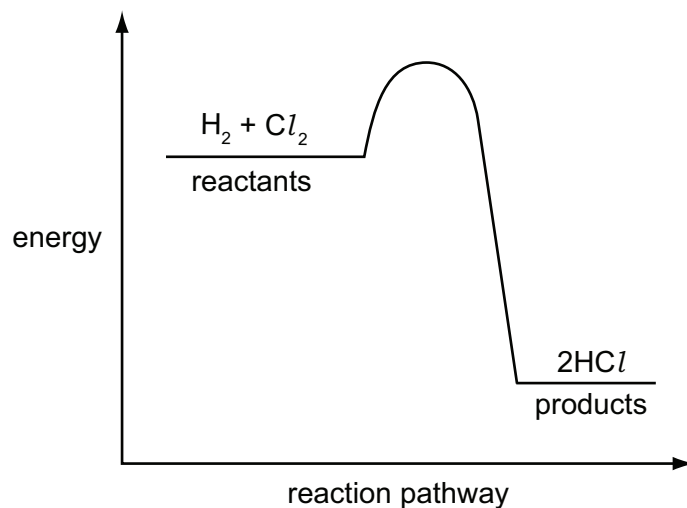
13 The diagram shows the electrolysis of molten lead(II) bromide using inert electrodes.



What happens during this electrolysis?

- A Atoms change to ions.
- B Covalent bonds are broken.
- C Ions change to atoms.
- D New compounds are formed.

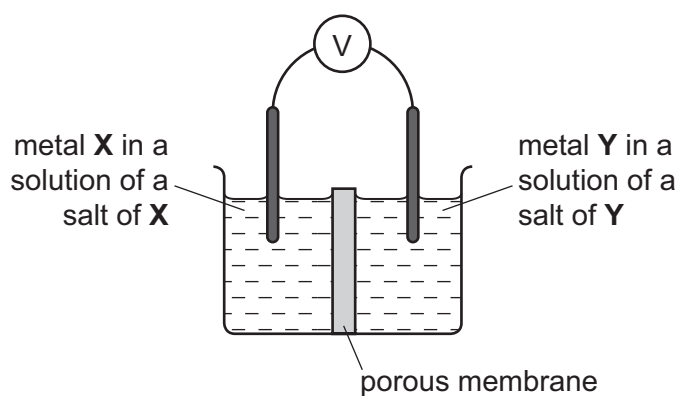
14 The energy profile diagram for the reaction between hydrogen and chlorine is shown.



What information about this reaction does the diagram show?

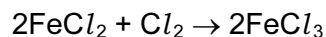
	type of reaction	sign of enthalpy change, ΔH
A	endothermic	negative
B	endothermic	positive
C	exothermic	negative
D	exothermic	positive

15 Which pair of metals **X** and **Y** will produce the highest voltage when used as electrodes in a simple cell?



	metal X	metal Y
A	copper	silver
B	magnesium	silver
C	magnesium	zinc
D	zinc	copper

- 16 The equation shows what happens in a redox reaction between iron(II) chloride and chlorine gas.



Which equation describes the reduction process in this reaction?

- A $2\text{Cl}^- \rightarrow \text{Cl}_2 + 2\text{e}^-$
 - B $\text{Cl}_2 + 2\text{e}^- \rightarrow 2\text{Cl}^-$
 - C $\text{Fe}^{2+} \rightarrow \text{Fe}^{3+} + \text{e}^-$
 - D $\text{Fe}^{3+} + \text{e}^- \rightarrow \text{Fe}^{2+}$
- 17 Which acid and base react together to produce an **insoluble** salt?
- A hydrochloric acid and sodium hydroxide
 - B nitric acid and calcium oxide
 - C sulfuric acid and barium hydroxide
 - D sulfuric acid and zinc oxide

- 18 Carbon and silicon are both in Group IV of the Periodic Table.

Which statement is correct for both carbon dioxide and silicon dioxide?

- A They are acidic oxides.
 - B They are readily soluble in water.
 - C They contain ionic bonds.
 - D They have giant molecular structures.
- 19 The following changes could be made to the conditions in the reaction between zinc and hydrochloric acid.
- 1 increase in concentration of the acid
 - 2 increase in particle size of the zinc
 - 3 increase in pressure on the system
 - 4 increase in temperature of the system

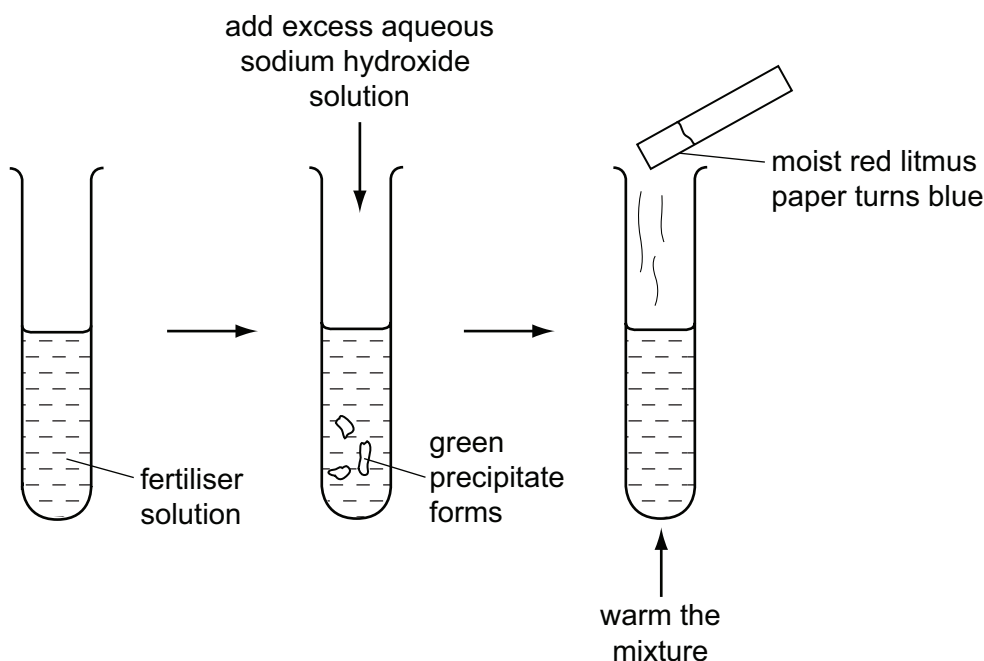
Which pair of changes will increase the rate of reaction?

- A 1 and 2 B 1 and 4 C 2 and 3 D 3 and 4

20 Which calcium compound does **not** increase the pH of acidic soils?

- A calcium carbonate
- B calcium hydroxide
- C calcium oxide
- D calcium sulfate

21 A solution of fertiliser was tested as shown.



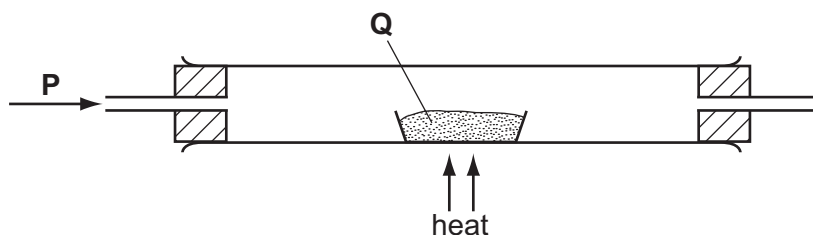
Which ions must be present in the fertiliser?

- A Fe^{2+} and SO_4^{2-}
- B Fe^{3+} and NO_3^-
- C NH_4^+ and Fe^{2+}
- D NH_4^+ and NO_3^-

22 Which pair of properties are **both** correct for a typical transition element?

	property 1	property 2
A	forms coloured compounds	soluble in water
B	high density	has variable oxidation states
C	low density	high melting point
D	low melting point	can act as a catalyst

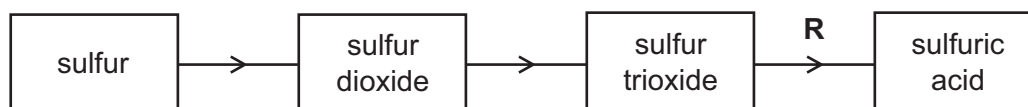
- 23 What happens when zinc foil is placed in an aqueous solution of copper(II) sulfate?
- A Copper(II) ions are oxidised.
 B There is no reaction.
 C Zinc atoms are oxidised.
 D Zinc sulfate is precipitated.
- 24 Which deduction about the element astatine, At, can be made from its position in Group VII?
- A It forms covalent compounds with sodium.
 B It is a gas.
 C It is displaced from aqueous potassium astatide, KAt, by chlorine.
 D It is more reactive than iodine.
- 25 In the apparatus shown, gas **P** is passed over solid **Q**.



No reaction occurs if **P** and **Q** are

	P	Q
A	hydrogen	lead(II) oxide
B	hydrogen	magnesium oxide
C	oxygen	carbon
D	oxygen	sulfur

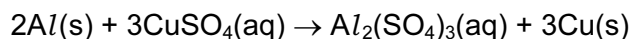
- 26 The diagram represents the manufacture of sulfuric acid by the Contact process.



What is used in step **R**?

- A concentrated sulfuric acid followed by water
 B vanadium(V) oxide
 C water followed by concentrated sulfuric acid
 D water only

- 27 Aluminium is higher than copper in the reactivity series so the following displacement reaction should be feasible.

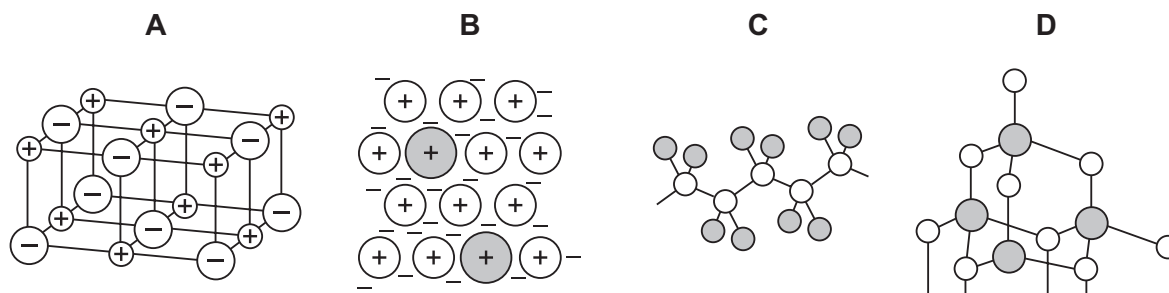


The reaction does not take place at room temperature.

What is the reason for this?

- A Aluminium has an inert coating all over it.
 - B The compound aluminium sulfate does not exist.
 - C The reaction is exothermic.
 - D The reaction needs to be warmed to take place.
- 28 Scrap iron is often recycled.
- Which reason for recycling is **not** correct?
- A It reduces the amount of pollution at the site of the ore extraction.
 - B It reduces the amount of waste taken to landfill sites.
 - C It reduces the need to collect the scrap iron.
 - D It saves natural resources.
- 29 The gases coming from a car's exhaust contain oxides of nitrogen.
- How are these oxides formed?
- A Nitrogen reacts with carbon dioxide.
 - B Nitrogen reacts with carbon monoxide.
 - C Nitrogen reacts with oxygen.
 - D Nitrogen reacts with petrol.
- 30 Which element can only be extracted from its ore using electrolysis?
- A calcium
 - B copper
 - C lead
 - D silver

31 Which diagram represents the structure of an alloy?



32 When a volcano erupts, which gas is produced in significant amounts?

- A** carbon monoxide
- B** chlorofluorocarbons
- C** methane
- D** sulfur dioxide

33 Useful fractions are obtained by the fractional distillation of petroleum.

Which fraction is matched by its use?

	fraction	use
A	bitumen	fuel in cars
B	lubricating oils	for making waxes and polishes
C	paraffin (kerosene)	for making roads
D	petrol (gasolene)	aircraft fuel

34 Compounds X and Y are both alkanes. Compound X has a higher boiling point than compound Y.

What could be the formulae of compounds X and Y?

	compound X	compound Y
A	C_8H_{16}	C_9H_{18}
B	C_8H_{18}	C_9H_{20}
C	C_9H_{18}	C_8H_{16}
D	C_9H_{20}	C_8H_{18}

35 Compound X is a hydrocarbon. It reacts with steam to form an alcohol.

Which type of compound is X and what would be its effect on bromine water?

	type of compound	effect on bromine water
A	alkane	turns from brown to colourless
B	alkane	turns from colourless to brown
C	alkene	turns from brown to colourless
D	alkene	turns from colourless to brown

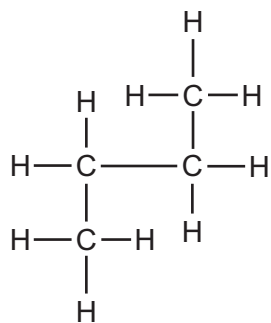
36 Which bond is present in both nylon and *Terylene*?

A C – O **B** C = O **C** N – C **D** N – H

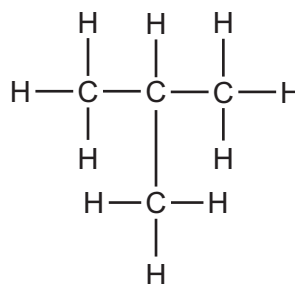
37 With which substance will ethene react to form more than one product?

- A** bromine
- B** hydrogen
- C** oxygen
- D** steam

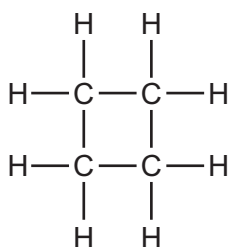
38 Four hydrocarbon structures are shown.



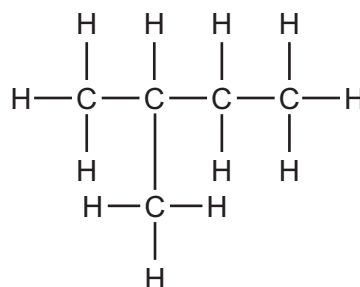
1



2



3



4

Which hydrocarbons are isomers of each other?

- A** 1, 2 and 3 **B** 1, 2 and 4 **C** 1 and 2 only **D** 3 and 4

39 When a compound X is reacted with sodium carbonate, carbon dioxide gas is evolved.

What could be the formula of compound X?

- A** $\text{C}_2\text{H}_5\text{CO}_2\text{CH}_3$ **B** $\text{C}_3\text{H}_7\text{CO}_2\text{H}$ **C** $\text{CH}_3\text{CO}_2\text{C}_2\text{H}_5$ **D** $\text{C}_4\text{H}_9\text{OH}$

40 Which statement about ethanoic acid is correct?

- A** It contains three carbon atoms per molecule.
B It contains five hydrogen atoms per molecule.
C It is insoluble in water.
D It reacts with ethanol to form a sweet-smelling compound.

DATA SHEET
The Periodic Table of the Elements

		Group																																																																																																									
I	II	III	IV	V	VI	VII	0																																																																																																				
7 Li Lithium 3	9 Be Beryllium 4	1 H Hydrogen 1	11 B Boron 5	12 C Carbon 6	14 N Nitrogen 7	16 O Oxygen 8	19 F Fluorine 9	20 Ne Neon 10	23 Na Sodium 11	24 Mg Magnesium 12	27 Al Aluminium 13	28 Si Silicon 14	31 P Phosphorus 15	32 S Sulfur 16	35.5 Cl Chlorine 17	40 Ar Argon 18	39 K Potassium 19	40 Ca Calcium 20	45 Sc Scandium 21	48 Ti Titanium 22	51 V Vanadium 23	52 Cr Chromium 24	55 Mn Manganese 25	56 Fe Iron 26	59 Co Cobalt 27	59 Ni Nickel 28	64 Cu Copper 29	65 Zn Zinc 30	70 Ga Gallium 31	73 Ge Germanium 32	75 As Arsenic 33	79 Se Selenium 34	80 Br Bromine 35	84 Kr Krypton 36	85 Rb Rubidium 37	88 Sr Strontium 38	89 Y Yttrium 39	91 Zr Zirconium 40	93 Nb Niobium 41	96 Mo Molybdenum 42	101 Ru Ruthenium 44	106 Pd Palladium 46	112 Cd Cadmium 48	115 In Indium 49	119 Sn Tin 50	122 Sb Antimony 51	128 Te Tellurium 52	127 I Iodine 53	131 Xe Xenon 54	133 Cs Caesium 55	137 Ba Barium 56	139 La Lanthanum 57	178 Hf Hafnium 72	181 Ta Tantalum 73	184 W Tungsten 74	190 Os Osmium 76	192 Ir Iridium 77	195 Pt Platinum 78	197 Au Gold 79	201 Hg Mercury 80	204 Tl Thallium 81	207 Pb Lead 82	209 Bi Bismuth 83	210 Po Polonium 84	210 At Astatine 85	210 Rn Radon 86	226 Ra Radium 88	227 Ac Actinium 89	232 Th Thorium 90	238 U Uranium 92	238 Np Neptunium 93	238 Pu Plutonium 94	238 Am Americium 95	238 Cm Curium 96	238 Bk Berkelium 97	238 Cf Californium 98	238 Es Einsteinium 99	238 Fm Fermium 100	238 Md Mendelevium 101	238 No Nobelium 102	238 Lr Lawrencium 103	140 Ce Cerium 58	141 Pr Praseodymium 59	144 Nd Neodymium 60	147 Pm Promethium 61	150 Sm Samarium 62	152 Eu Europium 63	157 Gd Gadolinium 64	162 Dy Dysprosium 66	165 Ho Holmium 67	167 Er Erbium 68	169 Tm Thulium 69	173 Yb Ytterbium 70	175 Lu Lutetium 71	140 Ce Cerium 58	141 Pr Praseodymium 59	144 Nd Neodymium 60	147 Pm Promethium 61	150 Sm Samarium 62	152 Eu Europium 63	157 Gd Gadolinium 64	162 Dy Dysprosium 66	165 Ho Holmium 67	167 Er Erbium 68	169 Tm Thulium 69	173 Yb Ytterbium 70	175 Lu Lutetium 71

*58-71 Lanthanoid series
†90-103 Actinoid series

Key

a	X
b	

a = relative atomic mass
X = atomic symbol
b = proton (atomic) number

The volume of one mole of any gas is 24 dm³ at room temperature and pressure (r.t.p.).

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UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS
General Certificate of Education Ordinary Level

CHEMISTRY

5070/12

Paper 1 Multiple Choice

October/November 2011

1 hour

Additional Materials: Multiple Choice Answer Sheet
 Soft clean eraser
 Soft pencil (type B or HB recommended)



READ THESE INSTRUCTIONS FIRST

Write in soft pencil.

Do not use staples, paper clips, highlighters, glue or correction fluid.

Write your name, Centre number and candidate number on the Answer Sheet in the spaces provided unless this has been done for you.

There are **forty** questions on this paper. Answer **all** questions. For each question there are four possible answers **A, B, C** and **D**.

Choose the **one** you consider correct and record your choice in **soft pencil** on the separate Answer Sheet.

Read the instructions on the Answer Sheet very carefully.

Each correct answer will score one mark. A mark will not be deducted for a wrong answer.

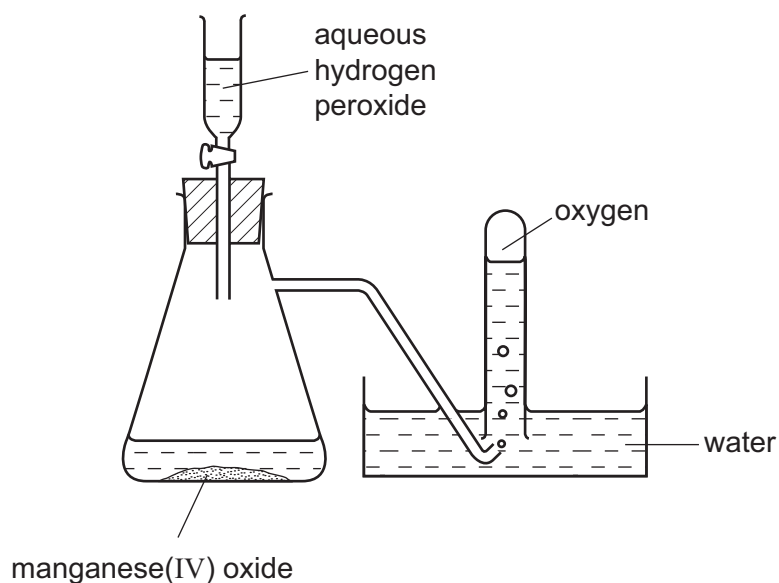
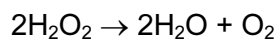
Any rough working should be done in this booklet.

A copy of the Periodic Table is printed on page 12.

This document consists of **12** printed pages.



- 1 Oxygen was prepared from hydrogen peroxide, with manganese(IV) oxide as catalyst. The oxygen was collected as shown in the diagram.



The first few tubes of gas were rejected because the gas was contaminated by

- A hydrogen.
 - B hydrogen peroxide.
 - C nitrogen.
 - D water vapour.
- 2 The labels fell off two bottles each containing a colourless solution, one of which was sodium carbonate solution and the other was sodium chloride solution.

The addition of which solution to a sample from each bottle would **most** readily enable the bottles to be correctly relabelled?

- A ammonia
- B hydrochloric acid
- C lead(II) nitrate
- D sodium hydroxide

- 3 In a titration between an acid (in the burette) and an alkali, you may need to re-use the same titration flask.

Which is the best procedure for rinsing the flask?

- A Rinse with distilled water and then with the alkali.
B Rinse with tap water and then with distilled water.
C Rinse with tap water and then with the acid.
D Rinse with the alkali.
- 4 In which pair is each substance a mixture?
- A air and water
B limewater and water
C quicklime and limewater
D sea water and air
- 5 A researcher notices that atoms of an element are releasing energy.

Why are the atoms releasing energy?

- A The atoms are absorbing light.
B The atoms are evaporating.
C The atoms are radioactive.
D The atoms react with argon in the air.
- 6 Radium (Ra) is in the same group of the Periodic Table as magnesium.

What is the charge on a radium ion?

- A 2- B 1- C 1+ D 2+

- 7 How many of the molecules shown contain only one covalent bond?

Cl_2 H_2 HCl N_2 O_2

- A 2 B 3 C 4 D 5

8 Below are two statements about metals.

- 1 Metals contain a lattice of negative ions in a 'sea of electrons'.
- 2 The electrical conductivity of metals is related to the mobility of the electrons in the structure.

Which is correct?

- A Both statements are correct and statement 1 explains statement 2.
 - B Both statements are correct but statement 1 does not explain statement 2.
 - C Statement 1 is correct and statement 2 is incorrect.
 - D Statement 2 is correct and statement 1 is incorrect.
- 9 Which compound contains three elements?
- A aluminium chloride
 - B iron(III) oxide
 - C potassium oxide
 - D sodium carbonate
- 10 What happens when sodium chloride melts?
- A Covalent bonds in a giant lattice are broken.
 - B Electrons are released from atoms.
 - C Electrostatic forces of attraction between ions are overcome.
 - D Molecules are separated into ions.

11 What is the relative molecular mass M_r of $\text{CuSO}_4 \cdot 5\text{H}_2\text{O}$?

- A 160 B 178 C 186 D 250

12 What is the ratio of the number of molecules in 71 g of gaseous chlorine to the number of molecules in 2 g of gaseous hydrogen? [Relative atomic masses A_r (atomic weights): H, 1; Cl, 35.5]

- A 1:1 B 1:2 C 2:1 D 71:2

13 How can sodium be manufactured?

- A by electrolysis aqueous sodium chloride
- B by electrolysis aqueous sodium hydroxide
- C by electrolysis molten sodium chloride
- D by heating sodium oxide with carbon

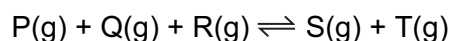
14 Which pair of statements about the combustion of a carbohydrate and its formation by photosynthesis is **not** correct?

	combustion	photosynthesis
A	chemical energy converted to heat energy	chemical energy converted to light energy
B	no catalyst needed	catalyst needed
C	oxygen used up	oxygen released
D	reaction exothermic	reaction endothermic

15 Which statement about the electrolysis of an aqueous solution of copper(II) sulfate with platinum electrodes is correct?

- A Oxygen is given off at the positive electrode.
- B The mass of the negative electrode remains constant.
- C The mass of the positive electrode decreases.
- D There is no change in the colour of the solution.

16 The following reversible reaction takes place in a closed vessel at constant temperature.



When the system has reached equilibrium, more T is added.

Which increases in concentration occur?

- A P, Q, R and S
- B P and Q only
- C P, Q and R only
- D S only

17 An excess of calcium hydroxide is added to an acidic soil.

What happens to the pH of the soil?

	change in pH	final pH
A	decrease	5
B	decrease	7
C	increase	7
D	increase	10

18 A lump of element **X** can be cut by a knife.

During its reaction with water, **X** floats and melts.

What is X?

- A** calcium
- B** copper
- C** magnesium
- D** potassium

19 The table gives the formulae of the catalysts used in some industrial processes.

process	catalyst
Haber process	Fe + Mo
Contact process	V ₂ O ₅
cracking of alkanes	Al ₂ O ₃ + SiO ₂
polymerisation of ethene	Al(C ₂ H ₅) ₃ + TiCl ₄
manufacture of silicones	CuCl

How many different transition metals are included, as elements or as compounds, in the list of catalysts?

- A** 3
- B** 4
- C** 5
- D** 6

20 Which statement about the elements chlorine, bromine and iodine is correct?

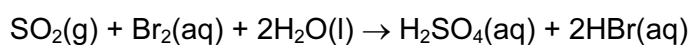
- A** They are all gases at room temperature and pressure.
- B** They are in the same period of the Periodic Table.
- C** They become darker in colour from chlorine to bromine to iodine.
- D** They possess one electron in the outermost shell.

- 21 Ammonium sulfate and potassium sulfate are salts which can be found in fertilisers. A sample of a fertiliser is warmed with aqueous sodium hydroxide and a gas with pH10 is given off.

Which salt must be in the fertiliser and which gas is given off?

	salt in fertiliser	name of gas
A	ammonium sulfate	ammonia
B	ammonium sulfate	sulfur dioxide
C	potassium sulfate	ammonia
D	potassium sulfate	sulfur dioxide

- 22 Sulfur dioxide reacts with aqueous bromine according to the following equation.



Which element has been oxidised?

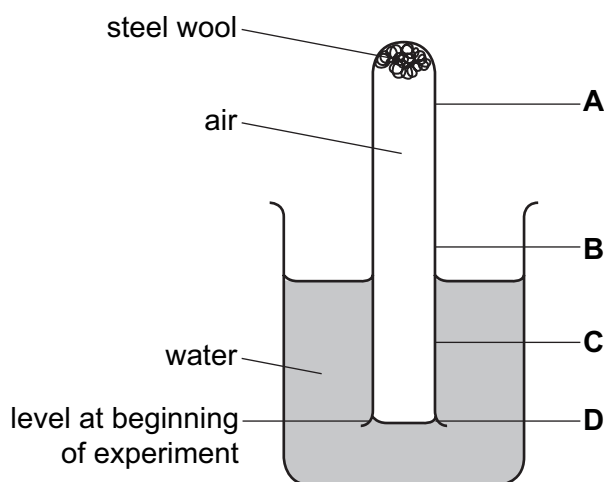
- A** bromine
 - B** hydrogen
 - C** oxygen
 - D** sulfur
- 23 Which substance would **not** be used for preparing a pure sample of crystalline magnesium sulfate by reaction with dilute sulfuric acid?
- A** magnesium carbonate
 - B** magnesium hydroxide
 - C** magnesium nitrate
 - D** magnesium oxide
- 24 Which carbonate decomposes on heating to give a black solid and a colourless gas?
- A** calcium carbonate
 - B** copper(II) carbonate
 - C** sodium carbonate
 - D** zinc carbonate

25 Which row shows the three metals in the correct order of decreasing reactivity?

	most active	—————>	least active
A	copper	zinc	iron
B	iron	copper	zinc
C	iron	zinc	copper
D	zinc	iron	copper

26 The diagram shows steel wool inside a test-tube. The test-tube is inverted in water, trapping air inside.

What will be the water level inside the tube after several days?



27 Iron is manufactured in the blast furnace.

Which statement about iron and its manufacture is **not** true?

- A** Iron ore is readily abundant.
- B** It is a continuous process.
- C** Pure iron is produced.
- D** The reducing agent is cheap.

28 Which equation shows a reaction that would actually take place?

- A** $2\text{MgO} + \text{C} \rightarrow \text{CO}_2 + \text{Mg}$
- B** $\text{MgO} + \text{Cu} \rightarrow \text{CuO} + \text{Mg}$
- C** $\text{PbO} + \text{Zn} \rightarrow \text{ZnO} + \text{Pb}$
- D** $\text{ZnO} + \text{H}_2 \rightarrow \text{H}_2\text{O} + \text{Zn}$

- 29 Which gas **cannot** be removed from the exhaust gases of a petrol-powered car by its catalytic converter?
- A carbon dioxide
 - B carbon monoxide
 - C hydrocarbons
 - D nitrogen dioxide
- 30 Which statement shows that diamond and graphite are different forms of the element carbon?
- A Both have giant molecular structures.
 - B Complete combustion of equal masses of each produces equal masses of carbon dioxide as the only product.
 - C Graphite conducts electricity, whereas diamond does not.
 - D Under suitable conditions, graphite can be converted into diamond.
- 31 A sample of tap water gave a white precipitate with acidified silver nitrate.
- What does this show about the tap water?
- A It contained chloride.
 - B It contained harmful microbes.
 - C It contained nitrates.
 - D It had not been filtered.
- 32 Which noble gas is present in the largest percentage by volume in air?
- A argon
 - B helium
 - C krypton
 - D neon
- 33 What is the purpose of vanadium(V) oxide in the Contact Process?
- A It oxidises sulfur to sulfur dioxide.
 - B It oxidises sulfur to sulfur trioxide.
 - C It speeds up the conversion of sulfur dioxide into sulfur trioxide.
 - D It speeds up the conversion of sulfur trioxide into sulfuric acid.

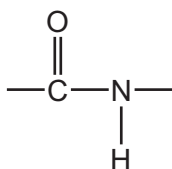
34 Shown below are some properties of compound X.

- reacts with potassium carbonate to produce carbon dioxide
- reacts with ethanol to produce a sweet-smelling liquid
- reacts with sodium hydroxide to produce a salt

What is X?

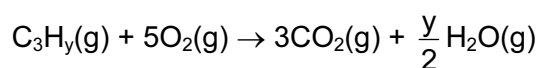
- A ethanol
- B ethanoic acid
- C ethyl ethanoate
- D ethyl methanoate

35 Which pair of macromolecules both contain the linkage shown?



- A fats and proteins
- B nylon and proteins
- C starch and sugars
- D *Terylene* and sugars

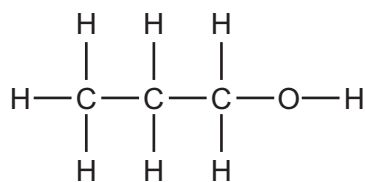
36 A hydrocarbon, C_3H_y , burns in air to form carbon dioxide and water.



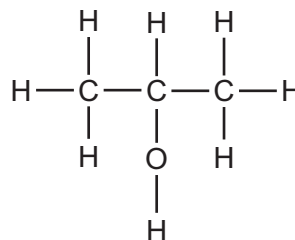
What is the value of y ?

- A 4
- B 6
- C 7
- D 8

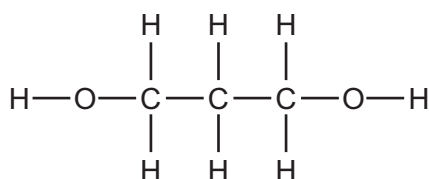
37 The structural formulae of some organic compounds are shown below.



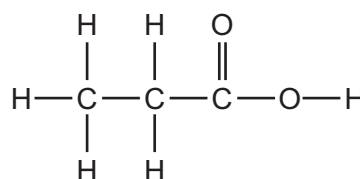
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4

Which compounds are alcohols?

- A** 1, 2, 3 and 4 **B** 1 and 2 only **C** 1, 2 and 3 only **D** 4 only

38 A hydride is a compound containing only two elements, one of which is hydrogen.

Which element forms the **most** hydrides?

- A** carbon
B chlorine
C nitrogen
D oxygen

39 Which compound is manufactured by reacting ethene with steam in the presence of a heated catalyst?

- A** C₂H₆ **B** C₂H₅OH **C** C₄H₈ **D** C₄H₉OH

40 Under certain conditions 1 mole of ethane reacts with 2 moles of chlorine in a substitution reaction.

What is the formula of the organic product in this reaction?

- A** C₂H₅Cl **B** C₂H₄Cl₂ **C** C₂H₂Cl₄ **D** CH₂Cl₂

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*58-71 Lanthanoid series
†90-103 Actinoid series

a	X	a = relative atomic mass
b	X	X = atomic symbol
b	X	b = proton (atomic) number

The volume of one mole of any gas is 24 dm³ at room temperature and pressure (r.t.p.).

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UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS
General Certificate of Education Ordinary Level

CHEMISTRY

5070/12

Paper 1 Multiple Choice

May/June 2012

1 hour

Additional Materials: Multiple Choice Answer Sheet
Soft clean eraser
Soft pencil (type B or HB is recommended)



READ THESE INSTRUCTIONS FIRST

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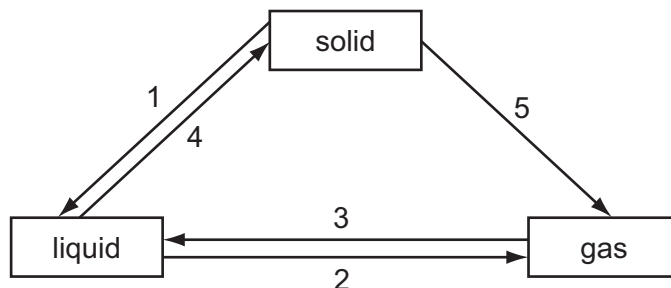
Any rough working should be done in this booklet.

A copy of the Periodic Table is printed on page 16.

This document consists of **13** printed pages and **3** blank pages.



- 1 The diagram shows some of the changes of state.



Which statement is correct?

- A** Although the change is not shown on the diagram, a gas can change directly to a solid.
- B** The changes 1 and 3 involve particles moving closer together.
- C** The changes 2 and 4 involve particles moving further apart.
- D** The changes 3, 4 and 5 all involve the release of energy.
- 2 Which gas is **not** obtained industrially by fractional distillation?
- A** ammonia
- B** argon
- C** nitrogen
- D** oxygen
- 3 When dilute hydrochloric acid is added to a white powder a gas is produced.

The solution remaining is tested separately with small volumes of both aqueous ammonia and aqueous sodium hydroxide.

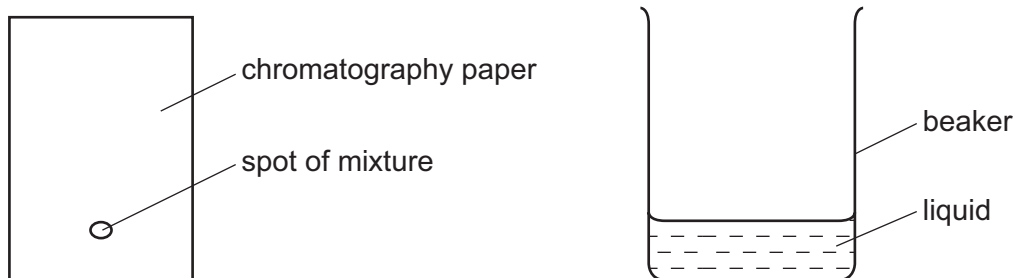
A white precipitate is produced in both tests.

What is the white powder?

- A** aluminium oxide
- B** calcium oxide
- C** copper(II) carbonate
- D** zinc carbonate

- 4 A mixture of two substances is spotted onto a piece of chromatography paper.

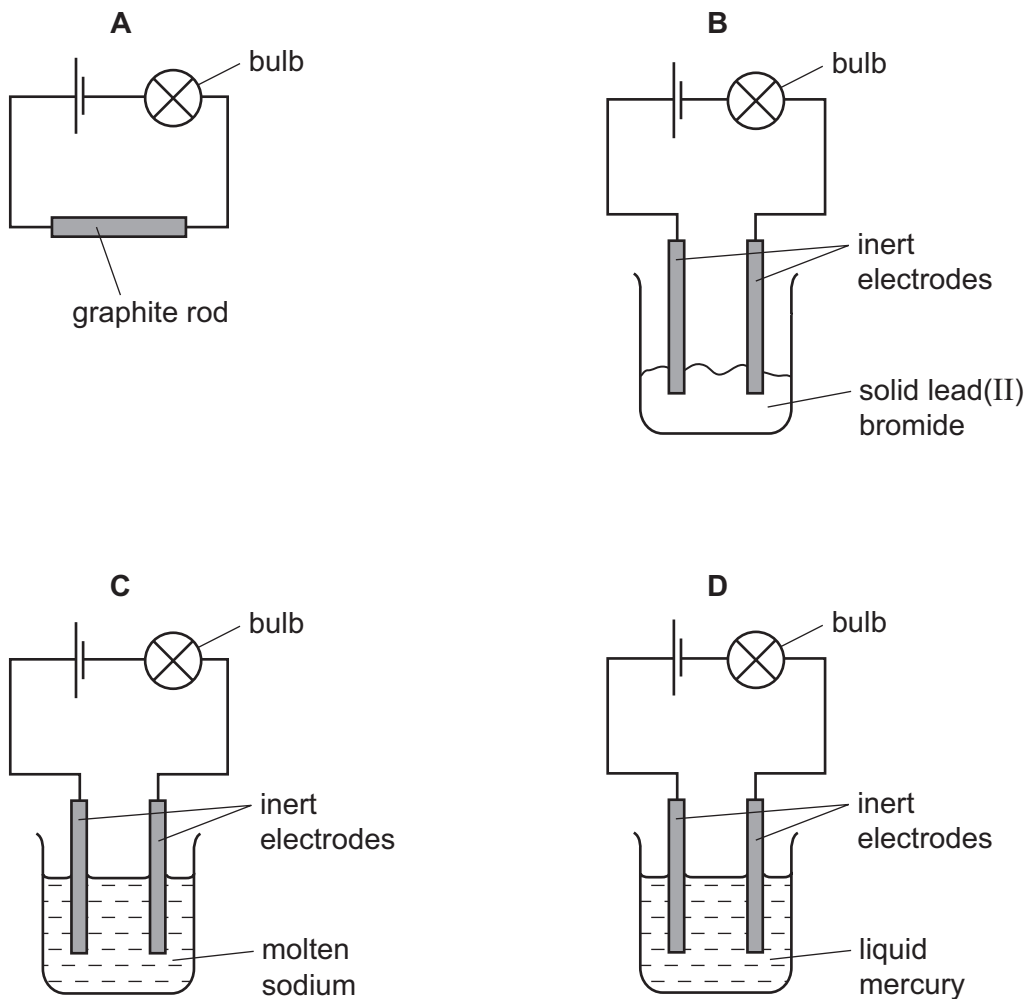
The paper is inserted into a beaker containing a liquid.



For separation of the substances to occur the spot of mixture must

- A be placed so that the spot is just below the level of the liquid.
 - B be soluble in the liquid.
 - C contain substances of the same R_f values.
 - D contain substances that are coloured.
- 5 Which reagent could be used to distinguish between dilute nitric acid and dilute hydrochloric acid?
- A aqueous barium chloride
 - B aqueous silver nitrate
 - C aqueous sodium hydroxide
 - D copper(II) carbonate
- 6 What is the structure of sand?
- A a macromolecule
 - B an ionic lattice
 - C a polymer
 - D a simple molecule
- 7 Pentane, C_5H_{12} , has a higher boiling point than propane, C_3H_8 . Which statement explains the difference in boiling point?
- A Carbon-carbon single bonds are stronger than carbon-hydrogen bonds.
 - B Pentane has more covalent bonds to break.
 - C Pentane does not burn as easily as propane.
 - D The forces of attraction between pentane molecules are stronger than those between propane molecules

8 In which set of apparatus will the bulb be **least** bright?



9 Four substances have the following electrical properties.

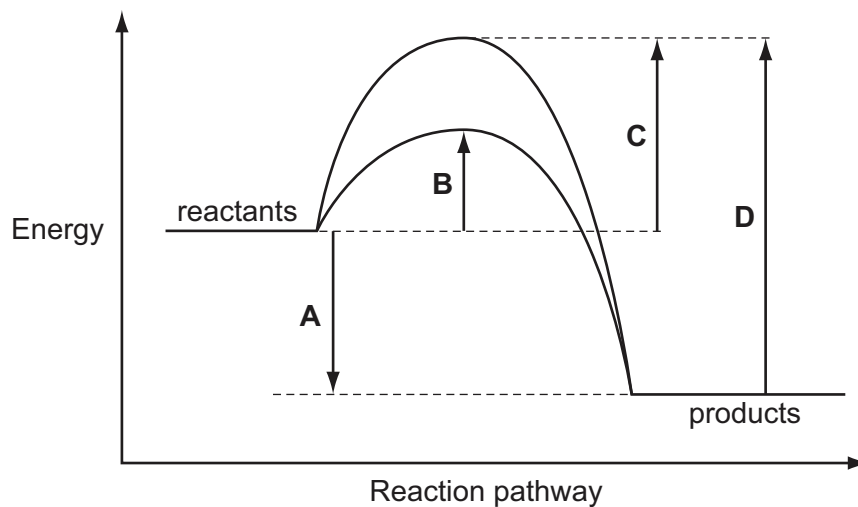
substance	property
W	does not conduct under any conditions
X	conducts only in aqueous solution
Y	conducts in both the molten and solid states
Z	conducts in both the molten and aqueous states

What are these four substances?

	W	X	Y	Z
A	HCl	S	NaCl	Pb
B	Pb	HCl	NaCl	S
C	S	HCl	Pb	NaCl
D	S	NaCl	HCl	Pb

10 The energy profile diagram shows the pathways for a reaction with and without a catalyst.

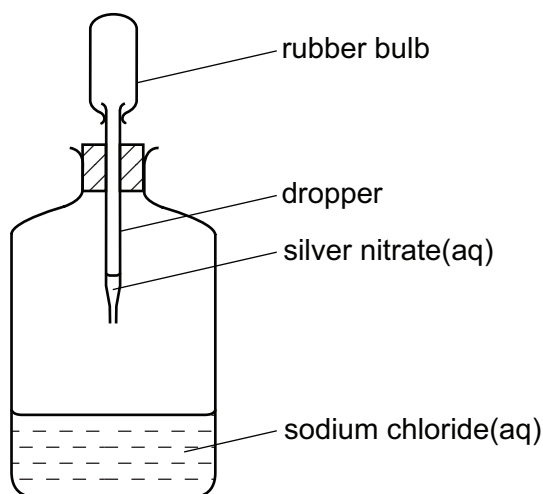
Which energy change is the activation energy for the catalysed reaction?



11 Which statement about conduction of electricity is correct?

- A Electricity is conducted in aqueous solution by electrons.
- B Electricity is conducted in a metal wire by ions.
- C Electricity is conducted in a molten electrolyte by electrons.
- D Electricity is conducted in an acid solution by ions.

- 12 When the rubber bulb of the dropper in the diagram is squeezed, the aqueous silver nitrate drops into the aqueous sodium chloride and a white precipitate of silver chloride is formed.



What happens to the total mass of the bottle and contents?

- A** It increases due to the formation of the heavy precipitate.
- B** It remains the same because only a physical change has taken place.
- C** It decreases because heat is evolved.
- D** It remains the same because none of the products escapes from the bottle.
- 13 What has the same mass as 0.25 mol of copper atoms?
- A** 0.5 mol of oxygen molecules
- B** 1 mol of sulfur dioxide molecules
- C** 1.5 mol of water molecules
- D** 2 mol of oxygen atoms
- 14 Which change **always** takes place when an aqueous solution of copper(II) sulfate is electrolysed?
- A** Copper is deposited at the negative electrode.
- B** Oxygen is evolved at the positive electrode.
- C** Sulfate ions move towards the negative electrode.
- D** The colour of the solution fades.

15 Which substance will conduct electricity without being chemically changed?

- A sodium chloride solution
- B solid iron
- C solid sodium chloride
- D solid sulfur

16 A sample of air was bubbled into water. The pH of the water slowly changed from 7 to 6.

Which gas in the sample caused this change?

- A carbon dioxide
- B carbon monoxide
- C nitrogen
- D oxygen

17 The oxide Q dissolves in water to form a colourless solution. This solution reacts with sodium carbonate to produce carbon dioxide.

What is Q?

- A copper(II) oxide
- B sodium oxide
- C sulfur dioxide
- D zinc oxide

18 The following statements about dilute sulfuric acid are **all** correct.

- 1 Addition of Universal Indicator shows that the solution has a pH value of less than 7.0.
- 2 A white precipitate is formed when aqueous barium nitrate is added.
- 3 The solution reacts with copper(II) oxide, forming a blue solution.
- 4 The solution turns anhydrous copper(II) sulfate from white to blue.

Which two statements confirm the acidic nature of the solution?

- A 1 and 2 B 1 and 3 C 2 and 4 D 3 and 4

19 Which ion reacts with aqueous ammonia to give a precipitate that dissolves in an excess of ammonia?

- A $Al^{3+}(aq)$ B $Fe^{2+}(aq)$ C $Fe^{3+}(aq)$ D $Zn^{2+}(aq)$

20 Which element is **most** likely to be used as an industrial catalyst?

- A Li B Cs C Rh D Po

21 Which compound when reacted with sulfuric acid produces a product which is used as a fertiliser?

- A ammonia
 B calcium carbonate
 C calcium hydroxide
 D sodium hydroxide

22 In which reaction is the underlined substance behaving as an oxidising agent?

- A BaCl₂ + Na₂SO₄ → BaSO₄ + 2NaCl
 B 3CuO + 2NH₃ → 3Cu + N₂ + 3H₂O
 C 2FeCl₂ + Cl₂ → 2FeCl₃
 D O₂ + 2SO₂ → 2SO₃

23 Which statements are true about **all** the noble gases?

- 1 The number of protons in their atoms equals the number of neutrons.
- 2 The number of protons in their atoms does not equal the number of electrons.
- 3 They all have eight electrons in their outer shell.
- 4 They do not react to form ionic compounds.

- A 1, 2 and 3
 B 1 and 3 only
 C 3 only
 D 4 only

24 How many electrons and protons are in an **ion** of an element in Group 2 of the Periodic Table?

	Number of electrons	Number of protons
A	6	4
B	10	12
C	22	20
D	139	137

25 A metal **X** forms oxides with the formulae XO and X_2O_3 .

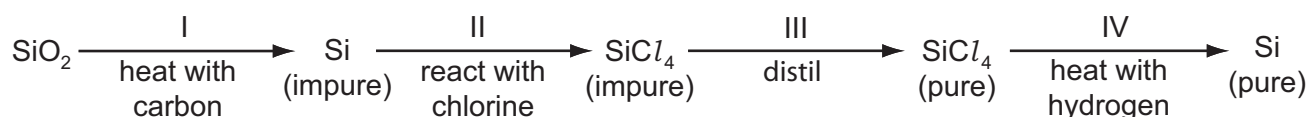
Where is **X** in the Periodic Table?

- A in Group II
- B in Group III
- C the second Period
- D in the transition elements

26 What is a characteristic of a weak acid?

- A It does not react with sodium carbonate.
- B It forms an aqueous solution with a pH of 8.
- C It is only partially ionised when added to water.
- D It turns litmus solution blue.

27 The reaction scheme represents the process for obtaining pure silicon.



In which of the stages is the silicon reduced?

- A I only B I and II C I and IV D II and III

28 Which metal can be obtained from its oxide using hydrogen?

- A calcium
- B copper
- C magnesium
- D zinc

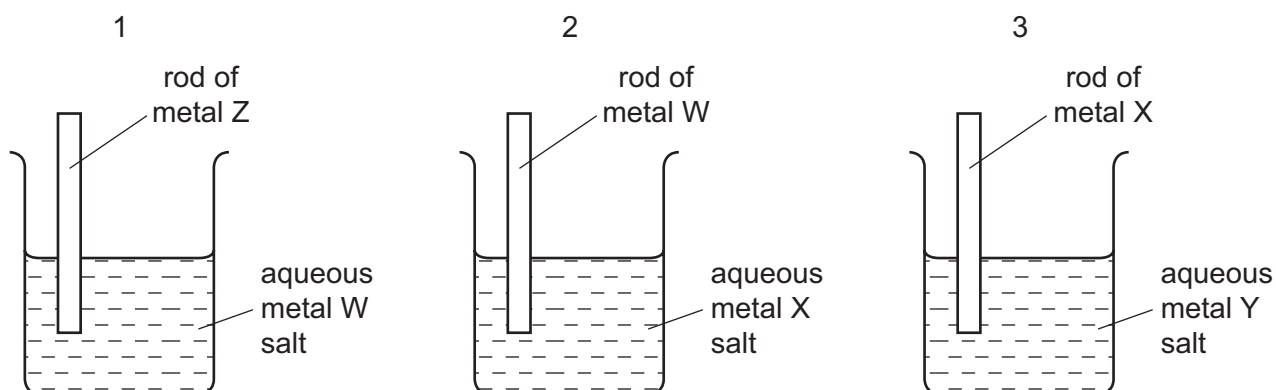
29 Which substance undergoes decomposition because of the high temperature in the blast furnace?

- A coke
- B calcium carbonate
- C calcium silicate
- D slag

30 Which reaction occurring in the blast furnace is an acid base reaction?

- A $C + CO_2 \rightarrow 2CO$
 B $C + O_2 \rightarrow CO_2$
 C $CaO + SiO_2 \rightarrow CaSiO_3$
 D $Fe_2O_3 + 3CO \rightarrow 2Fe + 3CO_2$

31 Three different beakers are set up as shown.



In beaker 1 metal W is displaced from solution.

In beaker 2 metal X is displaced from solution.

In beaker 3 metal Y is displaced from solution.

What is the order of **decreasing** reactivity of the four metals?

	most reactive	→		least reactive
A	W	X	Y	Z
B	X	Y	W	Z
C	Z	W	X	Y
D	Z	X	W	Y

32 Aluminium is manufactured by the electrolysis of aluminium oxide.

Which substances are formed at the electrodes?

	positive electrode	negative electrode
A	aluminium	carbon dioxide
B	aluminium	oxygen
C	carbon dioxide	aluminium
D	oxygen	carbon dioxide

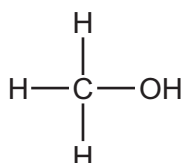
- 33 The processes photosynthesis, respiration and fermentation all change the amount of carbon dioxide in the atmosphere.

Which processes increase the amount of carbon dioxide in the atmosphere?

- A photosynthesis and fermentation
B photosynthesis only
C respiration and fermentation
D respiration only
- 34 Which process would destroy the bacteria in water?
- A chlorination
B desalination
C filtration
D treatment with carbon
- 35 Which compound has more than two carbon atoms per molecule?
- A ethanoic acid
B ethanol
C ethene
D ethyl ethanoate
- 36 The equations show some reactions of organic compounds.

Which is an addition reaction?

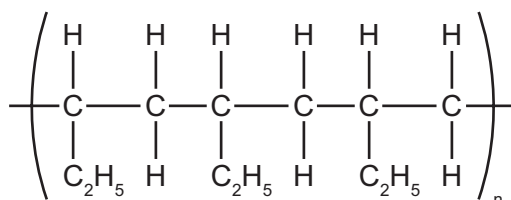
- A $\text{CH}_4 + \text{Br}_2 \rightarrow \text{CH}_3\text{Br} + \text{HBr}$
B $\text{C}_2\text{H}_5\text{OH} + \text{O}_2 \rightarrow \text{CH}_3\text{CO}_2\text{H} + \text{H}_2\text{O}$
C $\text{C}_2\text{H}_5\text{OH} + \text{CH}_3\text{CO}_2\text{H} \rightarrow \text{CH}_3\text{CO}_2\text{C}_2\text{H}_5 + \text{H}_2\text{O}$
D $\text{C}_4\text{H}_4 + 2\text{Br}_2 \rightarrow \text{C}_4\text{H}_4\text{Br}_4$
- 37 Which statement about methanol is correct?
- A It can be oxidised to form methanoic acid.
B It is a constituent of alcoholic drinks.
C It is formed by fermentation.
D Its fully displayed structural formula is



- 38 A 10 cm³ sample of a gaseous hydrocarbon is completely burnt in oxygen. The total volume of the products is 70 cm³. All gas volumes are measured at room temperature and pressure.

Which equation represents the combustion of the hydrocarbon?

- A $\text{CH}_4(\text{g}) + 2\text{O}_2(\text{g}) \rightarrow \text{CO}_2(\text{g}) + 2\text{H}_2\text{O}(\text{g})$
 B $\text{C}_2\text{H}_4(\text{g}) + 3\text{O}_2(\text{g}) \rightarrow 2\text{CO}_2(\text{g}) + 2\text{H}_2\text{O}(\text{g})$
 C $\text{C}_3\text{H}_8(\text{g}) + 5\text{O}_2(\text{g}) \rightarrow 3\text{CO}_2(\text{g}) + 4\text{H}_2\text{O}(\text{g})$
 D $2\text{C}_2\text{H}_6(\text{g}) + 7\text{O}_2(\text{g}) \rightarrow 4\text{CO}_2(\text{g}) + 6\text{H}_2\text{O}(\text{g})$
- 39 One mole of magnesium is dissolved in excess aqueous ethanoic acid, CH₃COOH.
 How many moles of hydrogen, H₂, will be produced?
- A 0.5 B 1 C 2 D 4
- 40 The section of a polymer chain is shown.



Which molecule would produce this polymer and by which type of polymerisation?

	molecule	type of polymerisation
A	CH ₃ -CH=CH-CH ₃	condensation
B	CH ₃ -CH ₂ -CH=CH ₂	addition
C	CH ₃ -CH ₂ -CH ₂ -CH=CH ₂	condensation
D	CH ₃ -CH=CH-CH ₃	addition

DATA SHEET
The Periodic Table of the Elements

		Group												
I	II	III	IV	V	VI	VII	0							
7 Li Lithium 3	9 Be Beryllium 4	1 H Hydrogen 1	11 B Boron 5	12 C Carbon 6	14 N Nitrogen 7	16 O Oxygen 8	19 F Fluorine 9	20 Ne Neon 10						
23 Na Sodium 11	24 Mg Magnesium 12	27 Al Aluminium 13	28 Si Silicon 14	31 P Phosphorus 15	32 S Sulfur 16	35.5 Cl Chlorine 17	40 Ar Argon 18							
39 K Potassium 19	40 Ca Calcium 20	56 Fe Iron 26	55 Mn Manganese 25	59 Co Cobalt 27	59 Ni Nickel 28	64 Cu Copper 29	65 Zn Zinc 30	70 Ga Gallium 31	73 Ge Germanium 32	75 As Arsenic 33	79 Se Selenium 34	84 Kr Krypton 36		
85 Rb Rubidium 37	88 Sr Strontium 38	101 Ru Ruthenium 44	101 Ru Ruthenium 44	103 Rh Rhodium 45	106 Pd Palladium 46	108 Ag Silver 47	112 Cd Cadmium 48	115 In Indium 49	119 Sn Tin 50	122 Sb Antimony 51	128 Te Tellurium 52	131 Xe Xenon 54		
133 Cs Caesium 55	137 Ba Barium 56	186 Os Osmium 76	186 Os Osmium 76	184 W Tungsten 74	195 Pt Platinum 78	197 Au Gold 79	201 Hg Mercury 80	204 Tl Thallium 81	207 Pb Lead 82	209 Bi Bismuth 83	210 Po Polonium 84	210 Rn Radon 86		
226 Ra Radium 88	227 Ac Actinium 89	140 Ce Cerium 58	141 Pr Praseodymium 59	144 Nd Neodymium 60	152 Eu Europium 63	157 Gd Gadolinium 64	159 Tb Terbium 65	162 Dy Dysprosium 66	165 Ho Holmium 67	167 Er Erbium 68	169 Tm Thulium 69	175 Lu Lutetium 71		
		232 Th Thorium 90	238 U Uranium 92	238 U Uranium 92	238 U Uranium 92	238 U Uranium 92	238 U Uranium 92	238 U Uranium 92	238 U Uranium 92	238 U Uranium 92	238 U Uranium 92	238 U Uranium 92	238 U Uranium 92	238 U Uranium 92

*58-71 Lanthanoid series
†90-103 Actinoid series

a	X	b
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Key
a = relative atomic mass
X = atomic symbol
b = proton (atomic) number

The volume of one mole of any gas is 24 dm³ at room temperature and pressure (r.t.p.).

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UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS
General Certificate of Education Ordinary Level

CHEMISTRY

5070/12

Paper 1 Multiple Choice

October/November 2012

1 hour

Additional Materials: Multiple Choice Answer Sheet
 Soft clean eraser
 Soft pencil (type B or HB recommended)



READ THESE INSTRUCTIONS FIRST

Write in soft pencil.

Do not use staples, paper clips, highlighters, glue or correction fluid.

Write your name, Centre number and candidate number on the Answer Sheet in the spaces provided unless this has been done for you.

There are **forty** questions on this paper. Answer **all** questions. For each question there are four possible answers **A, B, C** and **D**.

Choose the **one** you consider correct and record your choice in **soft pencil** on the separate Answer Sheet.

Read the instructions on the Answer Sheet very carefully.

Each correct answer will score one mark. A mark will not be deducted for a wrong answer.

Any rough working should be done in this booklet.

A copy of the Periodic Table is printed on page 16.

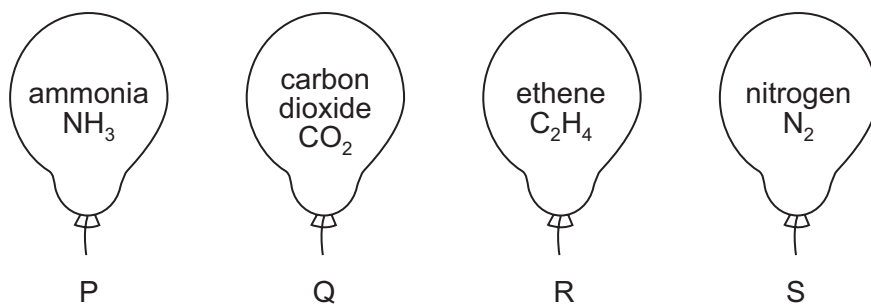
This document consists of **13** printed pages and **3** blank pages.



1 Which is a property of hydrogen gas?

- A It burns in air.
- B It has an unpleasant smell.
- C It relights a glowing splint.
- D It turns moist litmus paper red.

2 Four identical balloons are filled with different gases all at the same temperature and pressure.



The gases gradually diffuse out of the balloons.

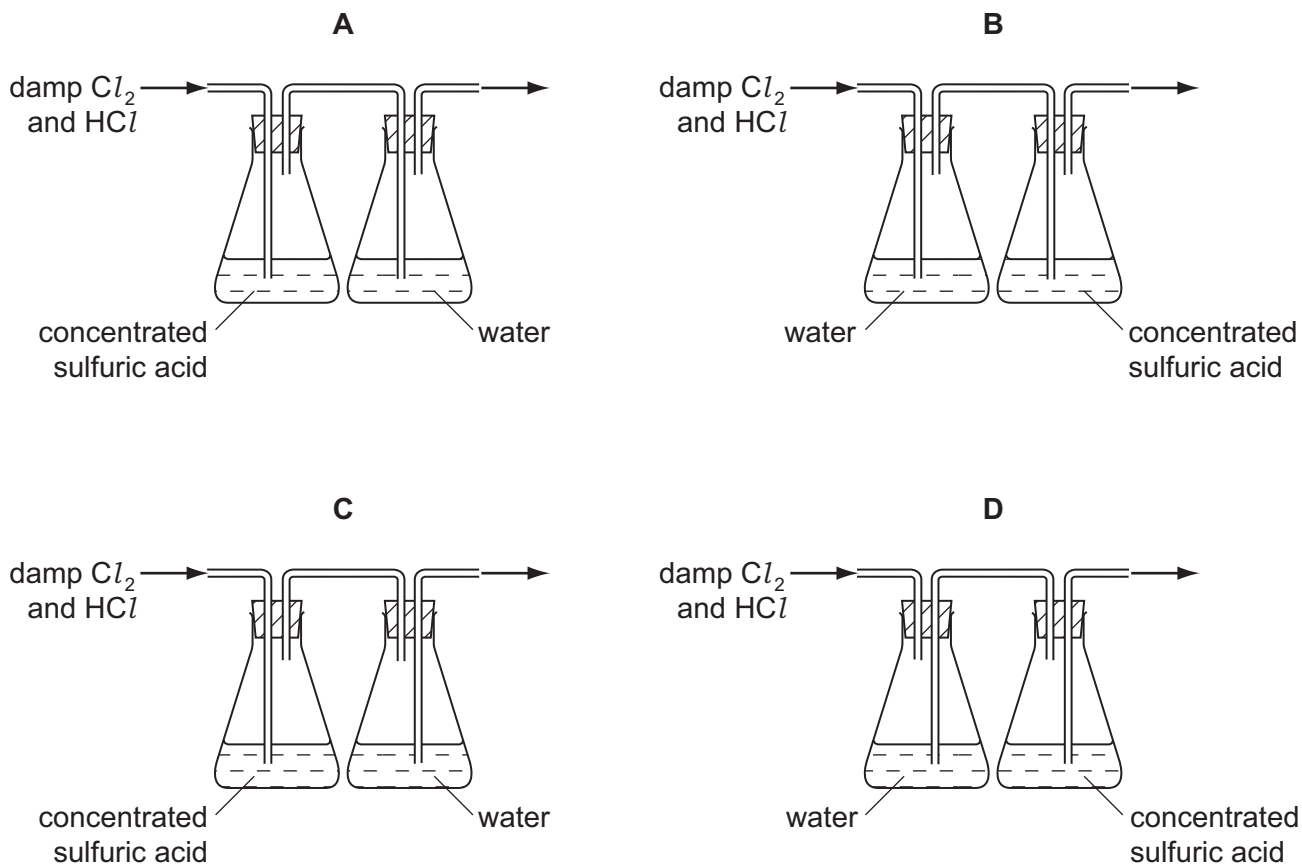
Which pair of balloons will deflate at the same rate?

- A P and Q
- B Q and R
- C R and S
- D S and P

- 3 Hydrogen chloride is very soluble in water, whereas chlorine is only slightly soluble in water.

Both gases can be dried using concentrated sulfuric acid.

Which diagram represents the correct method of obtaining pure dry chlorine from damp chlorine containing a small amount of hydrogen chloride?



- 4 Two particles have the compositions shown.

	electrons	neutrons	protons
X	4	6	5
Y	6	4	5

Which statement about X and Y is correct?

- A They are both positively charged.
- B They are particles of the same element.
- C They have the same mass number.
- D They have the same number of nucleons.

5 Which of the following is **not** a mixture?

- A ethanol
- B petrol
- C steel
- D tap water

6 When concentrated aqueous sodium chloride is electrolysed using carbon electrodes, which row correctly states the products at the electrodes and the solution remaining?

	cathode (-)	anode (+)	solution remaining
A	chlorine	hydrogen	hydrochloric acid
B	hydrogen	chlorine	sodium hydroxide
C	hydrogen	oxygen	sodium chloride
D	sodium	chlorine	water

7 Carbon and silicon are both in Group IV of the Periodic Table, but at room temperature CO_2 is a gas whereas SiO_2 is a solid.

Which statement explains this?

- A Covalent bonding is weaker in CO_2 .
- B Covalent bonds in CO_2 are double bonds and in SiO_2 the covalent bonds are single bonds.
- C CO_2 is a covalent compound and SiO_2 is ionic.
- D CO_2 is a simple covalent molecule and SiO_2 is a macromolecule.

8 An ionic compound has the formula X_3Y_2 .

To which groups of the Periodic Table do X and Y belong?

	group for X	group for Y
A	II	III
B	III	II
C	II	V
D	V	II

9 When two solutions are mixed, a precipitate of a magnesium compound is formed.

Which salt would be formed from solution as a precipitate?

- A MgCO_3
- B MgCl_2
- C $\text{Mg}(\text{NO}_3)_2$
- D MgSO_4

10 Which substance has metallic bonding?

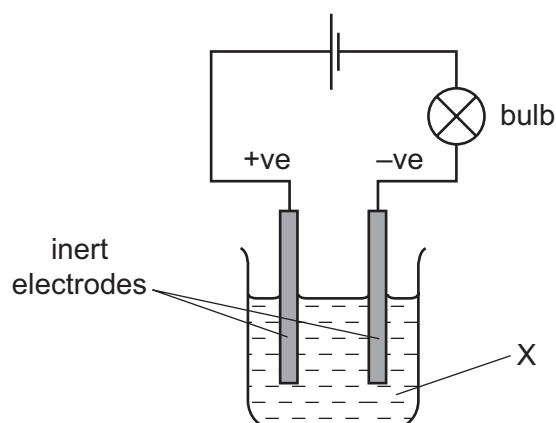
	conducts electricity		state of substance formed on reaction with oxygen
	when solid	when liquid	
A	✓	✓	solid
B	✓	✓	gas
C	x	✓	no reaction
D	x	x	solid

11 In separate experiments sulfur dioxide, a reducing agent, was passed through acidified solutions of potassium dichromate(VI) and potassium manganate(VII).

Which pair describes the colour changes observed in the experiments?

	colour change of potassium dichromate(VI)	colour change of potassium manganate(VII)
A	orange to green	pink to colourless
B	colourless to green	green to pink
C	colourless to orange	pink to green
D	orange to green	colourless to pink

12 In the experiment shown in the diagram, the bulb lights and two colourless gases are formed, one at each electrode.



What is X?

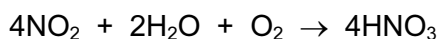
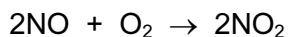
- A** concentrated aqueous sodium chloride
- B** dilute sulfuric acid
- C** methanol
- D** molten sodium chloride

- 13 0.5 mol/dm³ hydrochloric acid is added gradually to a flask containing 20 cm³ of 2 mol/dm³ sodium hydroxide solution.

What is the total volume, in cm³, of the mixture in the flask when the solution is just neutral?

- A 30 B 40 C 60 D 100

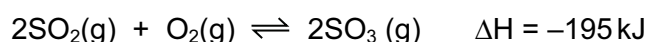
- 14 Two of the reactions used in the manufacture of nitric acid, HNO₃, are shown.



What is the maximum number of moles of nitric acid which could be formed from one mole of nitrogen monoxide, NO?

- A 0.5 B 1.0 C 2.0 D 4.0

- 15 Sulfur trioxide is produced by the following reaction.



Which change in conditions would produce a greater yield of SO₃ at equilibrium?

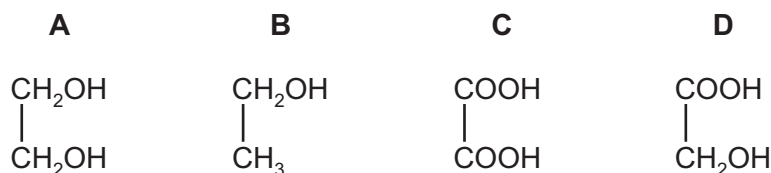
- A adding a catalyst
 B increasing the pressure
 C increasing the temperature
 D removing some SO₂ and O₂

- 16 Solution X has a pH value of 12. It is added to aqueous ammonium chloride and the mixture is warmed.

Which information is correct?

	solution X is	when the mixture is warmed
A	acidic	ammonia gas is given off
B	acidic	no gas is given off
C	alkaline	ammonia gas is given off
D	alkaline	no gas is given off

- 17 Which compound contains only eight covalent bonds?

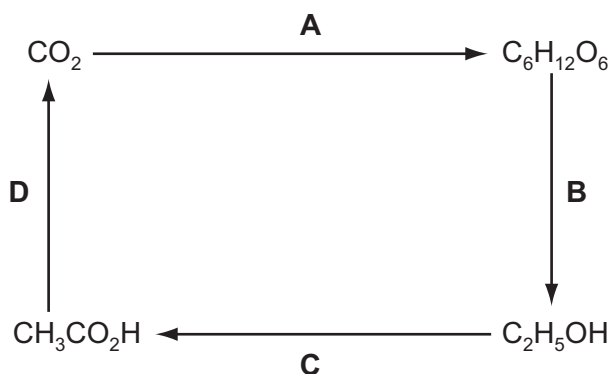


18 Why does an increase in pressure increase the rate of reaction between the gases nitrogen and hydrogen in the manufacture of ammonia?

- A The activation energy is lowered.
- B The molecules collide more frequently.
- C The molecules have more energy.
- D The reaction is more exothermic.

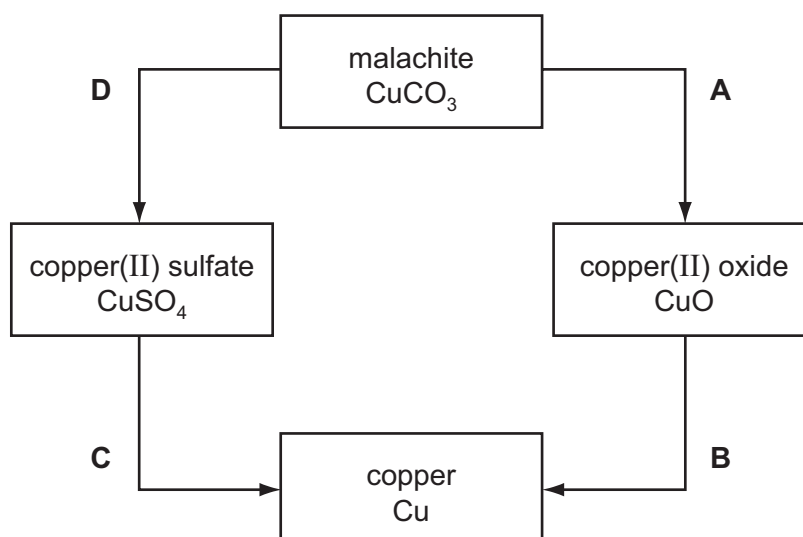
19 The diagram shows the steps by which carbon dioxide can be converted into organic products and finally returned to the atmosphere.

Which step is an example of combustion?



20 The diagram shows some reactions of copper compounds.

Which change is made by adding an acid?



- 21 What is the effect of a catalyst on the activation energy and on the enthalpy change, ΔH , of a reaction?

	activation energy	ΔH
A	decreases	decreases
B	decreases	unchanged
C	increases	decreases
D	increases	unchanged

- 22 Which substance in the table could be an amphoteric oxide?

	reaction with dilute hydrochloric acid	reaction with water	reaction with sodium hydroxide
A	dissolves	insoluble	dissolves
B	dissolves	insoluble	insoluble
C	insoluble	dissolves	insoluble
D	insoluble	insoluble	dissolves

- 23 Which element in the table is an alkali metal?

	melting point °C	density g/cm ³
A	-39	13.60
B	-7	3.10
C	98	0.97
D	1083	8.92

- 24 Which compound is present in sand in the largest proportion?

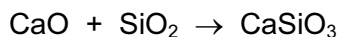
A Al_2O_3 **B** $CaSO_4$ **C** $NaCl$ **D** SiO_2

- 25 Atoms of elements X and Y have the electron configurations 2,5 and 2,8,5 respectively.

Which deduction about these elements can be made from this information?

- A** The atoms are isomers.
B The atoms are isotopes.
C The elements are in the same group of the Periodic Table.
D The elements are in the same period of the Periodic Table.

26 What is the function of silica, SiO_2 , in the equation shown below?



- A a basic oxide
 B a reducing agent
 C an acidic oxide
 D an oxidising agent
- 27 Which gas **can** be removed from the exhaust gases of a petrol-powered car by its catalytic converter?
- A carbon monoxide
 B carbon dioxide
 C nitrogen
 D steam
- 28 Metal **M** will displace copper from aqueous copper(II) sulfate solution, but will not displace iron from aqueous iron(II) sulfate solution. **M** is extracted from its oxide by heating the oxide with carbon.

What is the order of reactivity of these four metals?

	least reactive	—————→	most reactive	
A	sodium	metal M	iron	copper
B	sodium	iron	metal M	copper
C	copper	iron	metal M	sodium
D	copper	metal M	iron	sodium

29 Which substance in the table is the element iodine?

	state at room temperature	electrical conductivity when molten
A	liquid	good
B	liquid	none
C	solid	good
D	solid	none

30 Iron pipes corrode rapidly when exposed to sea water.

Which metal, when attached to the iron, would **not** offer protection against corrosion?

- A aluminium
- B copper
- C magnesium
- D zinc

31 Which method is used in industry to extract aluminium from bauxite?

- A electrolysis
- B heating alone
- C heating with carbon
- D heating with magnesium

32 Which row shows both the correct source and the correct effect of the named pollutant?

	pollutant	source	effect
A	carbon monoxide	incomplete combustion of carbon-containing materials	global warming
B	oxides of nitrogen	decaying vegetable matter	global warming
C	ozone	photochemical reactions	acid rain
D	sulfur dioxide	volcanoes	acid rain

33 A sample of soil has a nitrogenous fertiliser in the form of an ammonium salt added to it. The ammonium salt dissolves in the water in the soil.

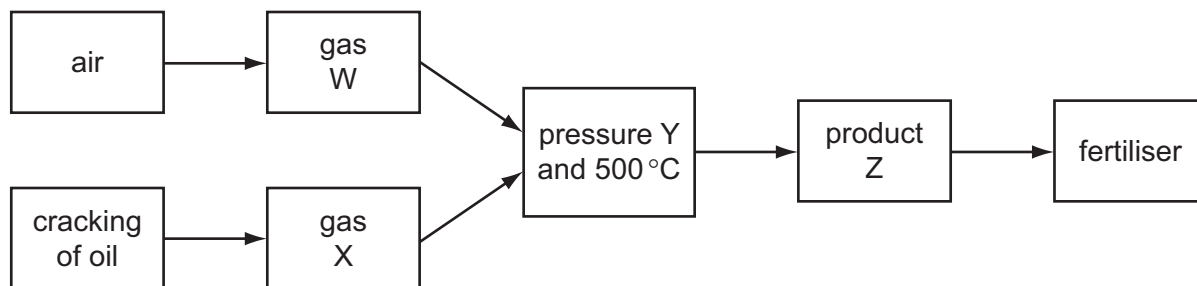
When tested a week later, the water in the soil contained 15.3% of dissolved nitrogen and had a pH of 4.6.

Calcium hydroxide was added to the soil and then the water in the soil was tested the next day, both for nitrogen content and pH.

What would be the most likely result of the final test?

	% of nitrogen	pH
A	11.4	3.8
B	12.7	6.9
C	15.3	4.6
D	19.8	4.2

34 The diagram shows a flow chart for the manufacture of fertiliser.



In the flow chart, what are W, X, Y and Z?

	W	X	Y	Z
A	H ₂	N ₂	high	NH ₃
B	O ₂	SO ₂	high	SO ₃
C	O ₂	SO ₂	low	SO ₃
D	N ₂	H ₂	high	NH ₃

35 A factory manufactures poly(ethene).

Which raw material will the factory need?

- A** bitumen
- B** methane
- C** methanol
- D** naphtha

36 Starch is a carbohydrate and is broken down to simple sugars by saliva in the mouth.

What is the name for this reaction?

- A** condensation
- B** fermentation
- C** hydrolysis
- D** polymerisation

37 If 1 mole of each alkane is completely burned in oxygen, which will provide 7 moles of products?

- A** CH₄
- B** C₂H₆
- C** C₃H₈
- D** C₄H₁₀

38 An alcohol contains 60% carbon by mass.

What is its formula?

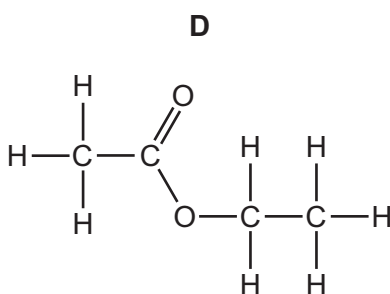
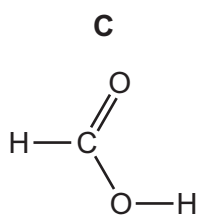
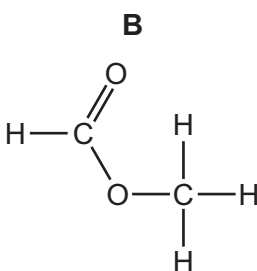
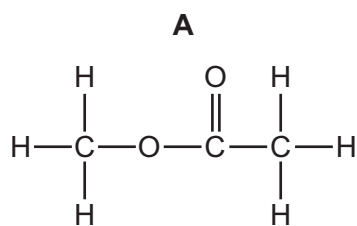
- A CH_3OH B $\text{C}_2\text{H}_5\text{OH}$ C $\text{C}_3\text{H}_7\text{OH}$ D $\text{C}_4\text{H}_9\text{OH}$

39 The alcohol $\text{C}_4\text{H}_9\text{OH}$ on oxidation with acidified potassium dichromate(VI) will give a carboxylic acid X.

Which acid is X?

- A $\text{C}_4\text{H}_9\text{COOH}$ B $\text{C}_3\text{H}_7\text{COOH}$ C $\text{C}_2\text{H}_5\text{COOH}$ D CH_3COOH

40 Which compound has a pH of less than 7?



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DATA SHEET
The Periodic Table of the Elements

		Group											
		I	II	III	IV	V	VI	VII	VIII	IX	X		
		1 H Hydrogen 1											
7	9												
Li Lithium 3	Be Beryllium 4												
23	24												
Na Sodium 11	Mg Magnesium 12												
39	40												
K Potassium 19	Ca Calcium 20	45	48	51	52	55	56	59	59	64	65		
		Sc Scandium 21	Ti Titanium 22	V Vanadium 23	Cr Chromium 24	Mn Manganese 25	Fe Iron 26	Co Cobalt 27	Ni Nickel 28	Cu Copper 29	Zn Zinc 30		
85	88	89	91	93	96	101	101	103	106	108	112		
Rb Rubidium 37	Sr Strontium 38	Y Yttrium 39	Zr Zirconium 40	Nb Niobium 41	Mo Molybdenum 42	Ru Ruthenium 44	Rh Rhodium 45	Pd Palladium 46	Ag Silver 47	Cd Cadmium 48			
133	137	139	178	181	184	190	190	192	195	197	201		
Cs Caesium 55	Ba Barium 56	La Lanthanum 57	Hf Hafnium 72	Ta Tantalum 73	W Tungsten 74	Os Osmium 76	Ir Iridium 77	Pt Platinum 78	Au Gold 79	Hg Mercury 80			
226	227	227											
Fr Francium 87	Ra Radium 88	Ac Actinium 89											
*58-71 Lanthanoid series †90-103 Actinoid series													
		a		X		b							
		Key		X = relative atomic mass		X = atomic symbol						b = proton (atomic) number	
140	141	144	150	152	157	159	162	165	167	169	173		
Ce Cerium 58	Pr Praseodymium 59	Nd Neodymium 60	Sm Samarium 62	Eu Europium 63	Gd Gadolinium 64	Tb Terbium 65	Dy Dysprosium 66	Ho Holmium 67	Er Erbium 68	Tm Thulium 69	Yb Ytterbium 70		
232	238	238	238	238	238	238	238	238	238	238	238		
Th Thorium 90	Pa Protactinium 91	U Uranium 92	Pu Plutonium 94	Am Americium 95	Cm Curium 96	Bk Berkelium 97	Cf Californium 98	Es Einsteinium 99	Fm Fermium 100	Md Mendelevium 101	No Nobelium 102		
175	175	175	175	175	175	175	175	175	175	175	175		
Lu Lutetium 71	Yb Ytterbium 71	Lu Lutetium 71	Lu Lutetium 71	Lu Lutetium 71	Lu Lutetium 71	Lu Lutetium 71	Lu Lutetium 71	Lu Lutetium 71	Lu Lutetium 71	Lu Lutetium 71	Lu Lutetium 71		
86	86	86	86	86	86	86	86	86	86	86	86		
Rn Radon 86	Rn Radon 86	Rn Radon 86	Rn Radon 86	Rn Radon 86	Rn Radon 86	Rn Radon 86	Rn Radon 86	Rn Radon 86	Rn Radon 86	Rn Radon 86	Rn Radon 86		

The volume of one mole of any gas is 24 dm³ at room temperature and pressure (r.t.p.).

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UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS
General Certificate of Education Ordinary Level

CHEMISTRY

5070/12

Paper 1 Multiple Choice

October/November 2013

1 hour

Additional Materials: Multiple Choice Answer Sheet
 Soft clean eraser
 Soft pencil (type B or HB recommended)



READ THESE INSTRUCTIONS FIRST

Write in soft pencil.

Do not use staples, paper clips, highlighters, glue or correction fluid.

Write your name, Centre number and candidate number on the Answer Sheet in the spaces provided unless this has been done for you.

DO NOT WRITE IN ANY BARCODES.

There are **forty** questions on this paper. Answer **all** questions. For each question there are four possible answers **A, B, C** and **D**.

Choose the **one** you consider correct and record your choice in **soft pencil** on the separate Answer Sheet.

Read the instructions on the Answer Sheet very carefully.

Each correct answer will score one mark. A mark will not be deducted for a wrong answer.

Any rough working should be done in this booklet.

A copy of the Periodic Table is printed on page 16.

Electronic calculators may be used.

This document consists of **15** printed pages and **1** blank page.

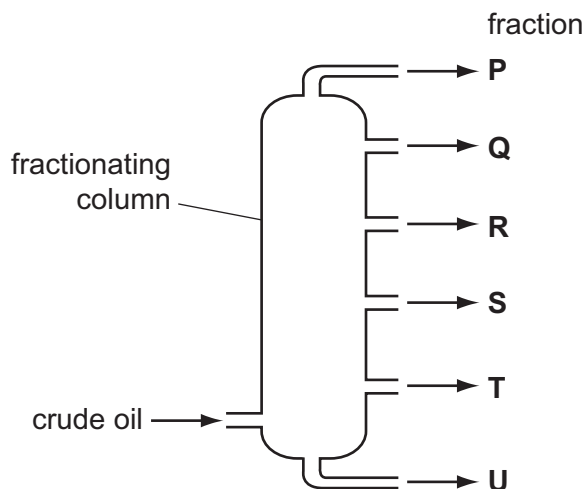


- 1 When drops of bromine are placed on a table-top at one side of a room, the smell of bromine can eventually be detected at the other side of the room.

What is **not** part of the explanation of this?

After evaporation, the bromine particles

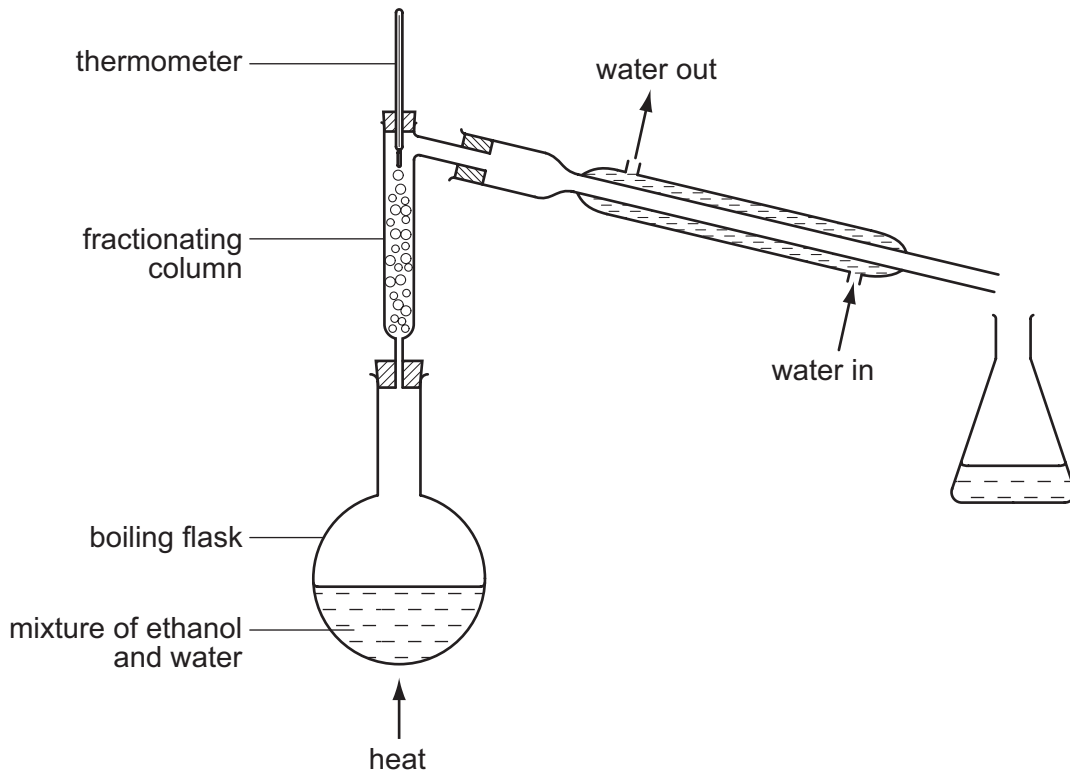
- A collide with air particles.
 - B move in a random way.
 - C spread out to occupy the total available space.
 - D vibrate from side to side.
- 2 Which elements exist as diatomic molecules at room temperature?
- A hydrogen, oxygen, helium
 - B nitrogen, chlorine, neon
 - C nitrogen, oxygen, fluorine
 - D oxygen, chlorine, helium
- 3 The diagram shows the fractionation of crude oil.



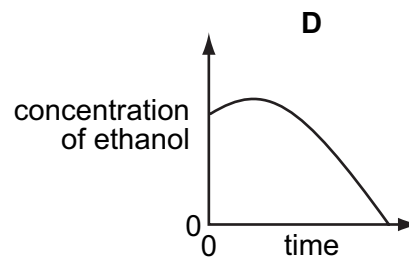
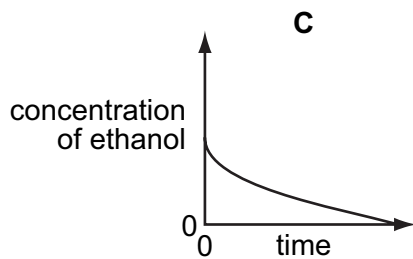
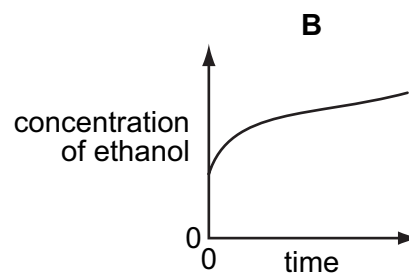
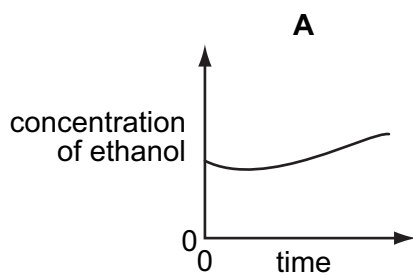
Which statement is correct?

- A Each fraction consists of a single compound.
- B Fraction **P** has the highest boiling point.
- C The highest temperature is at the top of the column.
- D The naphtha fraction is used as feedstock for the chemical industry.

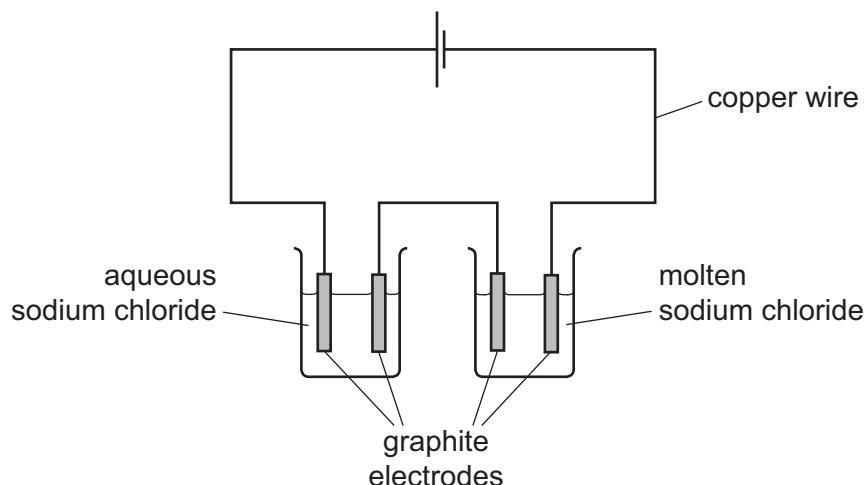
- 4 The apparatus shown is used to distil a dilute solution of ethanol in water.
[B.P.: ethanol, 78 °C; water 100 °C]



Which graph shows the change in concentration of the ethanol in the boiling flask as the distillation proceeds?



- 5 The diagram shows the electrolysis of aqueous sodium chloride and of molten sodium chloride.



Which substance in the diagram has both positive ions and mobile electrons?

- A** aqueous sodium chloride
B copper wire
C graphite electrodes
D molten sodium chloride
- 6 Substance X has a simple molecular structure and substance Y has a giant molecular structure.

Which row is correct?

	X could be	Y could be
A	an element only	an element only
B	an element only	an element or a compound
C	an element or a compound	an element only
D	an element or a compound	an element or a compound

- 7 The table gives some of the properties of four substances.

Which substance could be hydrogen chloride?

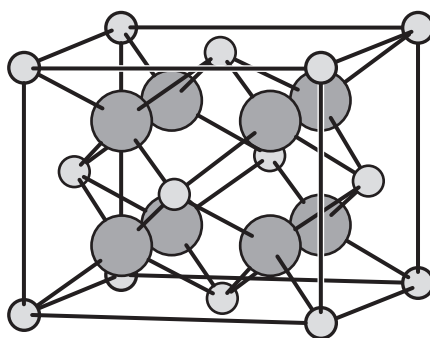
	melting point /°C	boiling point /°C	ability to conduct electricity	
			when liquid	in aqueous solution
A	-114	-85	none	good
B	-114	78	none	none
C	180	218	none	(insoluble)
D	808	1465	good	good

- 8 Aqueous silver nitrate is added to separate solutions of potassium chloride and sodium iodide.

What are the colours of the precipitates formed?

	colour of precipitate formed with chloride	colour of precipitate formed with iodide
A	white	white
B	white	yellow
C	yellow	white
D	yellow	yellow

- 9 The diagram shows the structure of an ionic compound.



What is a possible formula for this compound?

- A** CaF_2 **B** NaCl **C** SO_2 **D** MgO
- 10 18 g of water contains the same number of molecules as
- A** 18 g of ammonia gas.
B 2 g of hydrogen gas.
C 14 g of nitrogen gas.
D 16 g of oxygen gas.
- 11 The complete combustion of 20 cm^3 of a gaseous alkane, **X**, requires 130 cm^3 of oxygen. Both volumes were measured at r.t.p..
- What could be the identity of **X**?
- A** butane
B ethane
C methane
D propane

12 Which process will separate an ionic compound PQ into its elements P and Q ?

- A distillation
- B electrolysis
- C filtration
- D precipitation

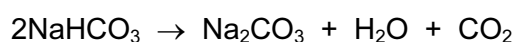
13 Which statement describes the conversion of magnesium atoms to magnesium ions?

- A The change is reduction, because there has been a gain of electrons.
- B The change is oxidation, because there has been a loss of electrons.
- C The change is reduction, because there has been a loss of electrons.
- D The change is oxidation, because there has been a gain of electrons.

14 Which arrangement would be used to electroplate copper onto a steel key?

	electrolyte	anode (positive electrode)	cathode (negative electrode)
A	aqueous copper(II) sulfate	piece of pure copper	steel key
B	aqueous copper(II) sulfate	steel key	piece of pure copper
C	aqueous sulfuric acid	piece of pure copper	steel key
D	aqueous sulfuric acid	steel key	piece of pure copper

15 Sodium hydrogencarbonate decomposes on heating.



In an experiment, a 5.0 mol sample of sodium hydrogencarbonate is heated.

Which volume of carbon dioxide, measured at room temperature and pressure, is evolved?

- A 24 dm³ B 36 dm³ C 48 dm³ D 60 dm³

16 It has been suggested that the cars of the future could be powered by fuel cells. One type of fuel cell uses the chemical reaction between oxygen and hydrogen to produce electricity.

What would be a disadvantage of using this type of fuel cell to power a car?

- A A car cannot be powered by electricity.
- B The hydrogen tank might split in an accident, leading to an explosion.
- C The product of the reaction between oxygen and hydrogen is toxic.
- D The oxygen would need to be obtained from air.

17 Sulfur and selenium, Se, are in the same group of the Periodic Table.

From this, we would expect selenium to form compounds having the formulae

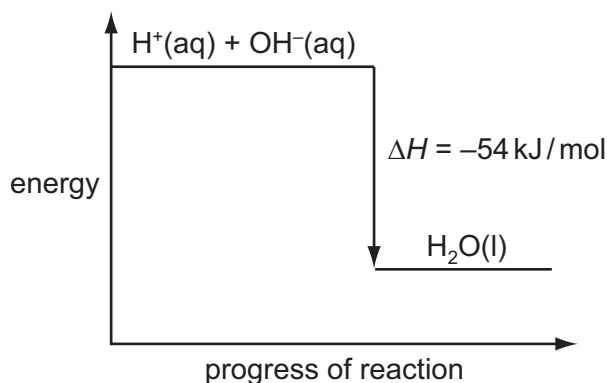
- A Se_2O , Na_2Se and NaSeO_4 .
- B SeO_2 , Na_2Se and NaSeO_4 .
- C SeO_2 , Na_2Se and Na_2SeO_4 .
- D SeO_3 , NaSe and NaSeO_4 .

18 When the product of a reaction between two gases is added to water, a solution of pH7 is formed.

Which could be these gases?

- A hydrogen and chlorine
- B hydrogen and nitrogen
- C hydrogen and oxygen
- D oxygen and carbon monoxide

19 The energy diagram for the reaction between aqueous sodium hydroxide and dilute hydrochloric acid is shown.



What can be deduced from the diagram?

- A The energy change when one mole of water is formed from its elements, hydrogen and oxygen, is 54 kJ/mol .
- B The OH^- ions have more energy than the H^+ ions.
- C The products contain less energy than the reactants.
- D The reaction is endothermic.

20 Which change will **not** increase the rate of a chemical reaction?

- A an increase in concentration of aqueous reactants
- B an increase in pressure of gaseous reactants
- C an increase in temperature of a reaction system
- D an increase in the particle size of solid reactants

21 The metals iron, lead and zinc can be manufactured by the reduction of their oxides with coke.

What is the correct order of the ease of reduction of the metal oxides?

	oxides become more difficult to reduce →
A	iron → lead → zinc
B	iron → zinc → lead
C	lead → iron → zinc
D	zinc → iron → lead

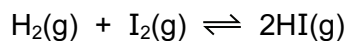
22 The following stages happen during eutrophication.

- 1 increase in growth of algae
- 2 increase in nitrate concentration
- 3 death of aquatic plants
- 4 decrease in dissolved oxygen

In which order do these stages occur?

- A 1 → 2 → 3 → 4
- B 1 → 2 → 4 → 3
- C 2 → 1 → 3 → 4
- D 2 → 1 → 4 → 3

- 23 The equation shows that mixtures of hydrogen gas and iodine vapour can reach dynamic equilibrium.



Two students, X and Y, make statements about the equilibrium mixture.

X Hydrogen iodide is continually being formed and decomposed.

Y If more hydrogen is injected into the equilibrium mixture the equilibrium concentration of HI increases.

Which statements are correct?

- A both X and Y
B X only
C Y only
D neither X nor Y
- 24 Aluminium is manufactured by the electrolysis of molten aluminium oxide.

Which gas is **not** formed during this process?

- A carbon dioxide
B carbon monoxide
C oxygen
D sulfur dioxide
- 25 Which equation represents a redox reaction?
- A $4\text{CuO} + \text{CH}_4 \rightarrow 4\text{Cu} + 2\text{H}_2\text{O} + \text{CO}_2$
B $\text{CuO} + \text{H}_2\text{SO}_4 \rightarrow \text{CuSO}_4 + \text{H}_2\text{O}$
C $\text{CuCO}_3 \rightarrow \text{CuO} + \text{CO}_2$
D $\text{CuSO}_4 + 2\text{NaOH} \rightarrow \text{Cu}(\text{OH})_2 + \text{Na}_2\text{SO}_4$

- 26 What is the percentage, by mass, of nitrogen in the fertiliser $(\text{NH}_4)_3\text{PO}_4$?
[A_r: H, 1; N, 14; O, 16; P, 31]

- A 9.4% B 18.8% C 28.2% D 37.6%

- 27 In the Contact process for the manufacture of sulfuric acid, the most important reaction occurs in the catalyst chamber.

Which set of reactants and catalyst for this reaction is correct?

	reactants	catalyst
A	sulfur and oxygen	vanadium(V) oxide
B	sulfur dioxide and air	vanadium(V) oxide
C	sulfur dioxide and steam	iron
D	sulfur trioxide and water	platinum

- 28 Which compound is formed by a method involving precipitation?

- A** NaCl
B K_2SO_4
C $\text{Ca}(\text{NO}_3)_2$
D PbSO_4

- 29 Ionic compounds have high melting points because of the strong attraction between oppositely charged ions.

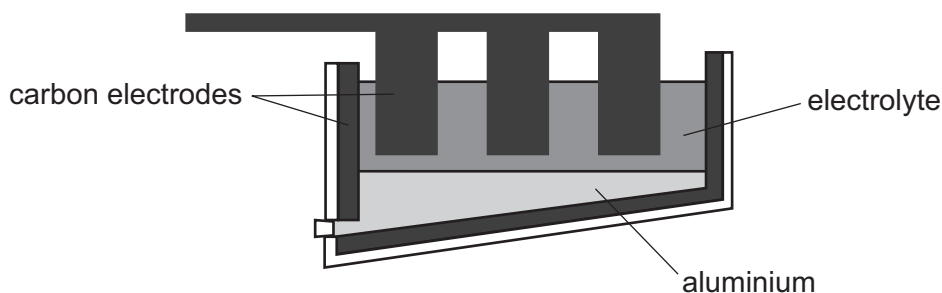
Which compound has the lowest melting point?

- A** $(\text{Al}^{3+})_2(\text{O}^{2-})_3$
B $\text{Mg}^{2+}\text{O}^{2-}$
C Na^+Cl^-
D $(\text{Fe}^{3+})_2(\text{O}^{2-})_3$

- 30 In which row are the elements placed in the correct order of their chemical reactivity, starting with the most reactive element?

	most reactive	—————→	least reactive
A	calcium	magnesium	silver
B	magnesium	calcium	silver
C	silver	calcium	magnesium
D	silver	magnesium	calcium

31 The diagram shows the apparatus needed to extract aluminium from aluminium oxide.



Which statement about this process is correct?

- A The electrolyte is a solid mixture of aluminium oxide and cryolite.
- B The electrolyte is aluminium oxide dissolved in water.
- C The equation for the reaction at the positive electrode is $Al^{3+} + 3e^{-} \rightarrow Al$.
- D The positive carbon electrodes lose mass during the process and need regular replacement.

32 Graphite shares some properties with metals.

Which property of graphite is **not** one of the general properties of metals?

- A Graphite forms a gaseous oxide.
- B Graphite has a high melting point.
- C Graphite is a conductor of electricity.
- D Graphite is a solid.

33 Which metallic element, represented by X, has the following characteristics?

- It can be prevented from corroding by attaching a piece of magnesium to it.
- Two of its oxides have the formulae XO and X_2O_3 .
- It has the highest percentage by mass of all the metals present in stainless steel.

- A Fe B Na C Pb D Zn

34 Which pair of gases are both non-acidic?

- A ammonia and methane
- B carbon dioxide and ammonia
- C methane and nitrogen dioxide
- D nitrogen dioxide and carbon dioxide

35 Both nylon and the proteins found in egg yolk are polymers.

Which statement about nylon and these proteins is correct?

A They are both naturally occurring macromolecules.

B They are both polyamides.

C They both possess the $\begin{array}{c} \text{O} \\ \parallel \\ \text{---C---O---} \end{array}$ linkage.

D They can both be hydrolysed to form amino acids.

36 An organic compound has an empirical formula $\text{C}_2\text{H}_4\text{O}$.

What could the compound be?

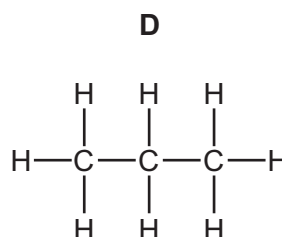
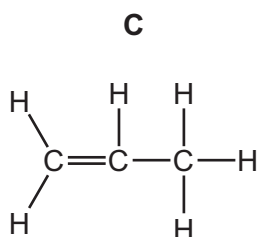
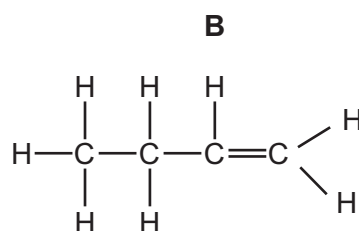
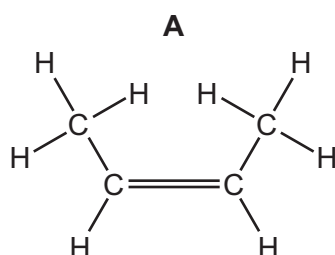
A butanoic acid

B butanol

C ethanoic acid

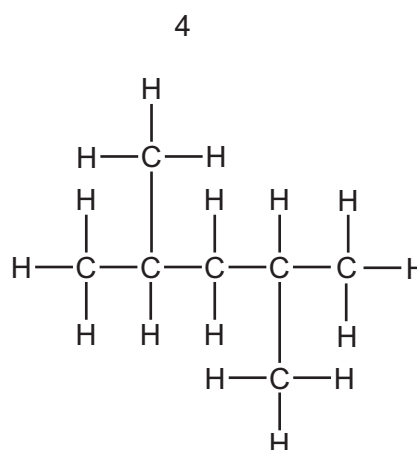
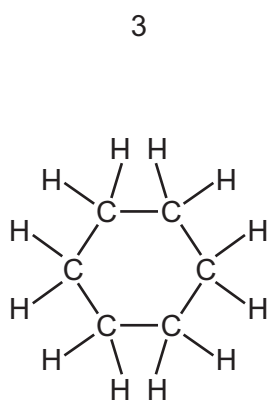
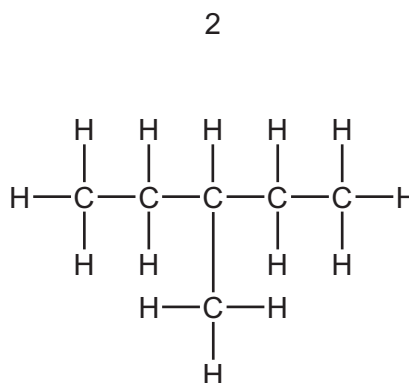
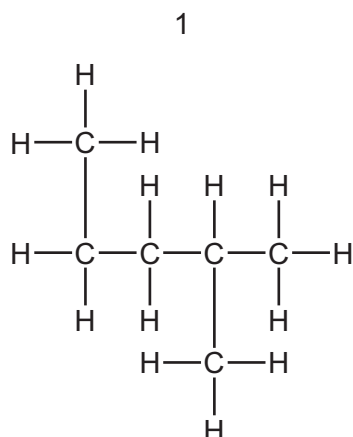
D ethanol

37 Which diagram shows the structure of the monomer of poly(propene)?



38 Alkanes are saturated compounds containing carbon and hydrogen only.

Structures 1, 2, 3 and 4 are saturated hydrocarbons.



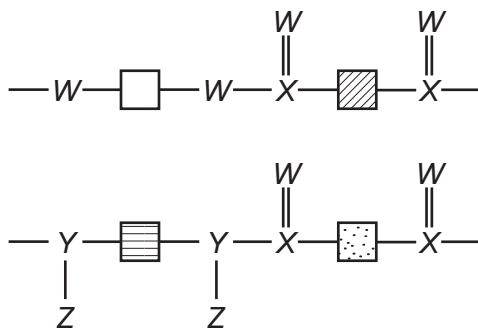
Which pair of structures are isomers?

- A** 1 and 2 **B** 1 and 4 **C** 2 and 3 **D** 2 and 4

39 Which pair of compounds are both esters and are isomers of each other?

- A** HCO_2CH_3 and $\text{CH}_3\text{CO}_2\text{H}$
B $\text{CH}_3\text{CO}_2\text{CH}_3$ and $\text{C}_2\text{H}_5\text{CO}_2\text{H}$
C $\text{CH}_3\text{CO}_2\text{C}_2\text{H}_5$ and $\text{C}_2\text{H}_5\text{CO}_2\text{CH}_3$
D $\text{C}_3\text{H}_7\text{CO}_2\text{CH}_3$ and $\text{CH}_3\text{CO}_2\text{C}_2\text{H}_5$

40 The diagram shows the partial structures of two different polymers.



Which chemical symbols should replace W , X , Y and Z ?

	W	X	Y	Z
A	C	N	H	O
B	O	C	H	N
C	O	C	N	H
D	N	H	O	C

DATA SHEET
The Periodic Table of the Elements

		Group																										
		I	II	III	IV	V	VI	VII	VIII	IX	X	0																
		1 H Hydrogen 1											4 He Helium 2															
7 Li Lithium 3	9 Be Beryllium 4											11 B Boron 5	12 C Carbon 6	14 N Nitrogen 7	16 O Oxygen 8	17 F Fluorine 9	18 Ne Neon 10											
23 Na Sodium 11	24 Mg Magnesium 12											27 Al Aluminium 13	28 Si Silicon 14	31 P Phosphorus 15	32 S Sulfur 16	35.5 Cl Chlorine 17	40 Ar Argon 18											
39 K Potassium 19	40 Ca Calcium 20	45 Sc Scandium 21	48 Ti Titanium 22	51 V Vanadium 23	52 Cr Chromium 24	55 Mn Manganese 25	56 Fe Iron 26	59 Co Cobalt 27	59 Ni Nickel 28	64 Cu Copper 29	65 Zn Zinc 30	70 Ga Gallium 31	73 Ge Germanium 32	75 As Arsenic 33	79 Se Selenium 34	80 Br Bromine 35	84 Kr Krypton 36											
85 Rb Rubidium 37	88 Sr Strontium 38	89 Y Yttrium 39	91 Zr Zirconium 40	93 Nb Niobium 41	96 Mo Molybdenum 42	101 Ru Ruthenium 44	106 Pd Palladium 46	108 Ag Silver 47	112 Cd Cadmium 48	115 In Indium 49	119 Sn Tin 50	122 Sb Antimony 51	128 Te Tellurium 52	127 I Iodine 53	131 Xe Xenon 54													
133 Cs Caesium 55	137 Ba Barium 56	139 La Lanthanum 57	178 Hf Hafnium 72	181 Ta Tantalum 73	184 W Tungsten 74	190 Os Osmium 76	195 Pt Platinum 78	197 Au Gold 79	201 Hg Mercury 80	204 Tl Thallium 81	207 Pb Lead 82	209 Bi Bismuth 83	210 Po Polonium 84	210 At Astatine 85	210 Rn Radon 86													
226 Ra Radium 88	227 Ac Actinium 89											226 Fr Francium 87																
													140 Ce Cerium 58	141 Pr Praseodymium 59	144 Nd Neodymium 60	150 Sm Samarium 62	152 Eu Europium 63	157 Gd Gadolinium 64	162 Dy Dysprosium 66	165 Ho Holmium 67	167 Er Erbium 68	169 Tm Thulium 69	173 Yb Ytterbium 70	175 Lu Lutetium 71				
													232 Th Thorium 90	238 Pa Protactinium 91	238 U Uranium 92	238 Np Neptunium 93	238 Pu Plutonium 94	238 Am Americium 95	238 Cm Curium 96	238 Bk Berkelium 97	238 Cf Californium 98	238 Es Einsteinium 99	238 Fm Fermium 100	238 Md Mendelevium 101	238 No Nobelium 102	238 Lr Lawrencium 103		

*58-71 Lanthanoid series
†90-103 Actinoid series

a = relative atomic mass

X = atomic symbol

b = proton (atomic) number

Key

a	X	b		†

The volume of one mole of any gas is 24 dm³ at room temperature and pressure (r.t.p.).

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UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS
General Certificate of Education Ordinary Level

CHEMISTRY

5070/12

Paper 1 Multiple Choice

May/June 2013

1 hour

Additional Materials: Multiple Choice Answer Sheet
Soft clean eraser
Soft pencil (type B or HB is recommended)



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DO NOT WRITE IN ANY BARCODES.

There are **forty** questions on this paper. Answer **all** questions. For each question there are four possible answers **A, B, C** and **D**.

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Any rough working should be done in this booklet.

A copy of the Periodic Table is printed on page 16.

Electronic calculators may be used.

This document consists of **14** printed pages and **2** blank pages.



1 Which mixture could best be separated by using a separating funnel?

- A oil and sand
- B oil and water
- C sodium chloride and sand
- D sodium chloride and water

2 Which process involves boiling a liquid and condensing the vapour?

- A crystallisation
- B distillation
- C evaporation
- D filtration

3 Which compound, when mixed with aqueous barium nitrate, does **not** form a white precipitate?

- A ammonium carbonate
- B dilute sulfuric acid
- C silver nitrate
- D sodium carbonate

4 The structure of metals consists of positive ions in a 'sea of electrons'.

Which statement correctly describes what happens to the particles in the metallic heating element of an electric kettle when the kettle is switched on?

- A Electrons move in both directions in the element.
- B Electrons move in one direction only in the element.
- C Electrons move in one direction and positive ions move in the opposite direction in the element.
- D Positive ions move in one direction only in the element.

5 Naturally-occurring bromine has a relative atomic mass of 80 and consists entirely of two isotopes of relative atomic masses 79 and 81.

What can be deduced about naturally-occurring bromine from this information only?

- A Bromine contains the two isotopes in equal proportions.
- B Bromine has different oxidation states.
- C Bromine isotopes have different numbers of protons.
- D Bromine is radioactive.

- 6 Silicon carbide, SiC, has a structure similar to diamond. Boron nitride, BN, has a structure similar to graphite. Bronze is an alloy of copper and tin.

Which statements about SiC, BN and bronze are correct?

- 1 All are bonded covalently.
- 2 All except silicon carbide conduct electricity when solid.
- 3 All have high melting points.

- A** 1 and 2 only
B 1 and 3 only
C 2 and 3 only
D 1, 2 and 3

- 7 What can be deduced about two gases that have the same relative molecular mass?

- A** They have the same boiling point.
B They have the same number of atoms in one molecule.
C They have the same rate of diffusion at room temperature and pressure.
D They have the same solubility in water at room temperature.

- 8 Sodium is in Group I of the Periodic Table.

When sodium combines with chlorine, what happens to each sodium atom?

- A** It gains one electron from one chlorine atom.
B It shares one electron with one chlorine atom.
C It transfers one electron to one chlorine atom.
D It transfers two electrons to one chlorine atom.

- 9 Hydrogen and sulfur react to form the compound hydrogen sulfide.

Which row shows the type of bonding between hydrogen and sulfur and the electrical conductivity of liquid hydrogen sulfide?

	type of bonding	electrical conductivity in the liquid state
A	covalent	good
B	covalent	non-conductor
C	ionic	good
D	ionic	non-conductor

10 Which statement about aqueous potassium sulfate is correct?

- A It contains more sulfate ions than potassium ions.
- B It contains two different types of molecule.
- C It does not conduct electricity.
- D It forms a white precipitate when added to aqueous barium nitrate.

11 One volume of a gaseous element X_2 combines with an equal volume of gaseous hydrogen to form two volumes of a gaseous hydride.

What is the formula for the hydride of X ?

- A H_2X B HX C HX_2 D H_2X_2

12 The relative atomic mass of chlorine is 35.5.

What is the mass of 2 moles of chlorine gas?

- A 17.75 g B 35.5 g C 71 g D 142 g

13 How could a sample of potassium be obtained from potassium chloride, KCl ?

method 1 adding zinc to a solution of KCl

method 2 electrolysing an aqueous solution of KCl

method 3 electrolysing molten KCl

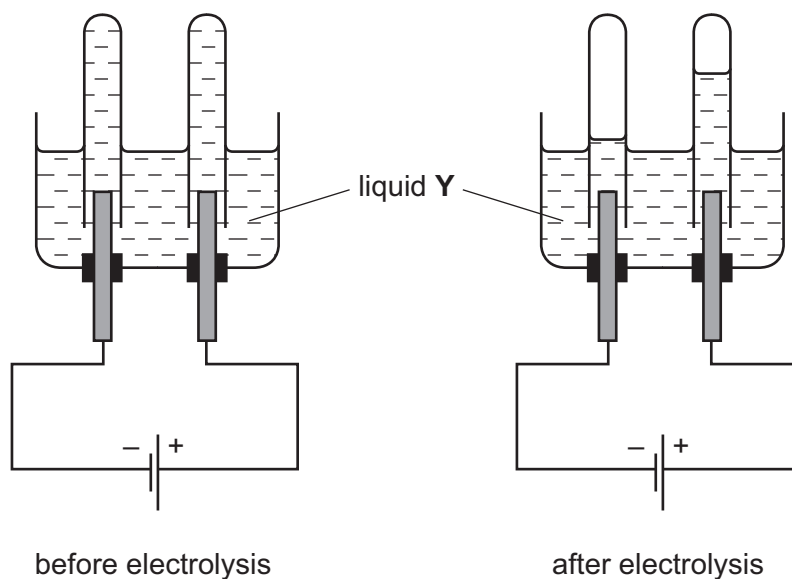
- A method 1 only
- B methods 1 and 2
- C methods 2 and 3
- D method 3 only

14 A concentrated aqueous solution of copper(II) chloride is electrolysed using inert electrodes.

What is the product at the positive electrode?

- A chlorine
- B copper
- C hydrogen
- D oxygen

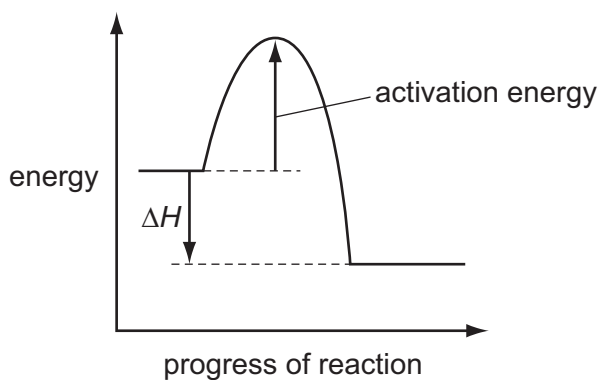
15 The diagrams show an electrolysis experiment using inert electrodes.



Which could be liquid Y?

- A aqueous copper(II) sulfate
- B concentrated aqueous sodium chloride
- C dilute sulfuric acid
- D ethanol

16 The energy profile for the forward direction of a reversible reaction is shown.



Which row correctly shows both the sign of the activation energy and the type of the enthalpy change for the **reverse** reaction?

	sign of activation energy	enthalpy change
A	negative	endothermic
B	negative	exothermic
C	positive	endothermic
D	positive	exothermic

17 Which ionic equation describes a redox reaction?

- A $\text{Ag}^+(\text{aq}) + \text{Cl}^-(\text{aq}) \rightarrow \text{AgCl}(\text{s})$
 B $2\text{H}^+(\text{aq}) + \text{CO}_3^{2-}(\text{aq}) \rightarrow \text{CO}_2(\text{g}) + \text{H}_2\text{O}(\text{l})$
 C $\text{H}^+(\text{aq}) + \text{OH}^-(\text{aq}) \rightarrow \text{H}_2\text{O}(\text{l})$
 D $\text{Zn}(\text{s}) + \text{Cu}^{2+}(\text{aq}) \rightarrow \text{Zn}^{2+}(\text{aq}) + \text{Cu}(\text{s})$

18 Four separate mixtures of a solution and a solid are made, as given in the table.

The mixtures are warmed.

In which mixtures does gas form?

	NaOH(aq) and NH ₄ Cl(s)	NaOH(aq) and Mg(s)	H ₂ SO ₄ (aq) and NH ₄ Cl(s)	H ₂ SO ₄ (aq) and Mg(s)
A	✓	x	✓	x
B	✓	x	x	✓
C	x	✓	✓	x
D	x	✓	x	✓

key

✓ = gas forms

x = no gas forms

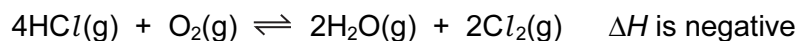
19 Four oxides are added separately to aqueous sodium hydroxide.

- 1 aluminium oxide
- 2 carbon dioxide
- 3 copper(II) oxide
- 4 magnesium oxide

Which oxides react with aqueous sodium hydroxide?

- A 1 and 2 only
 B 1, 3 and 4 only
 C 2 only
 D 3 and 4 only

20 Chlorine can be manufactured by the following reaction.



A mixture in dynamic equilibrium is formed.

Which change to the mixture will increase the amount of chlorine at equilibrium?

- A adding a catalyst
- B adding more $\text{HCl}(\text{g})$
- C decreasing the pressure
- D increasing the temperature

21 Which is a use of sulfuric acid?

- A as a bleach
- B in the manufacture of ammonia
- C in the manufacture of fertilisers
- D in the manufacture of sulfur trioxide

22 Which statement about ammonia is correct?

- A It is a colourless, odourless gas.
- B It is a gas which turns damp blue litmus paper red.
- C It is formed when potassium nitrate is heated with aqueous sodium hydroxide and aluminium.
- D It is manufactured using vanadium(V) oxide as a catalyst.

23 Which property is common to calcium, potassium and sodium?

- A Their atoms all have more neutrons than protons.
- B Their ions all have eight electrons in their outer shell.
- C They all sink when added to water.
- D They are all deposited at the positive electrode when their molten chloride is electrolysed.

24 The table shows the solubility of some compounds of metal Q in cold water.

salt	solubility in cold water
carbonate	insoluble
chloride	soluble
sulfate	insoluble

What is metal Q?

- A barium
- B lead
- C magnesium
- D sodium

25 Which two statements indicate that metal *M* may have a proton number between 21 and 30?

- 1 It conducts electricity.
- 2 It does not react with water.
- 3 It forms two basic oxides with formulae MO and M_2O_3 .
- 4 It forms two coloured sulfates.

- A 1 and 2 B 1 and 4 C 2 and 3 D 3 and 4

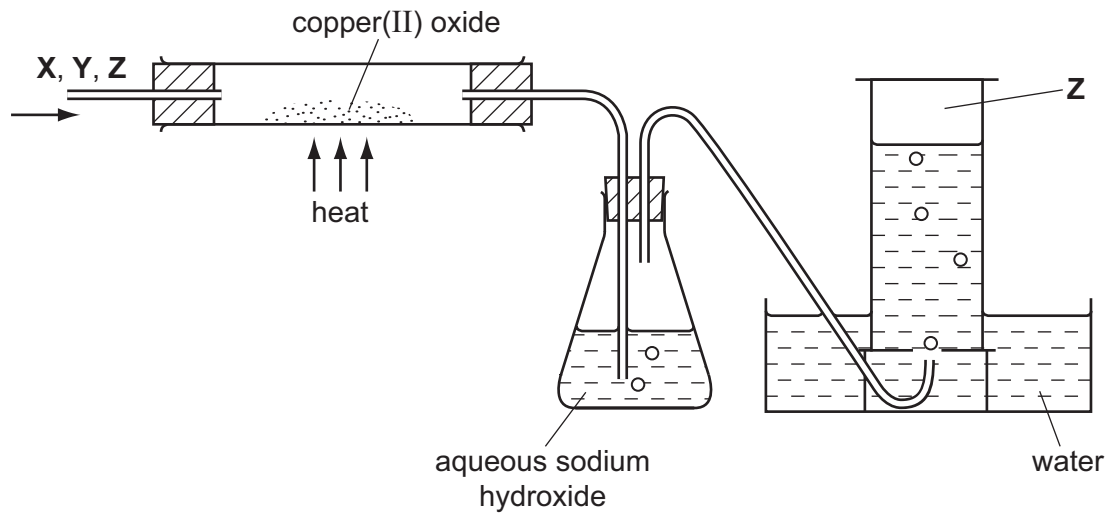
26 An atom of which element has the same electronic configuration as the strontium ion?

- A calcium
- B krypton
- C rubidium
- D selenium

27 Which substance, in the given physical state, is found at the bottom of the blast furnace?

	substance	physical state
A	calcium carbonate	solid
B	calcium silicate	liquid
C	carbon	liquid
D	iron	solid

- 28 Gas Z is to be separated from a mixture of gases X, Y and Z by the apparatus shown in the diagram.



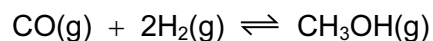
For which mixture will this system work successfully?

	X	Y	Z
A	hydrogen	carbon dioxide	nitrogen
B	oxygen	hydrogen	carbon monoxide
C	nitrogen	oxygen	hydrogen
D	carbon dioxide	nitrogen	oxygen

- 29 Magnesium can be obtained by heating magnesium oxide with which element?

- A carbon
- B hydrogen
- C sodium
- D zinc

30 Methanol is manufactured using the following reaction.



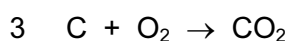
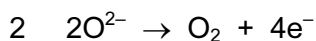
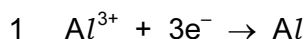
The usual conditions are 30 atmospheres and 300 °C.

At 400 °C the percentage of methanol in the equilibrium mixture is lower than at 300 °C.

What could be the explanation for this?

- A All the molecules are gaseous.
- B The forward reaction is exothermic.
- C The reaction is slower at 400 °C.
- D There are fewer product molecules than reactant molecules.

31 In the electrolysis of molten aluminium oxide for the extraction of aluminium, the following three reactions take place.



Which reactions take place at the positive electrode?

- A 1 only
- B 2 only
- C 1 and 3 only
- D 2 and 3 only

32 An alloy of copper and zinc is added to an excess of dilute hydrochloric acid. The resulting mixture is then filtered.

Which observations are correct?

	filtrate	residue
A	colourless solution	none
B	colourless solution	red-brown
C	blue solution	grey
D	blue solution	none

33 The compounds $\text{CO}(\text{NH}_2)_2$ and NH_4NO_3 are used as fertilisers.

The proportion of nitrogen by mass in $\text{CO}(\text{NH}_2)_2$ is1..... that in NH_4NO_3 .

The proportion of nitrogen by mole in $\text{CO}(\text{NH}_2)_2$ is2..... that in NH_4NO_3 .

Which words correctly complete gaps 1 and 2?

	1	2
A	equal to	equal to
B	higher than	equal to
C	higher than	higher than
D	lower than	lower than

34 Which method will remove salt from seawater?

- A** chlorination
- B** distillation
- C** filtration
- D** use of carbon

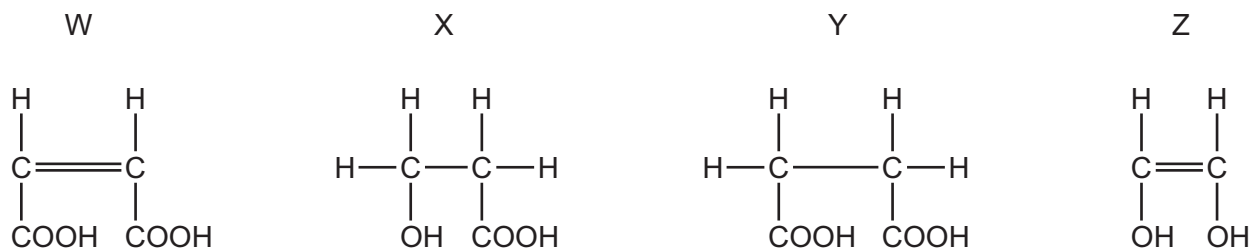
35 Which organic compound requires the least oxygen for the complete combustion of one mole of the compound?

- A** $\text{C}_3\text{H}_7\text{OH}$ **B** $\text{C}_3\text{H}_7\text{COOH}$ **C** C_3H_8 **D** C_4H_8

36 Which polymer contains only three elements?

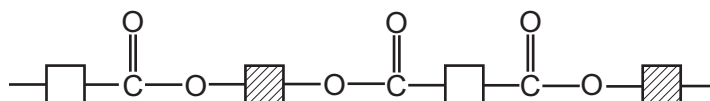
- A** protein
- B** poly(ethene)
- C** poly(propene)
- D** starch

37 What are the reactions of compounds W, X, Y and Z?

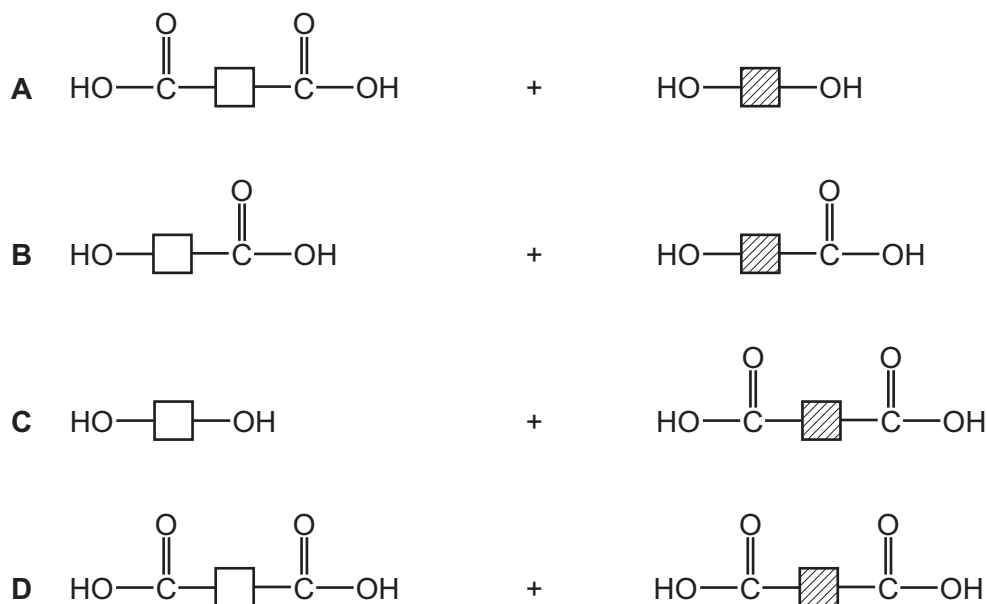


	decolourises aqueous bromine	has a pH of less than 7	reacts with a carboxylic acid to form an ester
A	X and Y	W, X and Y	W, X, Y and Z
B	X and Y	X and Z	X and Z
C	W and Z	W, X and Y	X and Z
D	W and Z	X and Z	W, X and Y

38 The diagram shows the partial structure of *Terylene*.



From which pair of compounds is it made?



39 Which straight chain hydrocarbon can form a polymer by addition polymerisation?

- A** C_6H_{14} **B** C_7H_{14} **C** C_8H_{18} **D** C_9H_{20}

40 Which information is correct regarding the formation of ethanol by the process of fermentation?

	substances fermented	gas evolved during fermentation
A	carbohydrates	carbon dioxide
B	carbohydrates	carbon monoxide
C	hydrocarbons	carbon dioxide
D	hydrocarbons	carbon monoxide

DATA SHEET
The Periodic Table of the Elements

		Group																																																																	
I	II	III	IV	V	VI	VII	0																																																												
7 Li Lithium 3	9 Be Beryllium 4	1 H Hydrogen 1	11 B Boron 5	12 C Carbon 6	14 N Nitrogen 7	16 O Oxygen 8	19 F Fluorine 9	20 Ne Neon 10	23 Na Sodium 11	24 Mg Magnesium 12	27 Al Aluminium 13	28 Si Silicon 14	31 P Phosphorus 15	32 S Sulfur 16	35.5 Cl Chlorine 17	40 Ar Argon 18	39 K Potassium 19	40 Ca Calcium 20	45 Sc Scandium 21	48 Ti Titanium 22	51 V Vanadium 23	52 Cr Chromium 24	55 Mn Manganese 25	56 Fe Iron 26	59 Co Cobalt 27	59 Ni Nickel 28	64 Cu Copper 29	65 Zn Zinc 30	70 Ga Gallium 31	73 Ge Germanium 32	75 As Arsenic 33	79 Se Selenium 34	80 Br Bromine 35	84 Kr Krypton 36	85 Rb Rubidium 37	88 Sr Strontium 38	89 Y Yttrium 39	91 Zr Zirconium 40	93 Nb Niobium 41	96 Mo Molybdenum 42	101 Ru Ruthenium 44	106 Pd Palladium 46	112 Cd Cadmium 48	115 In Indium 49	119 Sn Tin 50	122 Sb Antimony 51	128 Te Tellurium 52	131 Xe Xenon 54	133 Cs Caesium 55	137 Ba Barium 56	139 La Lanthanum 57	178 Hf Hafnium 72	181 Ta Tantalum 73	184 W Tungsten 74	190 Os Osmium 76	192 Ir Iridium 77	195 Pt Platinum 78	197 Au Gold 79	201 Hg Mercury 80	204 Tl Thallium 81	207 Pb Lead 82	209 Bi Bismuth 83	210 Po Polonium 84	210 At Astatine 85	210 Rn Radon 86	226 Ra Radium 88	227 Ac Actinium 89
												140 Ce Cerium 58	141 Pr Praseodymium 59	144 Nd Neodymium 60	150 Sm Samarium 62	152 Eu Europium 63	157 Gd Gadolinium 64	159 Tb Terbium 65	162 Dy Dysprosium 66	165 Ho Holmium 67	167 Er Erbium 68	169 Tm Thulium 69	173 Yb Ytterbium 70	175 Lu Lutetium 71	232 Th Thorium 90	238 U Uranium 92	238 Np Neptunium 93	238 Pu Plutonium 94	238 Am Americium 95	238 Cm Curium 96	238 Bk Berkelium 97	238 Cf Californium 98	238 Es Einsteinium 99	238 Fm Fermium 100	238 Md Mendelevium 101	238 No Nobelium 102	238 Lr Lawrencium 103																														

*58-71 Lanthanoid series
†90-103 Actinoid series

a = relative atomic mass
X = atomic symbol
b = proton (atomic) number

The volume of one mole of any gas is 24 dm³ at room temperature and pressure (r.t.p.).

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CHEMISTRY

5070/12

Paper 1 Multiple Choice

May/June 2014

1 hour

Additional Materials: Multiple Choice Answer Sheet
Soft clean eraser
Soft pencil (type B or HB is recommended)



READ THESE INSTRUCTIONS FIRST

Write in soft pencil.

Do not use staples, paper clips, glue or correction fluid.

Write your name, Centre number and candidate number on the Answer Sheet in the spaces provided unless this has been done for you.

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A copy of the Periodic Table is printed on page 16.

Electronic calculators may be used.

This document consists of **15** printed pages and **1** blank page.

1 Which process is suitable for obtaining the water from an aqueous solution of sugar?

- A crystallisation
- B distillation
- C filtration
- D use of a separating funnel

2 Sulfur dioxide and oxygen react together.

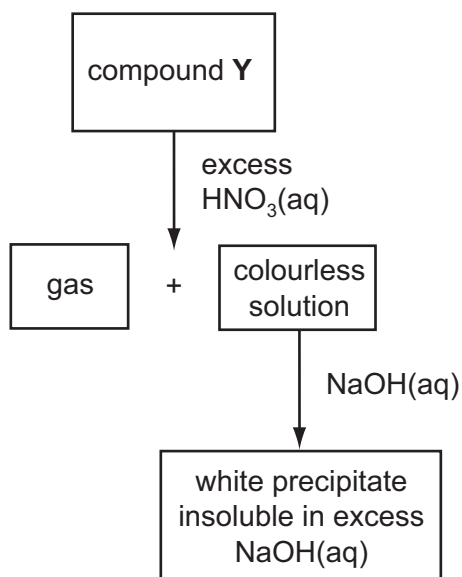


Which change(s) will increase both the rate of reaction and the equilibrium concentration of SO_3 ?

- 1 adding a catalyst
- 2 increasing temperature
- 3 increasing pressure

- A 1 only B 2 C 1 and 3 D 3 only

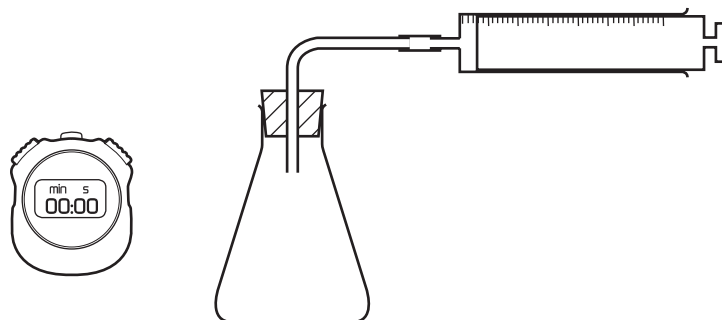
3 The scheme shows a sequence of reactions starting from compound Y.



What could the compound Y be?

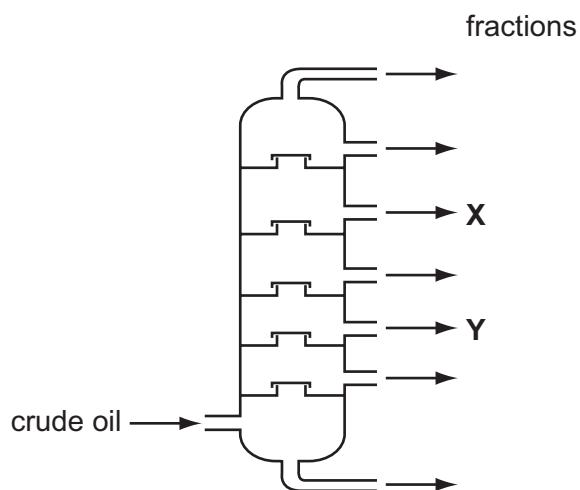
- A aluminium sulfate
- B calcium carbonate
- C copper(II) carbonate
- D zinc carbonate

- 4 The apparatus shown can be used to find the rate of some chemical reactions.



The rate of which reaction can be followed using this apparatus?

- A $\text{AgNO}_3 + \text{KI}$
 B $\text{Mg} + \text{HCl}$
 C $\text{NaOH} + \text{CuSO}_4$
 D $\text{NaOH} + \text{HCl}$
- 5 Crude oil is fractionally distilled in a fractionating column. The positions at which fractions **X** and **Y** are collected are shown.



Which statement is correct?

- A The temperature increases up the column.
 B **X** condenses at a lower temperature than **Y**.
 C **X** has a higher boiling point than **Y**.
 D **X** has longer chain molecules than **Y**.

- 6 An ion X^+ has 23 nucleons and 10 electrons.

What does the nucleus of X contain?

	protons	neutrons
A	9	14
B	10	13
C	11	12
D	13	10

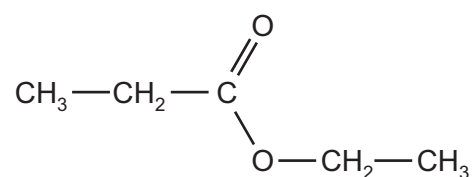
- 7 Which element exists as a macromolecule?

- A** carbon
- B** hydrogen
- C** oxygen
- D** sodium

- 8 Which substance can conduct electricity by the movement of ions?

- A** copper
- B** graphite
- C** mercury
- D** sodium chloride

- 9 The diagram shows the molecule ethyl propanoate.



Consider **all** the electrons in a molecule of ethyl propanoate.

How many electrons **not** involved in bonding are there in the molecule?

- A** 8
- B** 10
- C** 18
- D** 22

10 Sodium and magnesium are next to each other in the Periodic Table.

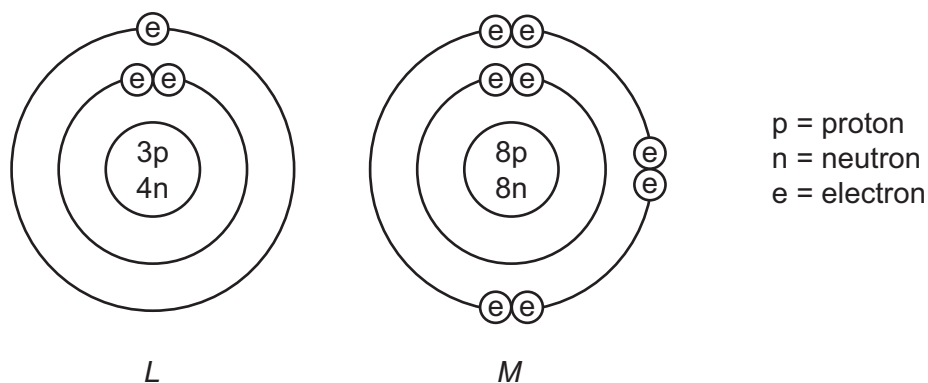
	melting point /°C	boiling point /°C
Na	98	883
Mg	649	1103

Which statement explains the differences in the melting and boiling points of these elements?

- A** Na and Mg have different types of bonding.
- B** The electrostatic forces of attraction are stronger in Mg.
- C** The ionic bonds in Mg are stronger than those in Na.
- D** The Mg atoms are larger than the Na atoms.
- 11 Sulfuric acid and potassium hydroxide can react together to form potassium hydrogensulfate, KHSO_4 , and water only.

Which amounts of the reactants are required?

- A** equal masses of sulfuric acid and potassium hydroxide
- B** equal numbers of moles of sulfuric acid and potassium hydroxide
- C** 1 mol of sulfuric acid to 2 mol of potassium hydroxide
- D** 2 mol of sulfuric acid to 1 mol of potassium hydroxide
- 12 The diagram shows the structures of the atoms of elements *L* and *M*.



The elements combine to form a compound.

What is the mass of one mole of this compound?

- A** 11g **B** 12g **C** 23g **D** 30g

13 A concentrated aqueous solution of sodium chloride is electrolysed.

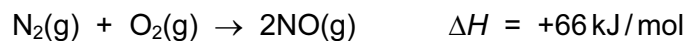
What are the equations for the reactions taking place at the cathode (negative electrode) and the anode (positive electrode)?

	cathode (-ve)	anode (+ve)
A	$2\text{H}^+ + 2\text{e}^- \rightarrow \text{H}_2$	$2\text{Cl}^- \rightarrow \text{Cl}_2 + 2\text{e}^-$
B	$2\text{H}^+ + 2\text{e}^- \rightarrow \text{H}_2$	$4\text{OH}^- \rightarrow \text{O}_2 + 2\text{H}_2\text{O} + 4\text{e}^-$
C	$\text{Na}^+ + \text{e}^- \rightarrow \text{Na}$	$2\text{Cl}^- \rightarrow \text{Cl}_2 + 2\text{e}^-$
D	$\text{Na}^+ + \text{e}^- \rightarrow \text{Na}$	$4\text{OH}^- \rightarrow \text{O}_2 + 2\text{H}_2\text{O} + 4\text{e}^-$

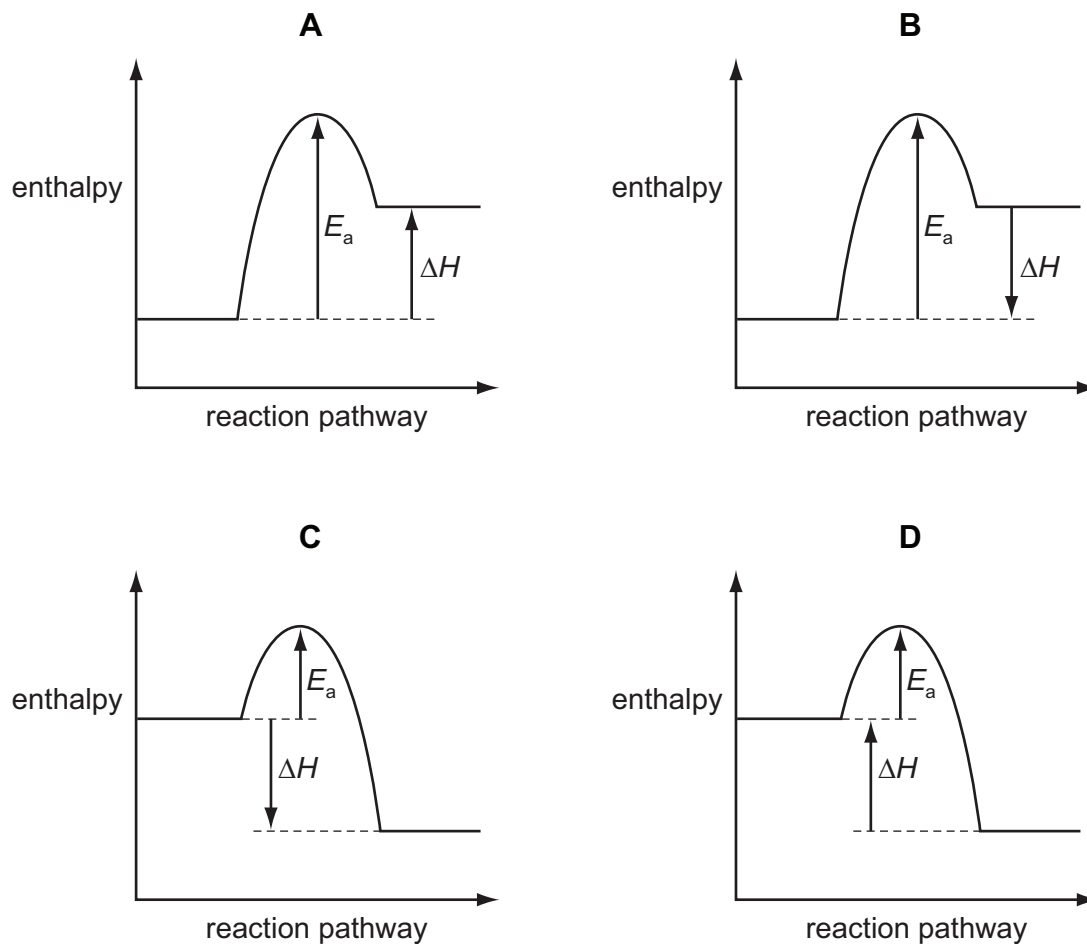
14 What is observed during the electrolysis of aqueous copper(II) sulfate using carbon electrodes?

- A** A pink solid is deposited on the anode.
- B** Bubbles form on the negative electrode.
- C** The colour of the solution fades.
- D** The negative electrode becomes smaller.

- 15 Nitrogen monoxide is an atmospheric pollutant that is formed in car engines by the reaction between nitrogen and oxygen.



Which diagram represents the energy profile for this reaction?



- 16 Which substance does **not** react with hydrochloric acid?

- A zinc carbonate
- B zinc hydroxide
- C zinc metal
- D zinc nitrate

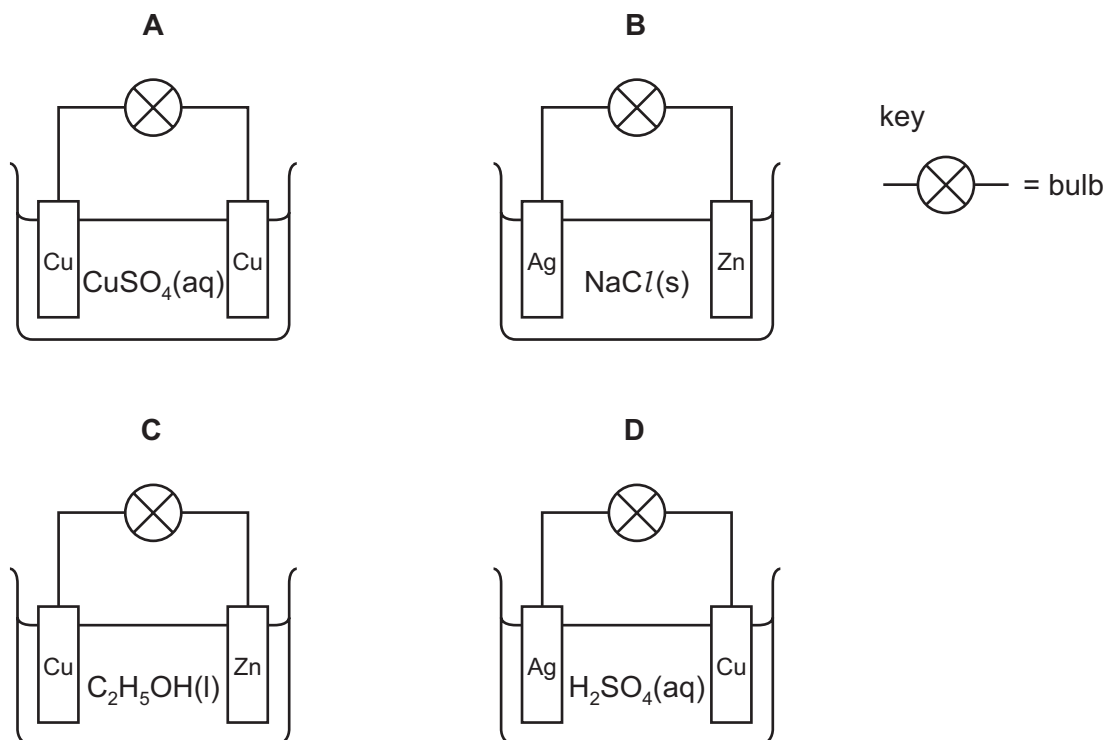
- 17 The table shows the energy released by the complete combustion of some compounds used as fuels.

compound	formula	M_r	ΔH in kJ/mol
benzene	C_6H_6	78	-3270
heptane	C_7H_{16}	100	-4800
octane	C_8H_{18}	114	-5510
propane	C_3H_8	44	-2200

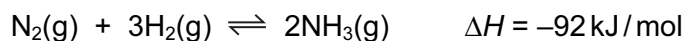
Which fuel releases the least energy when 1 g of the compound is completely burned?

- A** benzene
B heptane
C octane
D propane

- 18 In which circuit does the bulb light?



19 Ammonia is made by a reversible reaction between nitrogen and hydrogen.



What is the effect of increasing the pressure in this process?

- A Less heat is produced.
 - B More ammonia is formed.
 - C More nitrogen is present at equilibrium.
 - D The reaction slows down.
- 20 Which change involves reduction?
- A calcium carbonate to calcium oxide
 - B copper to brass
 - C ethene to poly(ethene)
 - D sand to silicon
- 21 Samples of three oxides, **X**, **Y** and **Z**, were added separately to dilute hydrochloric acid and to dilute sodium hydroxide.

X and **Y** react with dilute hydrochloric acid but **Z** does not react.

Y and **Z** react with aqueous sodium hydroxide but **X** does not react.

Which type of oxide are each of **X**, **Y** and **Z**?

	type of oxide		
	acidic	amphoteric	basic
A	X	Y	Z
B	Y	X	Z
C	Z	X	Y
D	Z	Y	X

- 22 Which process does **not** involve the use of a transition element?
- A the manufacture of margarine from vegetable oil
 - B the manufacture of sulfuric acid in the Contact process
 - C the purification of river water to produce drinking water
 - D the removal of combustion pollutants from car exhaust gases

23 Element Q is in Period 3 of the Periodic Table. It can form ions with the formula Q^{3-} .

Which element is most likely to be Q?

- A aluminium
- B arsenic
- C phosphorus
- D sulfur

24 Which property would all the hydrogen compounds of the Group VII elements possess?

- A be covalent
- B be solids at room temperature
- C form alkaline aqueous solutions
- D conduct electricity when molten

25 A student mixed together aqueous solutions of Y and Z. A white precipitate formed.

Which could **not** be Y and Z?

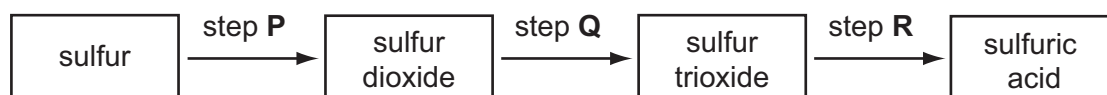
	Y	Z
A	hydrochloric acid	silver nitrate
B	hydrochloric acid	sodium nitrate
C	sodium chloride	lead(II) nitrate
D	sodium chloride	silver nitrate

26 Aluminium is extracted from its molten oxide ore by electrolysis whereas zinc is extracted by reduction of its oxide when heated with coke.

Which statement explains this?

- A Aluminium is very high in the reactivity series.
- B Aluminium ores are very rare.
- C Electrolysis is a cheaper method than reduction of the oxide with coke.
- D Zinc oxide has a higher melting point than aluminium oxide.

- 27 In which solid can layers of atoms slide over each other?
- A diamond
B graphite
C haematite
D silica
- 28 Which ion causes the acidity in dilute hydrochloric acid?
- A Cl^- B H^+ C H_2^+ D OH^-
- 29 Which metal can react rapidly with steam but reacts only **very slowly** with cold water?
- A calcium
B copper
C iron
D potassium
- 30 Which gas turns moist blue litmus paper red and produces a precipitate when bubbled through calcium hydroxide solution?
- A CO B CO_2 C HCl D NH_3
- 31 The diagram shows three steps in the manufacture of sulfuric acid.



In which steps is a catalyst used?

- A step Q only
B step R only
C steps Q and R only
D steps P and Q and R
- 32 Which property of compounds in a homologous series is correct?
- A They all have the same general formula.
B They all have the same molecular formula.
C They all have the same number of isomers.
D They all have the same physical properties.

33 Which compound, on combustion, **never** forms carbon?

- A carbon monoxide
- B ethanol
- C ethene
- D methane

34 Which process is an example of cracking?

- A $C_2H_4 + H_2O \rightarrow C_2H_5OH$
- B $C_3H_6 + H_2 \rightarrow C_3H_8$
- C $C_3H_8 + 5O_2 \rightarrow 3CO_2 + 4H_2O$
- D $C_4H_{10} \rightarrow C_2H_4 + C_2H_6$

35 A hydride is a compound containing **only** two elements, one of which is hydrogen.

Which element can form the greatest number of different hydrides?

- A carbon
- B chlorine
- C nitrogen
- D oxygen

36 A liquid reacts with each of sodium carbonate, potassium hydroxide and ethanol.

What is the liquid?

- A aqueous ammonia
- B ethanoic acid
- C ethyl ethanoate
- D sodium hydroxide

37 Compound **X** and compound **Y** combine to form a polymer.



compound **X**

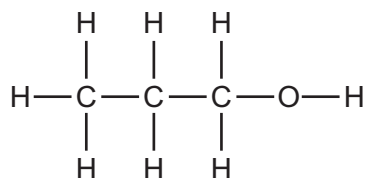


compound **Y**

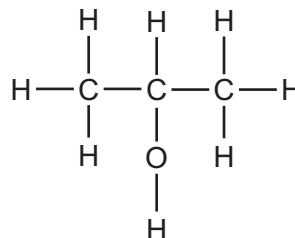
Which of the statements about the polymer and its formation is **not** correct?

- A** Ammonia is formed during the production of the polymer.
- B** Hydrolysis of the polymer produces **X** and **Y**.
- C** The polymer is a polyamide.
- D** The polymer is formed by a condensation reaction.

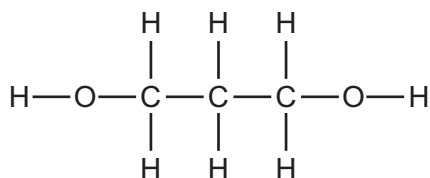
38 The structural formulae of some organic compounds are shown below.



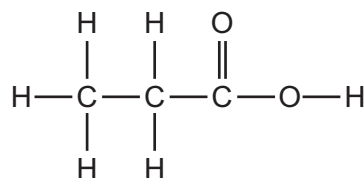
1



2



3



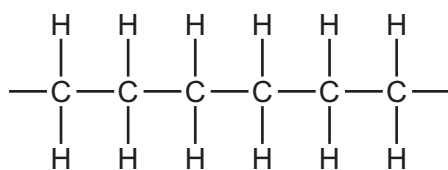
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Which compounds are alcohols?

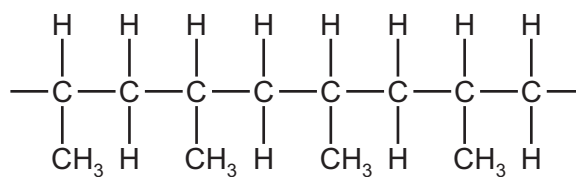
- A** 1 only
- B** 1 and 2 only
- C** 1, 2 and 3
- D** 4

39 What is the partial structure of the polymer formed by the polymerisation of propene, $\text{CH}_3\text{CH}=\text{CH}_2$?

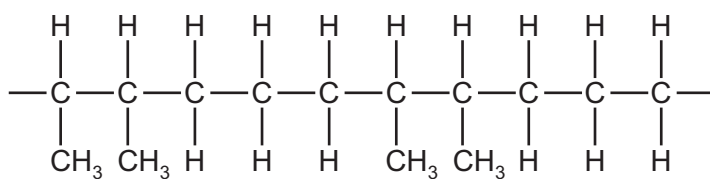
A



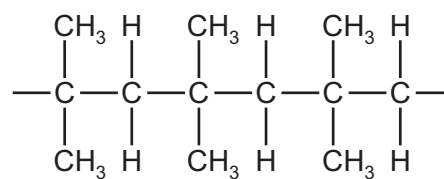
B



C



D



40 When a volcano erupts, which gas is produced in significant amounts?

- A carbon monoxide
- B methane
- C ozone
- D sulfur dioxide

DATA SHEET The Periodic Table of the Elements

		Group															
I	II	III	IV	V	VI	VII	0										
		1 H Hydrogen 1							4 He Helium 2								
3 Li Lithium 4	9 Be Beryllium 4											11 B Boron 5	12 C Carbon 6	14 N Nitrogen 7	16 O Oxygen 8	19 F Fluorine 9	20 Ne Neon 10
11 Na Sodium 12	24 Mg Magnesium 12											27 Al Aluminium 13	28 Si Silicon 14	31 P Phosphorus 15	32 S Sulfur 16	35.5 Cl Chlorine 17	40 Ar Argon 18
19 K Potassium 19	40 Ca Calcium 20	48 Ti Titanium 22	51 V Vanadium 23	52 Cr Chromium 24	55 Mn Manganese 25	56 Fe Iron 26	59 Co Cobalt 27	59 Ni Nickel 28	64 Cu Copper 29	65 Zn Zinc 30	70 Ga Gallium 31	73 Ge Germanium 32	75 As Arsenic 33	79 Se Selenium 34	80 Br Bromine 35	84 Kr Krypton 36	
37 Rb Rubidium 37	88 Sr Strontium 38	91 Zr Zirconium 40	93 Nb Niobium 41	96 Mo Molybdenum 42	101 Ru Ruthenium 44	106 Pd Palladium 46	108 Ag Silver 47	112 Cd Cadmium 48	115 In Indium 49	119 Sn Tin 50	122 Sb Antimony 51	128 Te Tellurium 52	127 I Iodine 53	131 Xe Xenon 54			
55 Cs Caesium 55	137 Ba Barium 56	178 Hf Hafnium 72	181 Ta Tantalum 73	184 W Tungsten 74	190 Os Osmium 76	195 Pt Platinum 78	197 Au Gold 79	201 Hg Mercury 80	204 Tl Thallium 81	207 Pb Lead 82	209 Bi Bismuth 83	210 Po Polonium 84	210 At Astatine 85	210 Rn Radon 86			
87 Fr Francium 87	226 Ra Radium 88											201 Hg Mercury 80	201 Hg Mercury 80	209 Bi Bismuth 83	210 Po Polonium 84	210 At Astatine 85	210 Rn Radon 86
*58-71 Lanthanoid series † 90-103 Actinoid series		58 Ce Cerium 58	141 Pr Praseodymium 59	144 Nd Neodymium 60	150 Sm Samarium 62	152 Eu Europium 63	157 Gd Gadolinium 64	162 Dy Dysprosium 66	165 Ho Holmium 67	167 Er Erbium 68	173 Yb Ytterbium 70	175 Lu Lutetium 71	101 Md Mendelevium 101	102 No Nobelium 102	103 Lr Lawrencium 103		

a	X
b	X

a = relative atomic mass	X	= atomic symbol
b = proton (atomic) number	X	= atomic symbol

Key

The volume of one mole of any gas is 24 dm³ at room temperature and pressure (r.t.p.).

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CHEMISTRY

5070/12

Paper 1 Multiple Choice

October/November 2014

1 hour

Additional Materials: Multiple Choice Answer Sheet
 Soft clean eraser
 Soft pencil (type B or HB recommended)



READ THESE INSTRUCTIONS FIRST

Write in soft pencil.

Do not use staples, paper clips, glue or correction fluid.

Write your name, Centre number and candidate number on the Answer Sheet in the spaces provided unless this has been done for you.

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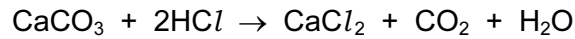
Any rough working should be done in this booklet.

A copy of the Periodic Table is printed on page 16.

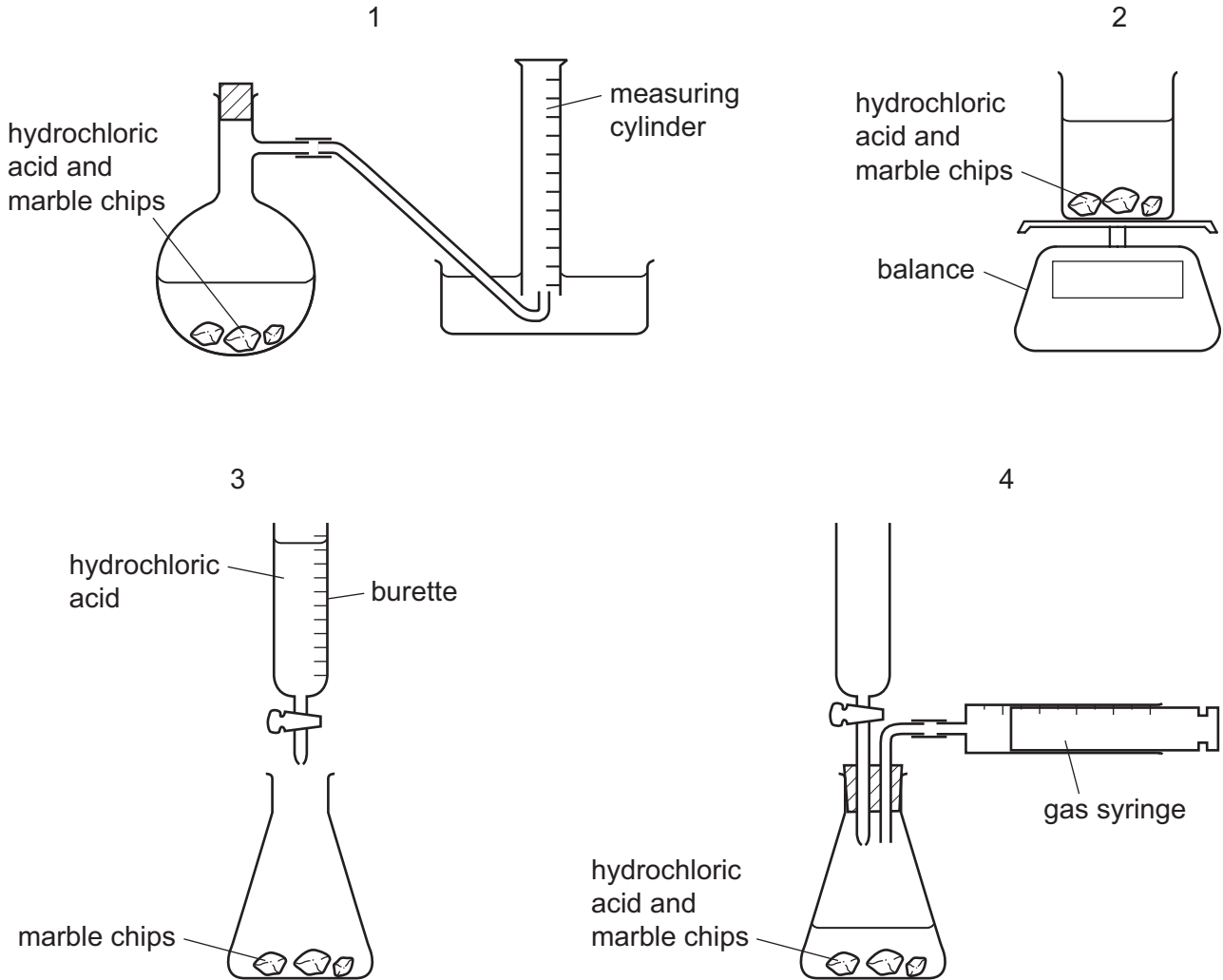
Electronic calculators may be used.

This document consists of **13** printed pages and **3** blank pages.

- 1 A student wants to carry out an experiment to follow the rate of the reaction between hydrochloric acid and marble chips.



Which diagrams show apparatus that is suitable for this experiment?



- A** 1 and 2 only **B** 1 and 3 only **C** 1 and 4 only **D** 1, 2 and 4

- 2 Solutions of lead(II) nitrate and potassium iodide are mixed together in the preparation of lead(II) iodide.

Which method can be used to separate the lead(II) iodide from the mixture?

- A** crystallisation
B distillation
C evaporation
D filtration

- 3 A small amount of aqueous copper(II) sulfate is put into a test-tube. A few drops of aqueous ammonia are added to the test-tube. Then an excess of aqueous ammonia is added to the same test-tube.

What are the two observations?

	few drops of aqueous ammonia	excess aqueous ammonia
A	light blue precipitate	dark blue solution
B	light blue precipitate	light blue precipitate
C	dark blue solution	dark blue solution
D	dark blue solution	light blue precipitate

- 4 An atom of element Z has 14 neutrons and 13 protons.

It forms a positive ion.

How many electrons does the ion of Z have?

- A** 10 **B** 13 **C** 14 **D** 27

- 5 Which gas is **neither** an element **nor** a compound?

- A** ammonia
B chlorine
C air
D carbon monoxide

- 6 Why does ammonia gas diffuse faster than hydrogen chloride gas?

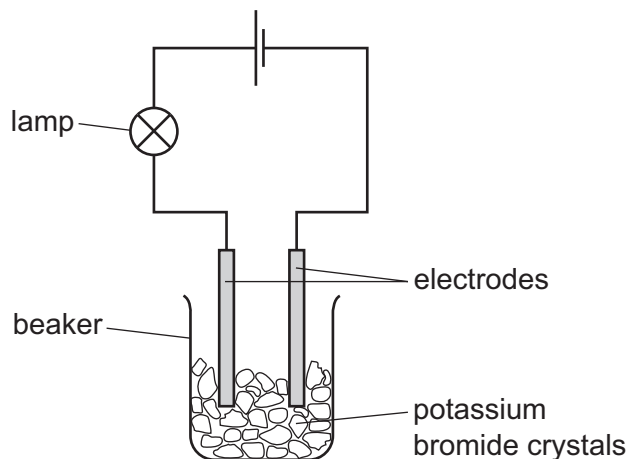
- A** Ammonia has a higher boiling point than hydrogen chloride.
B Ammonia is a base, hydrogen chloride is an acid.
C The ammonia molecule contains more atoms than a hydrogen chloride molecule.
D The relative molecular mass of ammonia is smaller than that of hydrogen chloride.

- 7 The compound formed between elements X and Y is ionic.

Which statement about elements X and Y is correct?

- A** X and Y are both at the left-hand side of the Periodic Table.
B X and Y are both at the right-hand side of the Periodic Table.
C X and Y are both transition elements.
D X is at the opposite side of the Periodic Table from element Y.

- 8 The experiment shown is used to test potassium bromide crystals.



The lamp does not light.

Distilled water is then added to the beaker and the lamp lights.

Which statement explains these results?

- A** Electrons are free to move in the solution when potassium bromide dissolves.
- B** Metal ions are free to move when potassium bromide melts.
- C** Metal ions are free to move when potassium reacts with water.
- D** Oppositely charged ions are free to move in the solution when potassium bromide dissolves.
- 9 How many electrons are used in covalent bonding in the N_2 molecule?
- A** 2 **B** 4 **C** 6 **D** 10
- 10 Propene, $CH_3CH=CH_2$, has a very low boiling point because of the weakness of the
- A** C–C bond.
- B** C=C bond.
- C** C–H bond.
- D** intermolecular forces.
- 11 What is the empirical formula of a compound containing 12g of carbon, 2g of hydrogen and 16g of oxygen only?
- A** CHO **B** CHO_2 **C** CH_2O **D** C_2HO

12 What is the correct equation for the reaction taking place at the negative electrode when molten magnesium chloride is electrolysed using inert electrodes?

- A $Cl^- \rightarrow Cl + e^-$
- B $2Cl^- \rightarrow Cl_2 + 2e^-$
- C $Mg^+ + e^- \rightarrow Mg$
- D $Mg^{2+} + 2e^- \rightarrow Mg$

13 Which fertiliser contains the greatest percentage by mass of nitrogen?

- A $(NH_4)_2HPO_4$ $M_r = 132$
- B $(NH_4)_2SO_4$ $M_r = 132$
- C NH_4NO_3 $M_r = 80$
- D $CO(NH_2)_2$ $M_r = 60$

14 A volume of ethane, C_2H_6 , at r.t.p. has a mass of 20 g.

What is the mass of an equal volume of propene, C_3H_6 , at r.t.p.?

- A 20 g
- B 21 g
- C 28 g
- D 42 g

15 Which of these processes are both endothermic?

- A combustion, cracking
- B combustion, fermentation
- C cracking, photosynthesis
- D fermentation, photosynthesis

16 Ethanol is produced by the fermentation of glucose from sugar cane. In some countries ethanol is used as a fuel.

Which statements are correct?

- 1 Sugar cane is a non-renewable (finite) resource.
- 2 When sugar cane is growing it removes carbon dioxide from the atmosphere.

- A 1 only
- B 2 only
- C both 1 and 2
- D neither 1 nor 2

17 Which row correctly classifies the oxides in the table?

	carbon dioxide	copper(II) oxide	zinc oxide
A	acidic	amphoteric	basic
B	acidic	basic	amphoteric
C	acidic	neutral	amphoteric
D	basic	neutral	neutral

18 Sulfur is burnt in air.

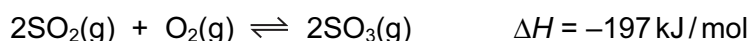
Which statement about this reaction is correct?

- A** The gas formed turns aqueous potassium dichromate(VI) from green to orange.
- B** The product is used as a food preservative.
- C** The reaction is endothermic.
- D** The reaction is reversible.

19 Which method is used to obtain chlorine from aqueous sodium chloride?

- A** crystallisation
- B** distillation
- C** electrolysis
- D** filtration

20 The equation shows the reaction for the formation of sulfur trioxide using a catalyst.



Which change in reaction conditions would produce more sulfur trioxide?

- A** adding more catalyst
- B** decreasing the pressure
- C** increasing the temperature
- D** removing some sulfur trioxide

21 How many of these salts are soluble in water?

- | | | | | | | | |
|----------|---------------|----------------------------|------------------------------|-----------------|---|----------|---|
| | AgCl | $\text{Ca}(\text{NO}_3)_2$ | $(\text{NH}_4)_2\text{SO}_4$ | PbCO_3 | | | |
| A | 1 | B | 2 | C | 3 | D | 4 |

22 The positions of four elements are shown on the outline of part of the Periodic Table.

Which element is a solid non-metal at r.t.p.?

The diagram shows a simplified periodic table with four elements marked: A, B, C, and D. Element A is in the second period, second group. Element B is in the second period, sixth group. Element C is in the third period, seventh group. Element D is in the fourth period, seventh group. There is also an empty box above the transition metal block.

23 Which statements about fertilisers containing nitrates are correct?

- 1 They increase plant growth.
- 2 Nitrates dissolve in water.
- 3 Eutrophication is caused by nitrates from farmland entering rivers.
- 4 If nitrates are applied to alkaline soils they produce ammonia gas.

A 1 and 3 only B 1, 2 and 3 C 1, 2 and 4 D 2 and 3 only

24 Which is a property of the element molybdenum, ${}_{42}^{96}\text{Mo}$?

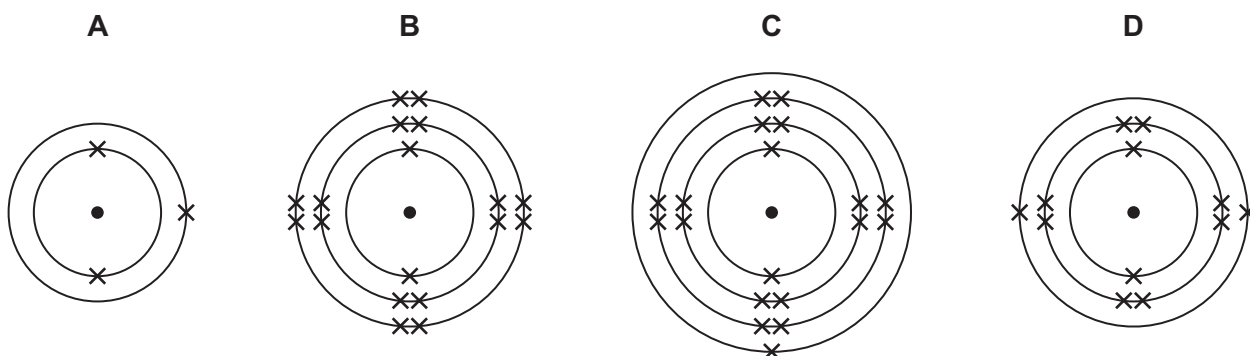
- A low density
- B low melting point
- C forms white or colourless compounds
- D has more than one oxidation state

25 In the Periodic Table, how many periods are needed to accommodate the elements of atomic numbers 1-18?

A 2 B 3 C 4 D 8

26 The diagram shows the arrangement of electrons in the atoms of four different elements.

Which is the **least** reactive of the four elements?



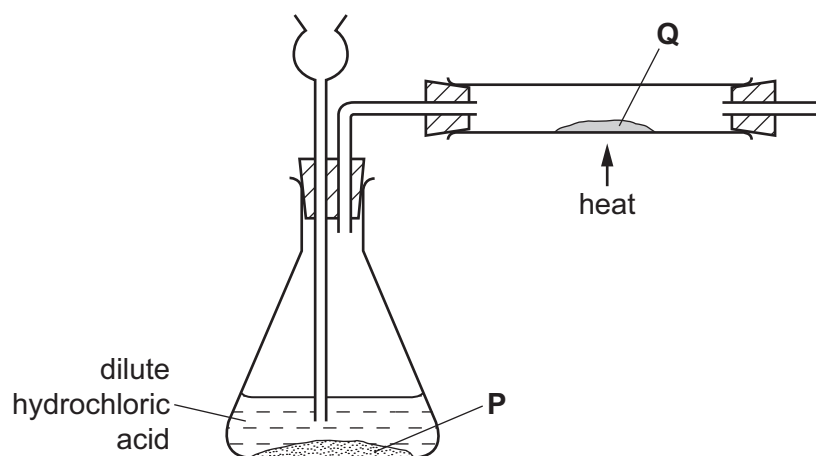
27 A gas **G**

- 1 has no smell,
- 2 is not poisonous,
- 3 reacts with hydrogen at high temperature and pressure.

What is gas **G**?

- A** carbon monoxide
- B** helium
- C** nitrogen
- D** chlorine

28 Substance **P** reacts with dilute hydrochloric acid to produce a gas. This gas reduces substance **Q**.



What are substances **P** and **Q**?

	P	Q
A	copper	copper(II) oxide
B	lead	lead(II) oxide
C	magnesium	zinc oxide
D	zinc	copper(II) oxide

29 Iron rusts when exposed to oxygen in the presence of water.

Which method will **not** slow down the rate of rusting of an iron roof?

- A attaching strips of copper to it
- B coating it with plastic
- C galvanising it with zinc
- D painting it

30 The solid carbonates of three metals, *W*, *X* and *Y*, are heated.

	result
carbonate of <i>W</i>	carbon dioxide given off solid changes colour from green to black
carbonate of <i>X</i>	carbon dioxide given off solid does not change colour
carbonate of <i>Y</i>	carbon dioxide not given off solid does not change colour

Which statements are correct?

- 1 Metal *Y* is more reactive than metal *X*.
- 2 Metal *W* is a transition metal.
- 3 If dilute nitric acid is added to all three carbonates, carbon dioxide is given off from the carbonates of *W* and *X* but not from the carbonate of *Y*.

A 1 and 2 only B 1 and 3 only C 2 and 3 only D 1, 2 and 3

31 Bond breaking is an endothermic process and bond making is an exothermic process.

For which change is it **not** possible, from the equation, to deduce whether the reaction is endothermic or exothermic?

- A $Cl_2(g) \rightarrow 2Cl(g)$
- B $H_2(g) + Cl_2(g) \rightarrow 2HCl(g)$
- C $H_2O(g) \rightarrow 2H(g) + O(g)$
- D $H(g) + Cl(g) \rightarrow HCl(g)$

32 Which row is correct for the reaction of the alkene with steam and a catalyst?

	alkene	product
A	$\text{CH}_3\text{CH}=\text{CH}_2$	$\text{CH}_3\text{CH}(\text{OH})\text{CH}_3$ only
B	$\text{CH}_3\text{CH}_2\text{CH}=\text{CH}_2$	$\text{CH}_3\text{CH}_2\text{CH}_2\text{CH}_2\text{OH}$ only
C	$\text{CH}_3\text{CH}=\text{CHCH}_3$	$\text{CH}_3\text{CH}(\text{OH})\text{CH}_2\text{CH}_3$ only
D	$(\text{CH}_3)_2\text{C}=\text{CH}_2$	$(\text{CH}_3)_2\text{CHCH}_2\text{OH}$ only

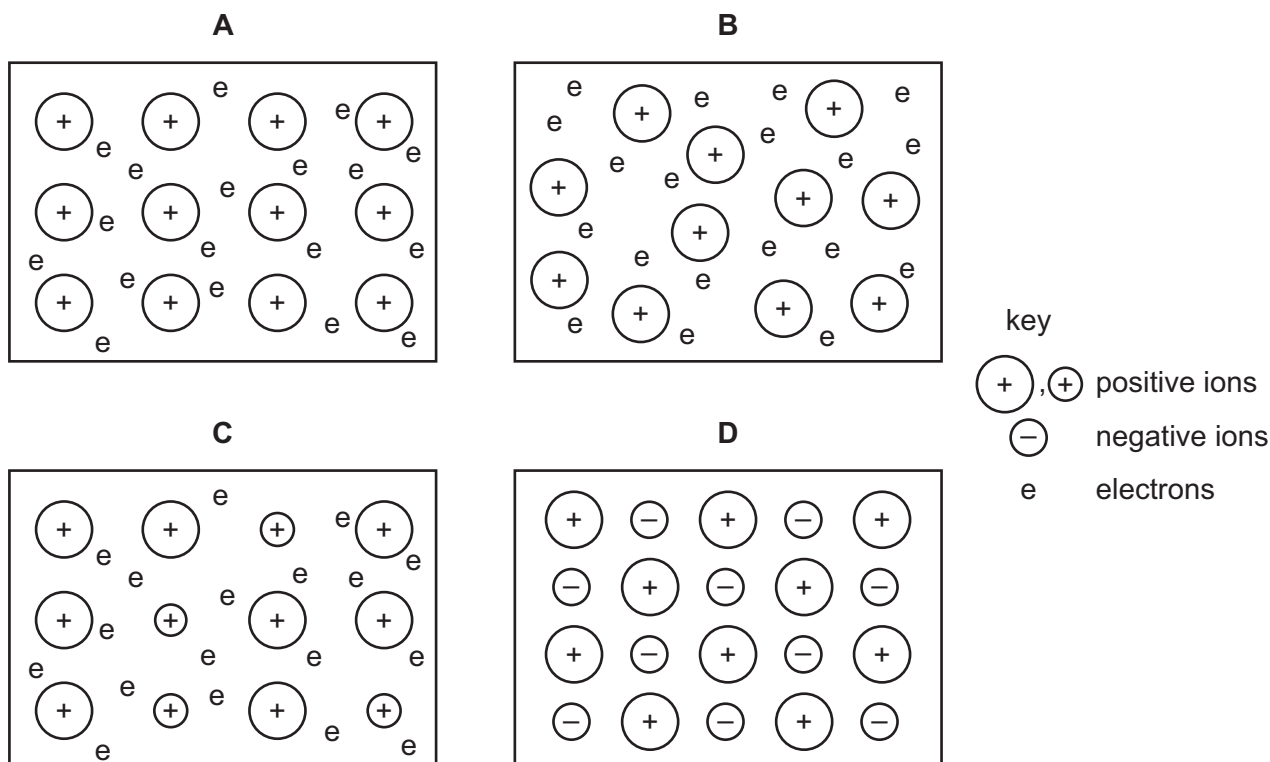
33 Why is carbon used in water purification?

- A** It acts as a filter to remove insoluble solids.
- B** It desalinates the water.
- C** It disinfects the water.
- D** It removes tastes and odours.

34 Which of the statements about the preparation and properties of ammonia is correct?

- A** Ammonia is formed when ammonium chloride is heated with an acid.
- B** Ammonia reacts with sodium hydroxide solution to form a salt and water.
- C** Ammonia reacts with water to form hydrogen ions.
- D** A solution of ammonia in water has a pH greater than 7.

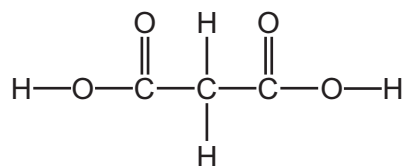
35 Which structure represents that of an alloy?



36 Which statement is **not** correct?

- A** Carbohydrates, proteins and fats are all natural macromolecules.
- B** *Terylene* contains the same linkages as a protein.
- C** When a carbohydrate is hydrolysed, sugars are formed.
- D** When a protein is hydrolysed, amino acids are formed.

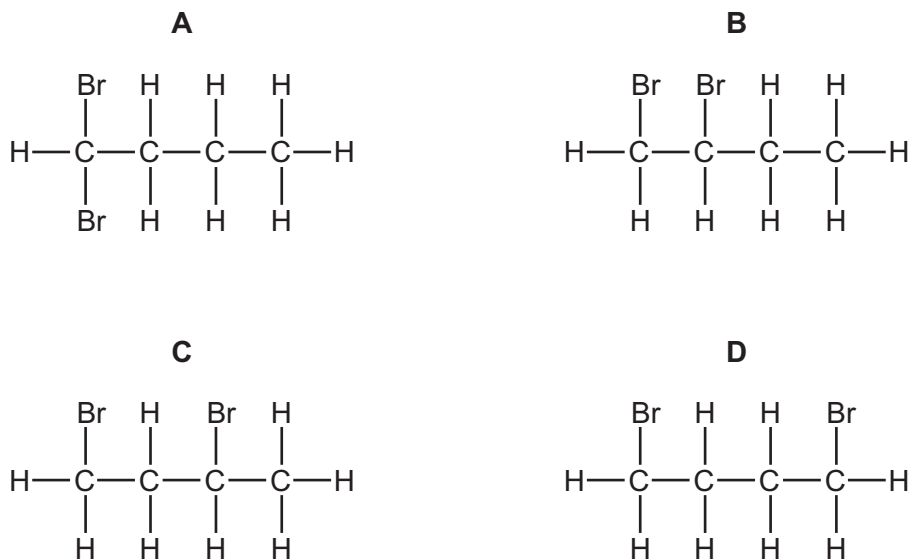
37 Which statements would be true of the compound which has the formula shown?



- 1 It would react with excess aqueous sodium hydroxide in a 1 : 1 molar ratio.
- 2 In aqueous solution, it would have a pH of 9.5.
- 3 It would react with an alcohol to form an ester.

- A** 1 only **B** 1 and 2 **C** 2 and 3 **D** 3 only

38 When butene reacts with bromine, which compound could be made?



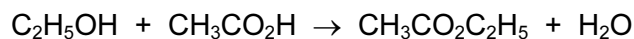
39 Methane is the first member of the alkane series of hydrocarbons. The second member is ethane.

Which statements about ethane are correct?

- 1 Ethane has the formula C_2H_4 .
- 2 Ethane has a higher boiling point than that of methane.
- 3 Ethane has the same molecular formula as methane.
- 4 Ethane has chemical properties very similar to those of methane.

A 1, 2 and 3 **B** 1 and 4 **C** 2 and 4 **D** 3 only

40 When ethanol reacts with ethanoic acid, the ester ethyl ethanoate is formed.



What is the formula of the ester formed when methanol reacts with butanoic acid, $\text{C}_3\text{H}_7\text{CO}_2\text{H}$?

- A** $\text{C}_2\text{H}_5\text{CO}_2\text{C}_2\text{H}_5$
B $\text{C}_3\text{H}_7\text{CO}_2\text{C}_2\text{H}_5$
C $\text{CH}_3\text{CO}_2\text{C}_3\text{H}_7$
D $\text{C}_3\text{H}_7\text{CO}_2\text{CH}_3$

DATA SHEET
The Periodic Table of the Elements

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*58-71 Lanthanoid series
†90-103 Actinoid series

Key

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b	X	X = atomic symbol
		b = proton (atomic) number

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CHEMISTRY

5070/12

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May/June 2015

1 hour

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Any rough working should be done in this booklet.

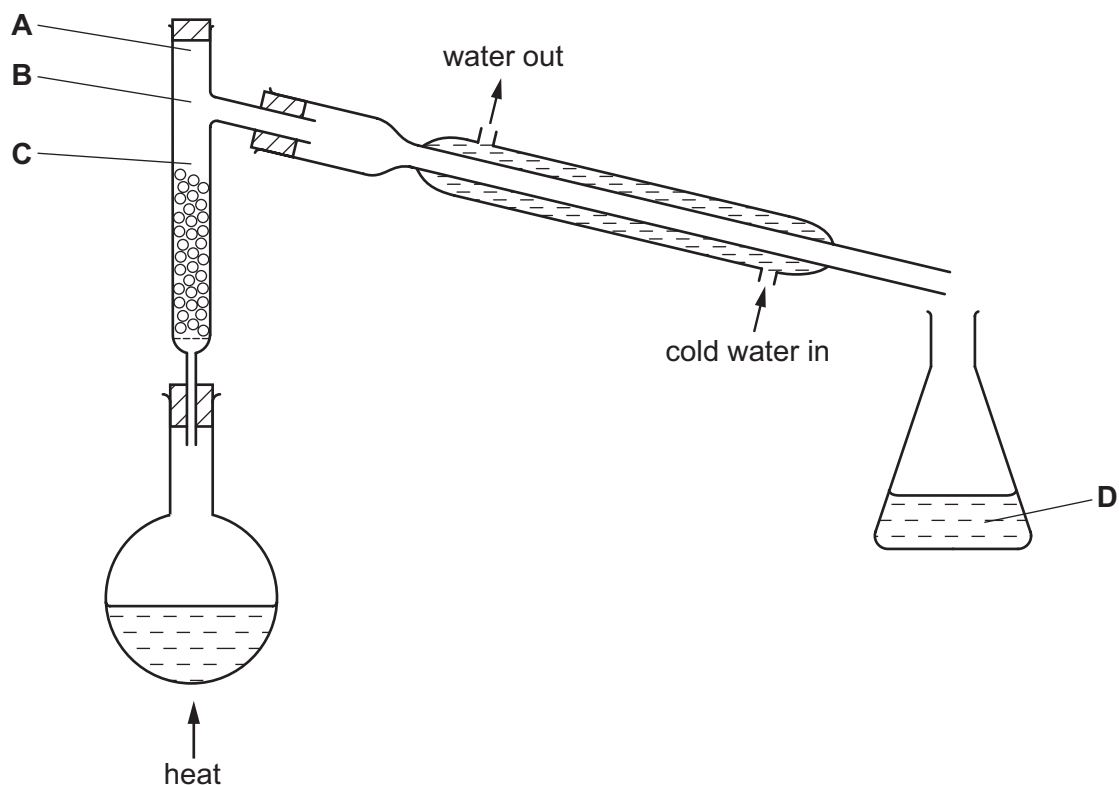
A copy of the Periodic Table is printed on page 16.

Electronic calculators may be used.

This document consists of **15** printed pages and **1** blank page.

- 1 The fractional distillation apparatus shown is being used to separate a mixture of two liquids. A thermometer is missing from the apparatus.

Where should the bulb of the thermometer be placed?



- 2 The concentration of aqueous sodium carbonate can be found by reaction with hydrochloric acid of known concentration using the indicator methyl orange.

Which items of equipment are needed?

- A burette, measuring cylinder, gas syringe
 B burette, measuring cylinder, thermometer
 C burette, pipette, conical flask
 D burette, pipette, stopwatch
- 3 Which molecules all contain one or more double covalent bonds?
- A chlorine, nitrogen and methane
 B chlorine, oxygen and ethene
 C oxygen, hydrogen chloride and ethene
 D oxygen, carbon dioxide and ethene

4 The metals Cr, Co, Fe and Mn are all transition elements.

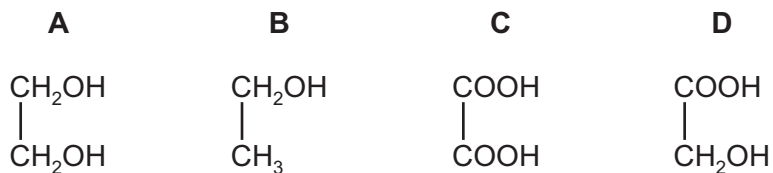
Which particles have the same number of electrons?

- A Co^{2+} and Cr
- B Co^{2+} and Fe^{3+}
- C Cr and Mn^{2+}
- D Fe^{3+} and Mn^{2+}

5 Which substance has metallic bonding?

	conducts electricity		state of product formed on reaction with oxygen
	when solid	when liquid	
A	✓	✓	solid
B	✓	✓	gas
C	x	✓	no reaction
D	x	x	solid

6 Which compound contains only eight covalent bonds?



- 7 The table shows the results of two reactions of an aqueous solution of a salt.

reagents	final observation
excess aqueous sodium hydroxide	white precipitate
dilute nitric acid and aqueous silver nitrate	white precipitate

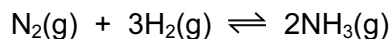
What could be the identity of the salt?

- A** calcium chloride
B calcium iodide
C zinc chloride
D zinc iodide
- 8 Which row shows correct statements about the speed at which a gas diffuses?

	effect of molecular mass	effect of temperature
A	higher molecular mass diffuses faster	diffusion is faster at higher temperatures
B	higher molecular mass diffuses faster	diffusion is faster at lower temperatures
C	lower molecular mass diffuses faster	diffusion is faster at higher temperatures
D	lower molecular mass diffuses faster	diffusion is faster at lower temperatures

- 9 What happens when sodium chloride melts?
- A** Covalent bonds in a giant lattice are broken.
B Electrons are released from atoms.
C Electrostatic forces of attraction between ions are overcome.
D Molecules are separated into ions.
- 10 Using the Periodic Table for the relative atomic masses, which has the greatest mass?
- A** 0.1 moles of iodine molecules, I_2
B 0.5 moles of carbon dioxide, CO_2
C 1.0 mole of beryllium oxide, BeO
D 1.0 mole of sodium, Na

11 Ammonia is manufactured from nitrogen and hydrogen by the Haber process.



What is the percentage yield when 60 kg of ammonia is produced from 60 kg of hydrogen?

- A** 5.9% **B** 17.6% **C** 35.3% **D** 50.0%

12 What is the relative molecular mass, M_r , of $\text{CuSO}_4 \cdot 5\text{H}_2\text{O}$?

- A** 127 **B** 160 **C** 178 **D** 250

13 The list shows some substances that conduct electricity.

- 1 aqueous sodium chloride
- 2 copper
- 3 graphite

In which substance(s) are only electrons involved in the conduction?

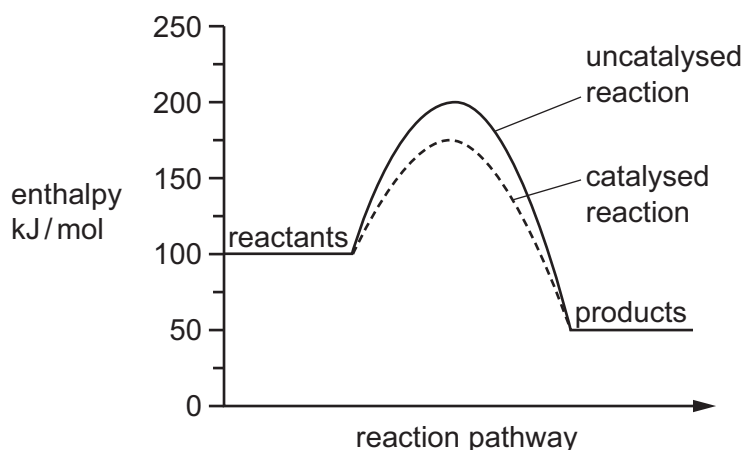
- A** 1 and 2 **B** 2 and 3 **C** 2 only **D** 3 only

14 Caesium is a Group I metal.

Which reaction involving this element would **not** produce hydrogen?

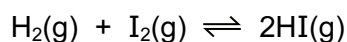
- A** adding caesium to ethanoic acid
B adding caesium to water
C electrolysis of aqueous caesium chloride
D electrolysis of molten caesium chloride

- 15 The energy diagram represents a chemical reaction carried out both with a catalyst and without a catalyst.



What is the enthalpy change for the catalysed reaction?

- A** -125 kJ/mol **B** -50 kJ/mol **C** $+75 \text{ kJ/mol}$ **D** $+100 \text{ kJ/mol}$
- 16 Hydrogen reacts with iodine to form hydrogen iodide. This is a slow reaction.



1 mole of hydrogen gas and 1 mole of iodine vapour were mixed and allowed to react. After t seconds, 0.6 moles of hydrogen remained.

What is the number of moles of iodine remaining after t seconds?

- A** 0.0 **B** 0.4 **C** 0.6 **D** 1.0
- 17 Acidified potassium manganate(VII) is used as a test reagent.

When it is added to an aqueous solution of compound **X**, the colour of the test reagent changes from1..... . This colour change shows that **X** is2..... .

Which words correctly complete gaps 1 and 2?

	1	2
A	colourless to purple	oxidised
B	colourless to purple	reduced
C	purple to colourless	oxidised
D	purple to colourless	reduced

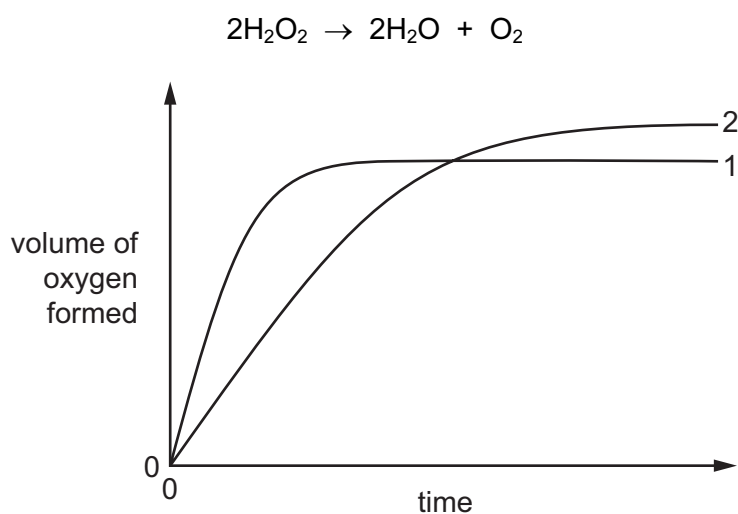
18 You are supplied with dilute hydrochloric acid together with

- copper solid,
- magnesium solid,
- aqueous lead nitrate,
- aqueous silver nitrate.

How many different insoluble chlorides could you make?

- A** 1 **B** 2 **C** 3 **D** 4

19 In the graph, curve 1 was obtained by observing the decomposition of 100 cm^3 of 1.0 mol/dm^3 hydrogen peroxide solution, catalysed by manganese(IV) oxide.



Which alteration to the original experimental conditions would produce curve 2?

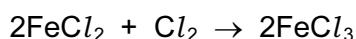
- A** adding some 0.1 mol/dm^3 hydrogen peroxide solution
B lowering the temperature
C using less manganese(IV) oxide
D using a different catalyst

20 A colourless solution reacts with magnesium to form a salt and hydrogen gas.

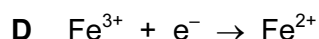
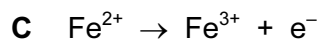
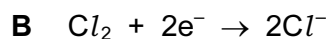
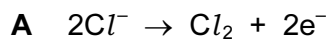
How is this solution acting?

- A** as a base
B as a reducing agent
C as a solvent
D as an acid

21 The equation shows a redox reaction between iron(II) chloride and chlorine gas.



Which equation describes the reduction process in this reaction?



22 Which compound produces the greatest number of ions when 1 mole is dissolved in water?

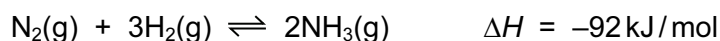
A aluminium sulfate

B ammonium carbonate

C ammonium nitrate

D calcium nitrate

23 The equation for the reaction taking place during the production of ammonia is shown.



The reaction is carried out between 350 °C and 450 °C and at around 200 atmospheres pressure using an iron catalyst.

Which statement is **not** correct?

A At higher temperatures the amount of ammonia present at equilibrium is less.

B Changing the pressure has no effect on the rate of reaction.

C The catalyst is used to speed up the reaction.

D When the reaction is at equilibrium, the forward reaction is taking place at the same rate as the backward reaction.

24 Which element is sodium?

	melting point in °C	electrical conduction	density in g/cm ³
A	1535	good	7.86
B	1083	good	8.92
C	113	poor	2.07
D	98	good	0.97

25 From their position in the Periodic Table, what would you expect the elements titanium, vanadium, chromium and cobalt to have in common?

- 1 variable oxidation states
- 2 coloured compounds
- 3 high melting points

A 1, 2 and 3 **B** 1 and 2 only **C** 1 and 3 only **D** 2 and 3 only

26 Which two gases do **not** damage limestone buildings?

- A** nitrogen and carbon monoxide
- B** nitrogen dioxide and carbon monoxide
- C** nitrogen dioxide and carbon dioxide
- D** sulfur dioxide and carbon dioxide

27 The following facts are known about four metals, P, Q, R and S.

- 1 R displaces both P and S from aqueous solutions of their ions.
- 2 Q reacts with water but R does not react with water.
- 3 S does not react with acid but P does react with acid.

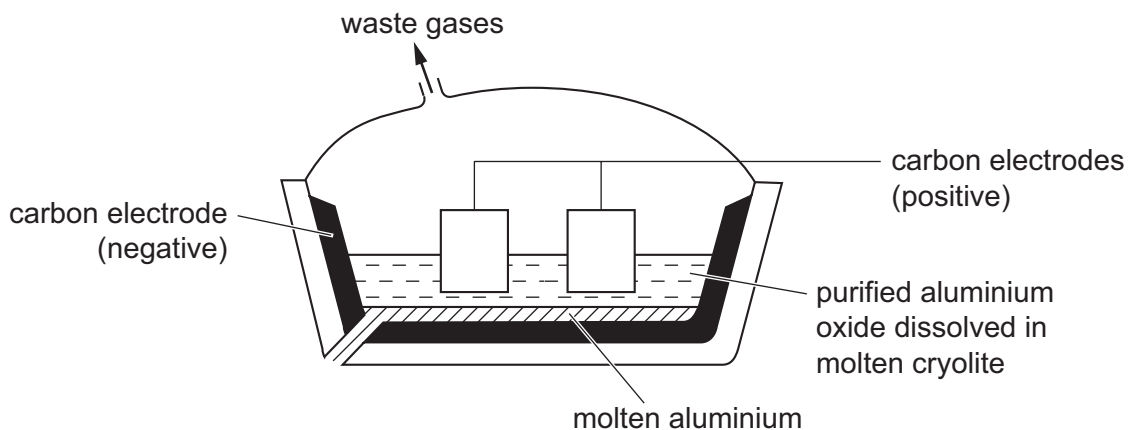
What is the correct order of reactivity, the most reactive first?

- A** P → S → Q → R
- B** Q → R → P → S
- C** Q → S → P → R
- D** S → P → R → Q

28 Which metal has to be extracted from its ore by electrolysis?

- A** Fe **B** Na **C** Pb **D** Zn

29 Aluminium is produced by the electrolysis of molten aluminium oxide.



Which statement about the process is correct?

- A Aluminium ions are reduced to aluminium by gaining electrons.
- B Aluminium oxide is reduced by cryolite.
- C Aluminium oxide is reduced by the carbon electrodes.
- D Aluminium oxide is reduced by the carbon monoxide formed at the negative electrode.

30 Hydrides are compounds of an element and hydrogen only.

Which statement is **not** correct?

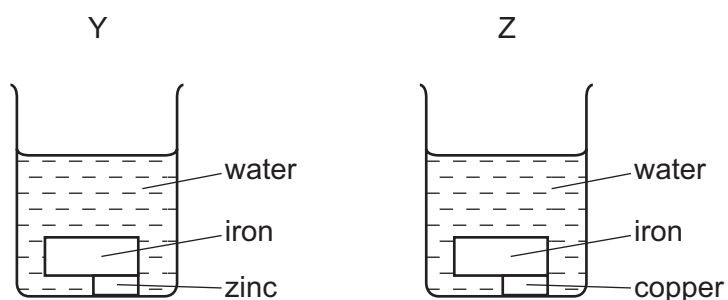
- A The hydride of carbon that contains four hydrogen atoms and one carbon atom, is a gas called methane.
- B The hydride of chlorine dissolves in water to form an alkaline solution.
- C The hydride of nitrogen is manufactured in the Haber process.
- D The hydride of oxygen is a liquid at room temperature.

31 In the extraction of iron from its ore in the blast furnace, limestone is added.

What is the function of the limestone?

- A to decrease the melting point of the iron
- B to produce carbon monoxide for the reduction of the iron ore
- C to produce heat to melt the iron formed
- D to remove sand

- 32 Two pieces of iron, one with zinc attached and the other with copper attached, are placed separately in water as shown.

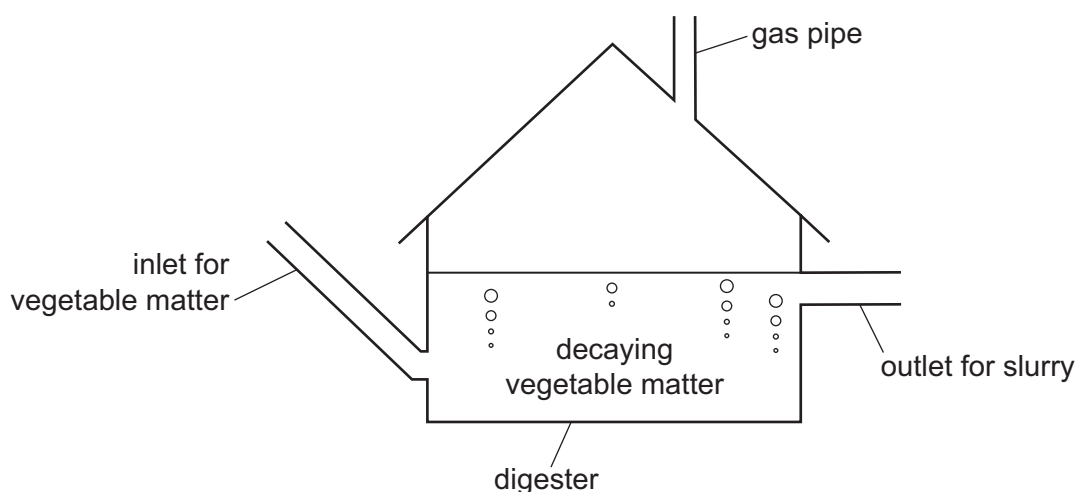


Which statements are correct?

- 1 The iron in Y will not rust.
- 2 The water in Z will turn blue.
- 3 The zinc in Y will be oxidised.

- A** 1, 2 and 3 **B** 1 and 2 only **C** 1 and 3 only **D** 2 and 3 only

- 33 A diagram of a biogas generator is shown.



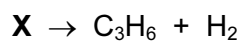
The gas, if collected, can be used as a fuel.

However, if the gas is allowed to escape it becomes an atmospheric pollutant.

What is the gas?

- A** carbon monoxide
- B** methane
- C** nitrogen
- D** sulfur dioxide

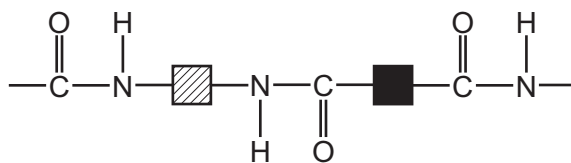
- 34 Which statement about alkanes is correct?
- A Alkanes are readily polymerised.
 - B Alkanes react with bromine by addition.
 - C Alkanes react with chlorine by substitution.
 - D Butane has three more carbon atoms and eight more hydrogen atoms than methane.
- 35 Which statement about members of the homologous series of alcohols is correct?
- A An alcohol with two carbon atoms in each molecule is called methanol.
 - B Butanol can be combusted to give carbon dioxide and water only.
 - C Ethanol is the only alcohol that can be oxidised to a carboxylic acid.
 - D Propanol can be made by the catalysed addition of steam to ethene.
- 36 When cracked, one mole of a compound, **X**, produces one mole of propene and one mole of hydrogen.



What type of compound is **X**?

- A an alcohol
- B an alkane
- C an alkene
- D a carboxylic acid

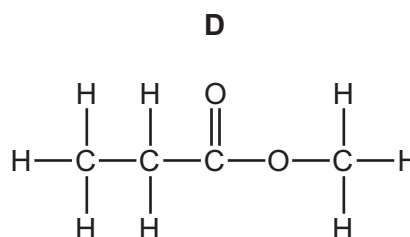
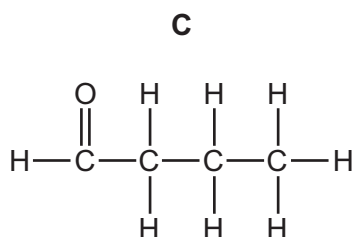
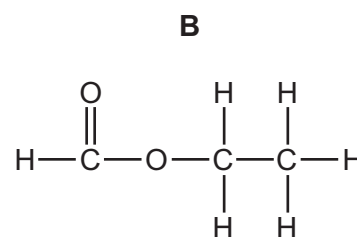
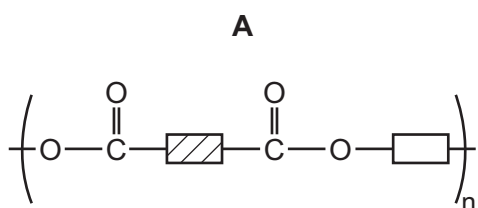
37 The diagram shows the partial structure of a polymer.



Which pair of reagents could have been used to form this polymer?

- A** and
- B** and
- C** and
- D** and

38 Which of the following has **not** been prepared by reacting a carboxylic acid with an alcohol?



- 39 Which statement about the properties of the four alkanes from methane to butane is **not** correct?
- A Successive members of the series differ in formula by CH_2 .
 - B They increase in boiling point.
 - C They increase in viscosity.
 - D They share the same empirical formula.
- 40 Which of these polymers is a protein?
- A $(\text{C}_2\text{H}_3\text{Cl})_n$
 - B $(\text{C}_5\text{H}_8\text{O}_2)_n$
 - C $(\text{C}_6\text{H}_{10}\text{O}_5)_n$
 - D $(\text{C}_2\text{H}_3\text{NO})_n$

DATA SHEET
The Periodic Table of the Elements

		Group																																										
I	II	III	IV	V	VI	VII	0						0																															
		1 H Hydrogen 1											4 He Helium 2																															
7 Li Lithium 3	9 Be Beryllium 4											20 Ne Neon 10																																
23 Na Sodium 11	24 Mg Magnesium 12	27 Al Aluminium 13	28 Si Silicon 14	31 P Phosphorus 15	32 S Sulfur 16	35.5 Cl Chlorine 17	40 Ar Argon 18						84 Kr Krypton 36																															
39 K Potassium 19	40 Ca Calcium 20	70 Ga Gallium 31	73 Ge Germanium 32	75 As Arsenic 33	79 Se Selenium 34	80 Br Bromine 35	84 Kr Krypton 36						131 Xe Xenon 54																															
85 Rb Rubidium 37	88 Sr Strontium 38	115 In Indium 49	119 Sn Tin 50	122 Sb Antimony 51	128 Te Tellurium 52	127 I Iodine 53	131 Xe Xenon 54						86 Rn Radon 86																															
133 Cs Caesium 55	137 Ba Barium 56	204 Tl Thallium 81	207 Pb Lead 82	209 Bi Bismuth 83	210 Po Polonium 84	210 At Astatine 85	210 Rn Radon 86						226 Ra Radium 88																															
226 Fr Francium 87	227 Ac Actinium 89											227 Ac Actinium 89																																
<p>*58-71 Lanthanoid series †90-103 Actinoid series</p>																																												
<table style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 5%;"></td> <td style="width: 5%; text-align: center;">a</td> <td style="width: 5%; text-align: center;">X</td> <td style="width: 5%; text-align: center;">b</td> <td style="width: 5%;"></td> <td style="width: 5%; text-align: center;">140 Ce Cerium 58</td> <td style="width: 5%; text-align: center;">141 Pr Praseodymium 59</td> <td style="width: 5%; text-align: center;">144 Nd Neodymium 60</td> <td style="width: 5%; text-align: center;">150 Sm Samarium 62</td> <td style="width: 5%; text-align: center;">152 Eu Europium 63</td> <td style="width: 5%; text-align: center;">157 Gd Gadolinium 64</td> <td style="width: 5%; text-align: center;">162 Dy Dysprosium 66</td> <td style="width: 5%; text-align: center;">165 Ho Holmium 67</td> <td style="width: 5%; text-align: center;">167 Er Erbium 68</td> <td style="width: 5%; text-align: center;">169 Tm Thulium 69</td> <td style="width: 5%; text-align: center;">173 Yb Ytterbium 70</td> <td style="width: 5%; text-align: center;">175 Lu Lutetium 71</td> <td style="width: 5%;"></td> <td style="width: 5%; text-align: center;">232 Th Thorium 90</td> <td style="width: 5%; text-align: center;">238 U Uranium 92</td> <td style="width: 5%; text-align: center;">238 Pa Protactinium 91</td> <td style="width: 5%; text-align: center;">238 Np Neptunium 93</td> <td style="width: 5%; text-align: center;">238 Pu Plutonium 94</td> <td style="width: 5%; text-align: center;">238 Am Americium 95</td> <td style="width: 5%; text-align: center;">238 Cm Curium 96</td> <td style="width: 5%; text-align: center;">238 Bk Berkelium 97</td> <td style="width: 5%; text-align: center;">238 Cf Californium 98</td> <td style="width: 5%; text-align: center;">238 Es Einsteinium 99</td> <td style="width: 5%; text-align: center;">238 Fm Fermium 100</td> <td style="width: 5%; text-align: center;">238 Md Mendelevium 101</td> <td style="width: 5%; text-align: center;">238 No Nobelium 102</td> <td style="width: 5%; text-align: center;">238 Lr Lawrencium 103</td> </tr> </table>														a	X	b		140 Ce Cerium 58	141 Pr Praseodymium 59	144 Nd Neodymium 60	150 Sm Samarium 62	152 Eu Europium 63	157 Gd Gadolinium 64	162 Dy Dysprosium 66	165 Ho Holmium 67	167 Er Erbium 68	169 Tm Thulium 69	173 Yb Ytterbium 70	175 Lu Lutetium 71		232 Th Thorium 90	238 U Uranium 92	238 Pa Protactinium 91	238 Np Neptunium 93	238 Pu Plutonium 94	238 Am Americium 95	238 Cm Curium 96	238 Bk Berkelium 97	238 Cf Californium 98	238 Es Einsteinium 99	238 Fm Fermium 100	238 Md Mendelevium 101	238 No Nobelium 102	238 Lr Lawrencium 103
	a	X	b		140 Ce Cerium 58	141 Pr Praseodymium 59	144 Nd Neodymium 60	150 Sm Samarium 62	152 Eu Europium 63	157 Gd Gadolinium 64	162 Dy Dysprosium 66	165 Ho Holmium 67	167 Er Erbium 68	169 Tm Thulium 69	173 Yb Ytterbium 70	175 Lu Lutetium 71		232 Th Thorium 90	238 U Uranium 92	238 Pa Protactinium 91	238 Np Neptunium 93	238 Pu Plutonium 94	238 Am Americium 95	238 Cm Curium 96	238 Bk Berkelium 97	238 Cf Californium 98	238 Es Einsteinium 99	238 Fm Fermium 100	238 Md Mendelevium 101	238 No Nobelium 102	238 Lr Lawrencium 103													
<p>Key</p> <p>a = relative atomic mass X = atomic symbol b = proton (atomic) number</p>																																												

The volume of one mole of any gas is 24 dm³ at room temperature and pressure (r.t.p.).

CHEMISTRY

5070/12

Paper 1 Multiple Choice

October/November 2015

1 hour

Additional Materials: Multiple Choice Answer Sheet
Soft clean eraser
Soft pencil (type B or HB recommended)



READ THESE INSTRUCTIONS FIRST

Write in soft pencil.

Do not use staples, paper clips, glue or correction fluid.

Write your name, Centre number and candidate number on the Answer Sheet in the spaces provided unless this has been done for you.

DO NOT WRITE IN ANY BARCODES.

There are **forty** questions on this paper. Answer **all** questions. For each question there are four possible answers **A, B, C** and **D**.

Choose the **one** you consider correct and record your choice in **soft pencil** on the separate Answer Sheet.

Read the instructions on the Answer Sheet very carefully.

Each correct answer will score one mark. A mark will not be deducted for a wrong answer.

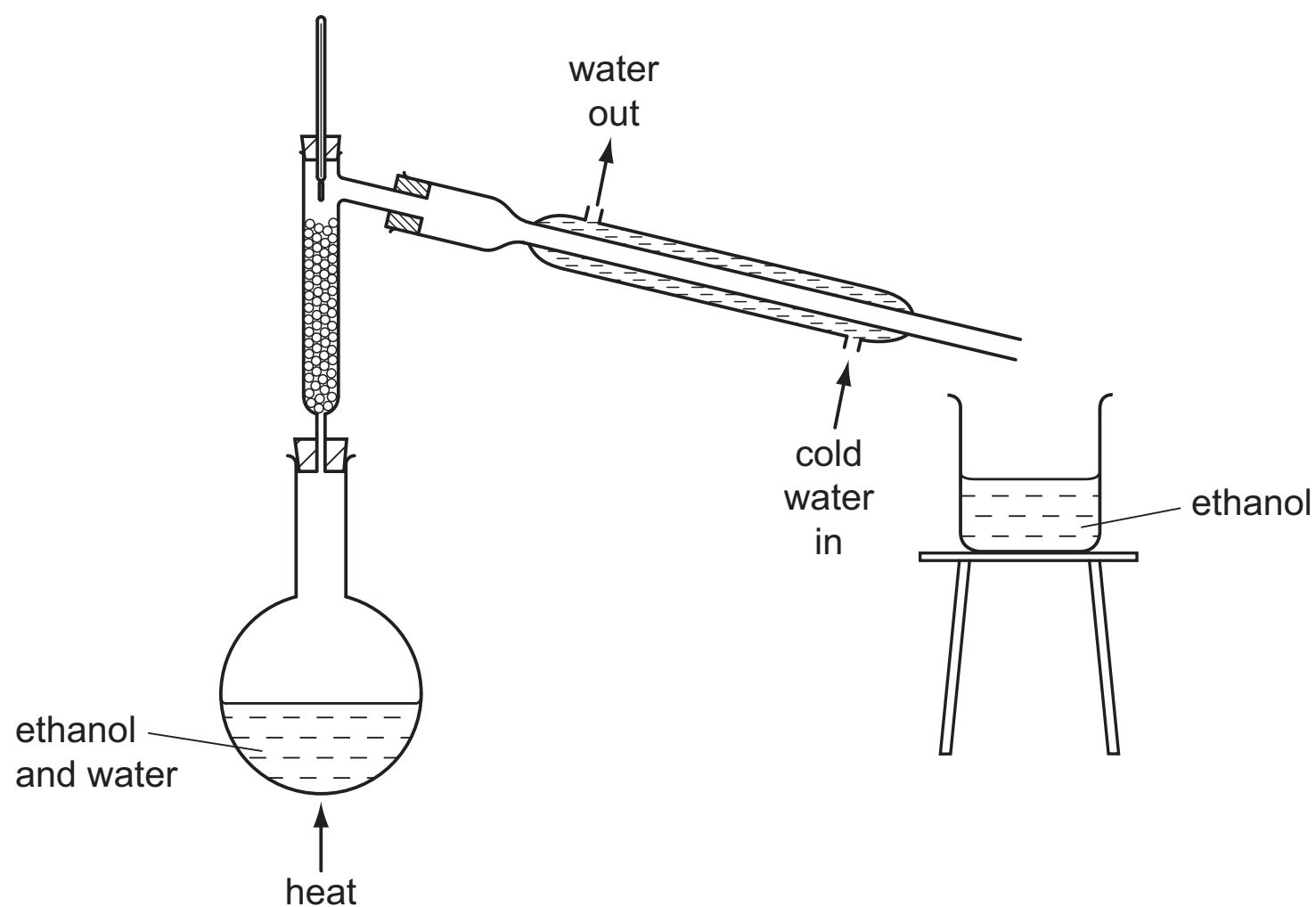
Any rough working should be done in this booklet.

A copy of the Periodic Table is printed on page 16.

Electronic calculators may be used.

This document consists of **15** printed pages and **1** blank page.

- 1 The diagram shows the fractional distillation of an aqueous solution of ethanol.



Which statement explains why ethanol is collected as the distillate?

- A Ethanol has a higher boiling point than water.
 - B Ethanol has a higher melting point than water.
 - C Ethanol has a lower boiling point than water.
 - D Ethanol has a lower melting point than water.
- 2 In a titration between an acid (in the burette) and an alkali, you may need to re-use the same titration flask.

Which is the best procedure for rinsing the flask?

- A Rinse with distilled water and then with the alkali.
- B Rinse with tap water and then with distilled water.
- C Rinse with tap water and then with the acid.
- D Rinse with the alkali.

3 Which statements are correct?

- 1 The volume of a gas at constant pressure increases as the temperature increases.
- 2 The rate of diffusion of a gas increases as the temperature increases.
- 3 The pressure of a gas at constant volume decreases as the temperature increases.

- A** 1 and 2 only
B 1 and 3 only
C 2 and 3 only
D 1, 2 and 3

4 A colourless solution is known to contain a sodium salt.

Tests were carried out to determine the identity of the anion in the solution.

test	observation
dilute hydrochloric acid	no reaction
dilute nitric acid followed by aqueous silver nitrate	no precipitate
dilute nitric acid followed by aqueous barium nitrate	no precipitate

Which anion could the solution contain?

- A** carbonate
B chloride
C nitrate
D sulfate

5 Which physical changes are both exothermic?

- A** condensation and evaporation
B evaporation and melting
C freezing and condensation
D melting and freezing

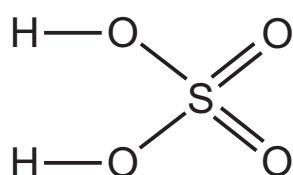
6 The following data may refer to the atom or to the ion of the same element.

- electronic configuration 2,8,8
- nucleon number 40
- proton number 20

Which element is described by these data?

- A** argon
B calcium
C chlorine
D neon

7 A molecule of sulfuric acid has the structural formula shown.



How many electrons are involved in forming all the covalent bonds in one molecule?

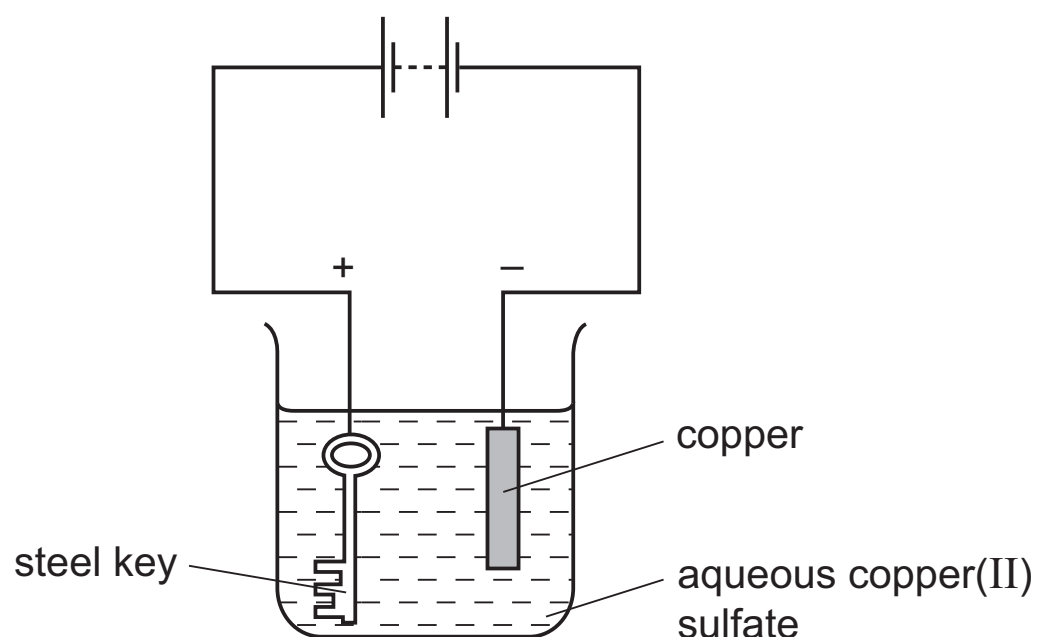
- A** 6 **B** 8 **C** 12 **D** 16

8 A metal consists of a lattice of positive ions in a 'sea of electrons'.

What happens to the electrons and positive ions in a metal wire when an electric current is passed through it?

	electrons	positive ions
A	replaced by new electrons	replaced by new ions
B	replaced by new electrons	unchanged
C	unchanged	replaced by new ions
D	unchanged	unchanged

- 9 The apparatus shown is set up to plate a steel key with copper.

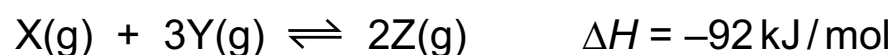


The key does not get coated with copper.

Which change needs to be made to plate the key?

- A** Increase the concentration of the aqueous copper(II) sulfate.
- B** Increase the voltage.
- C** Replace the solution with dilute sulfuric acid.
- D** Reverse the electrical connections.
- 10 What is the number of moles of hydrogen atoms in 3.2 g of methane?
- A** 0.02 **B** 0.2 **C** 0.4 **D** 0.8
- 11 The formula of the gas ozone is O_3 .
- What is the volume of 48 g of ozone at r.t.p.?
- A** 16 dm^3 **B** 24 dm^3 **C** 36 dm^3 **D** 72 dm^3
- 12 Which substance, when added to pure water, will produce a solution which conducts electricity?
- A** calcium chloride
- B** graphite
- C** iron
- D** sugar

13 Two gases, X and Y, react together to form a gas Z, as shown.



Which change in condition will both increase the rate of reaction and increase the equilibrium yield of Z?

- A decrease concentration of X
- B increase pressure
- C increase temperature
- D use a catalyst

14 A solution of sodium carbonate was added to tap water.

A white precipitate formed.

Which ion present in the tap water caused the precipitate to form?

- A chloride
- B magnesium
- C potassium
- D sulfate

15 In which reaction is nitric acid acting as an oxidising agent?

- A $\text{Cu} + 4\text{HNO}_3 \rightarrow \text{Cu}(\text{NO}_3)_2 + 2\text{H}_2\text{O} + 2\text{NO}_2$
- B $\text{CuO} + 2\text{HNO}_3 \rightarrow \text{Cu}(\text{NO}_3)_2 + \text{H}_2\text{O}$
- C $\text{Na}_2\text{CO}_3 + 2\text{HNO}_3 \rightarrow 2\text{NaNO}_3 + \text{H}_2\text{O} + \text{CO}_2$
- D $\text{NaOH} + \text{HNO}_3 \rightarrow \text{NaNO}_3 + \text{H}_2\text{O}$

16 Which reaction does **not** involve neutralisation?

- A $\text{H}_2\text{SO}_4(\text{aq}) + 2\text{NH}_3(\text{aq}) \rightarrow (\text{NH}_4)_2\text{SO}_4(\text{aq})$
- B $\text{H}_2\text{SO}_4(\text{aq}) + \text{BaCl}_2(\text{aq}) \rightarrow \text{BaSO}_4(\text{s}) + 2\text{HCl}(\text{aq})$
- C $\text{H}_2\text{SO}_4(\text{aq}) + \text{CuO}(\text{s}) \rightarrow \text{CuSO}_4(\text{aq}) + \text{H}_2\text{O}(\text{l})$
- D $\text{H}_2\text{SO}_4(\text{aq}) + 2\text{NaOH}(\text{aq}) \rightarrow \text{Na}_2\text{SO}_4(\text{aq}) + 2\text{H}_2\text{O}(\text{l})$

17 Which pair of substances reacts to form a salt and water only?

- A aqueous sodium chloride and aqueous silver nitrate
- B aqueous sodium hydroxide and dilute ethanoic acid
- C aqueous sodium carbonate and dilute sulfuric acid
- D zinc and dilute hydrochloric acid

18 Iron is obtained in the blast furnace from the ore haematite.

Which reaction takes place in the blast furnace?

- A Calcium carbonate is used to remove acidic impurities.
- B Coke is reduced to carbon dioxide.
- C Haematite is oxidised by carbon monoxide.
- D Haematite undergoes thermal decomposition.

19 Aluminium is manufactured from aluminium oxide by electrolysis. The compound cryolite is used in this process.

Which statement about cryolite is correct?

- A It is the common name for aluminium oxide.
- B It is used to dissolve the aluminium oxide.
- C It is used to make the positive electrode.
- D It is used to make the negative electrode.

20 An element is burned in an excess of oxygen.

Which statement about the oxide formed is always correct?

- A The mass of oxide formed is greater than the mass of element burned.
- B The oxide formed is a crystalline solid.
- C The oxide formed is soluble in water.
- D The oxide formed is white in colour.

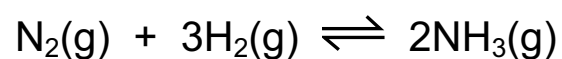
21 Which statement about the Periodic Table is correct?

- A Elements are arranged in order of decreasing proton number.
- B Group number is the number of electron shells in atoms of the elements in the group.
- C Group numbers can be used to predict the charges of ions.
- D Metallic character increases left to right across a period.

22 Which negative ions are present in aqueous copper(II) sulfate?

- A copper(II) ions and hydrogen ions
- B copper(II) ions only
- C sulfate ions and hydroxide ions
- D sulfate ions only

23 The reaction shown for the Haber process can reach equilibrium.



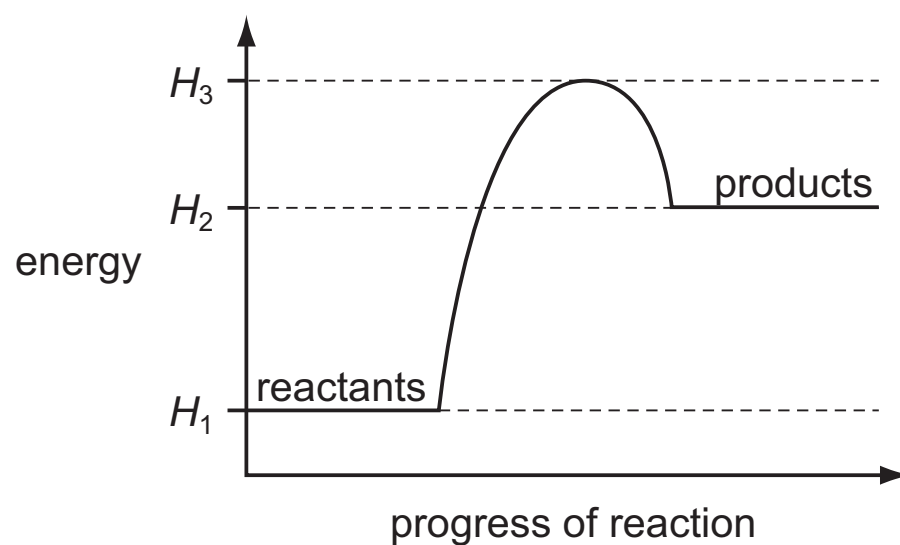
Which row shows the gases present at equilibrium?

	nitrogen	hydrogen	ammonia
A	no	no	yes
B	no	yes	yes
C	yes	no	yes
D	yes	yes	yes

24 Which statement about graphite is **not** correct?

- A It burns to form carbon dioxide.
- B It is a carbon compound.
- C It is a giant molecular substance.
- D It is used as a lubricant.

25 The energy profile diagram for a reaction is shown.



Which statement is correct?

- A** The activation energy of the reaction is $(H_3 - H_1)$.
- B** The activation energy of the reaction is $(H_3 - H_2)$.
- C** ΔH is $(H_1 - H_2)$.
- D** ΔH is $(H_1 - H_3)$.
- 26 The Periodic Table shows the positions of elements **A**, **B**, **C** and **D**. These are not the usual symbols of these elements.

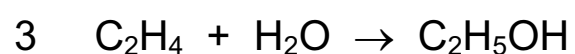
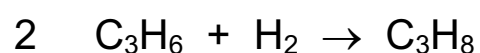
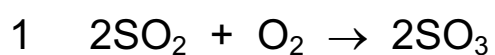
Which element has a high melting point and can be used as a catalyst?

I		II										III	IV	V	VI	VII	0	
A														D				
B										C								

27 Which of the statements about iron and steel is **not** correct?

- A** Both iron and steel conduct electricity.
- B** Mild steel is used in car bodies.
- C** Pure iron is formed in the blast furnace.
- D** The addition of carbon to mild steel makes it stronger.

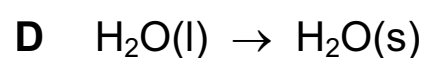
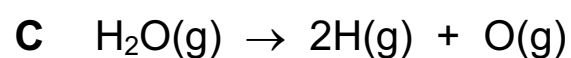
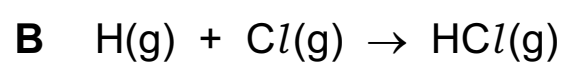
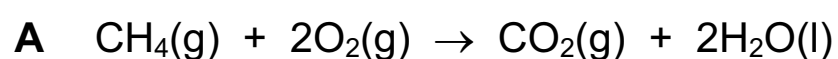
28 Some reactions are shown.



Which of these reactions use a catalyst when carried out industrially?

- A** 1 only **B** 1 and 2 only **C** 2 and 3 only **D** 1, 2 and 3

29 Which change is endothermic?



30 Which two elements are the major constituents of brass?

- A** Br and As **B** Cu and Sn **C** Cu and Zn **D** Sn and Zn

31 Two statements about copper are given.

1 Copper is below hydrogen in the reactivity series.

2 Copper can be obtained by heating its oxide with carbon.

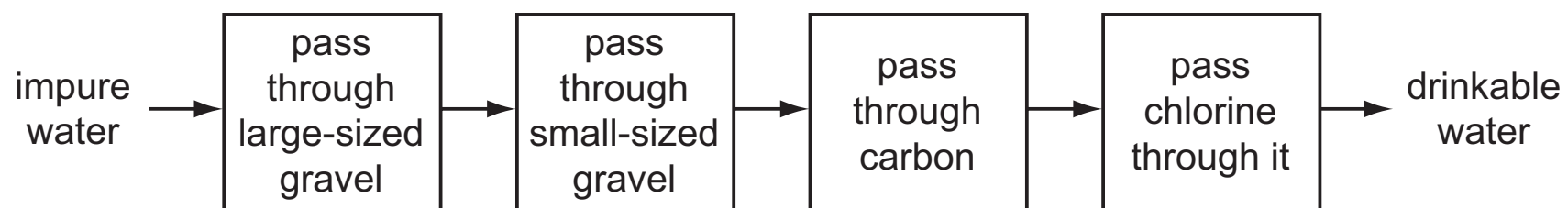
Which statements are correct?

- A** both 1 and 2
B 1 only
C 2 only
D neither 1 nor 2

32 What is the order of reactivity of the halogens?

	most reactive	—————→	least reactive
A	bromine	chlorine	iodine
B	chlorine	bromine	iodine
C	iodine	bromine	chlorine
D	iodine	chlorine	bromine

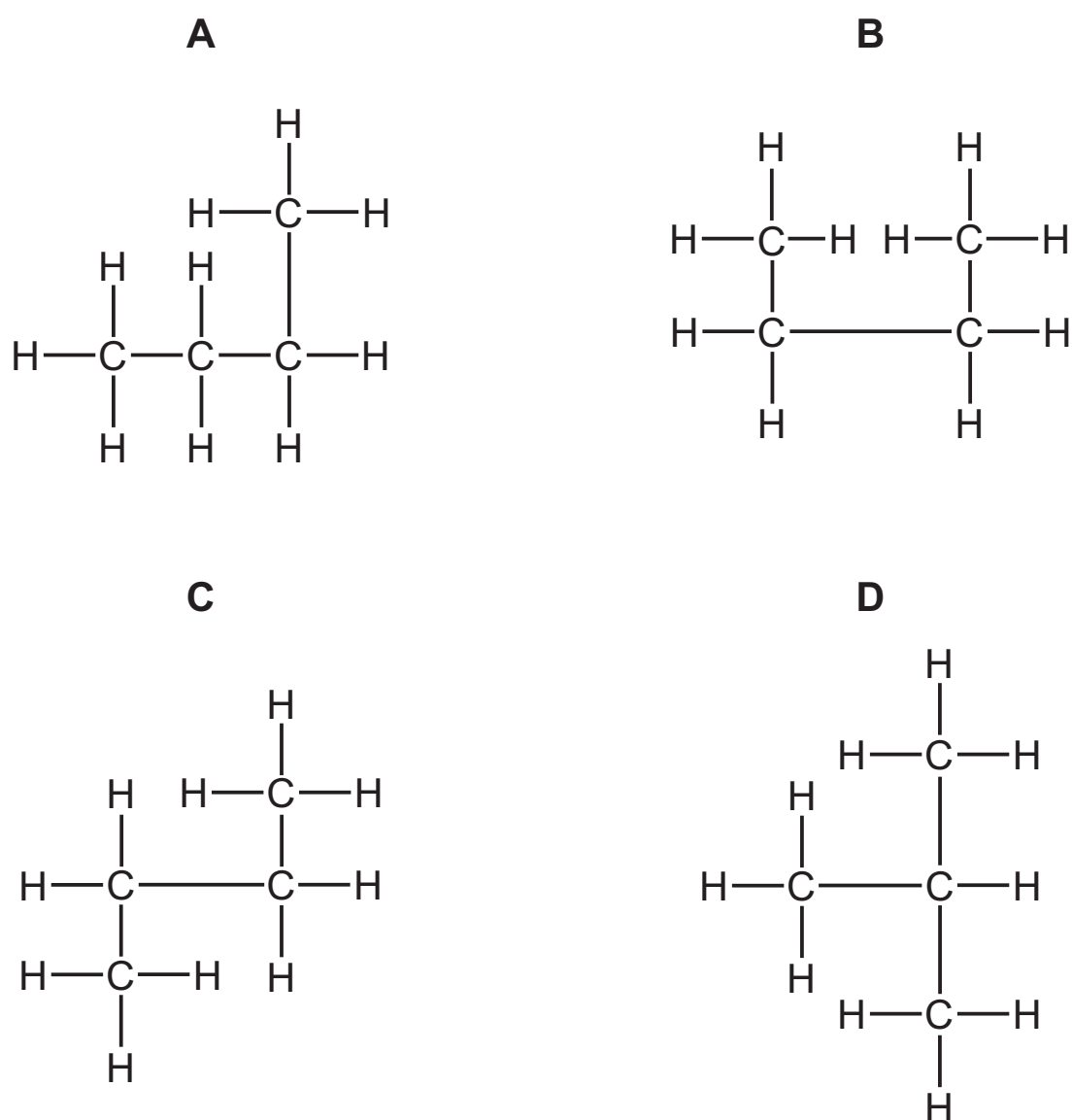
33 The flow chart shows how impure water can be treated to produce drinkable water.



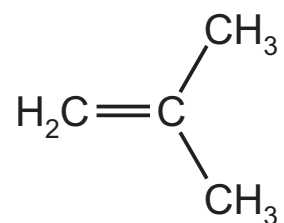
What is **not** removed from the water by this process?

- A clay particles
- B microbes
- C nitrates
- D odours

34 Which diagram shows the isomer of butane?

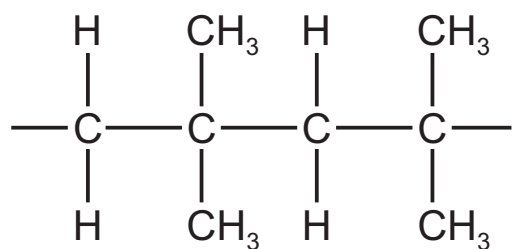


35 The diagram shows the structure of a monomer used to make a polymer.

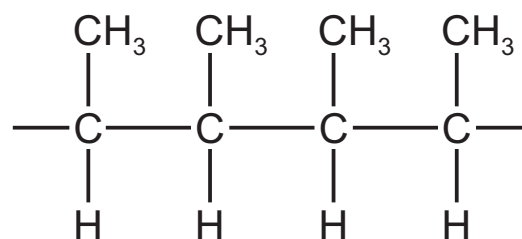


What is the structure of the polymer?

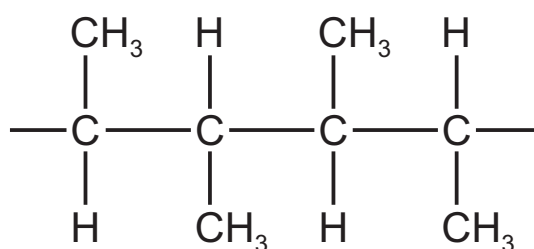
A



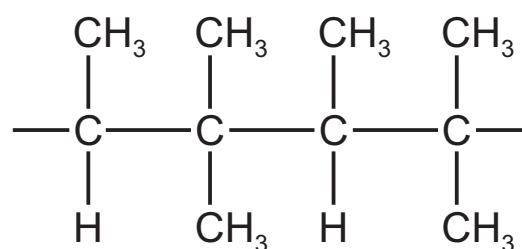
B



C



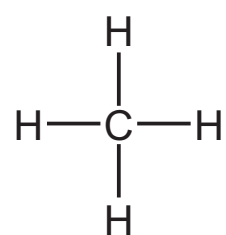
D



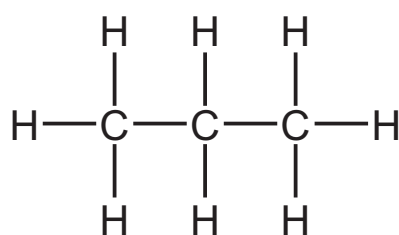
36 Which property of a liquid ester can be used to check its purity before use as a food flavouring?

- A** boiling point
- B** colour
- C** smell
- D** solubility in water

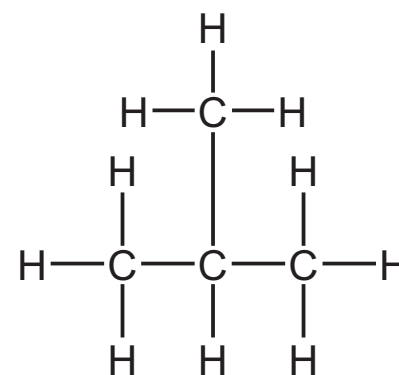
37 The structures of three hydrocarbons from the same homologous series are shown.



W



X



Y

Which statement is correct?

- A All three molecules are unsaturated hydrocarbons.
- B All three molecules have the same empirical formula.
- C W has the lowest boiling point.
- D X is an isomer of Y.

38 How many of the following statements about ethanol are correct?

- 1 molecular formula is $\text{C}_2\text{H}_6\text{O}$
- 2 manufactured from ethane and steam
- 3 oxidises to ethanoic acid
- 4 produced by the fermentation of glucose
- 5 used as a fuel
- 6 used as a solvent

A 3

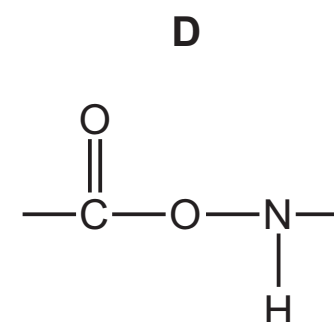
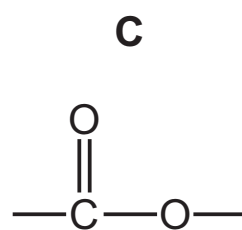
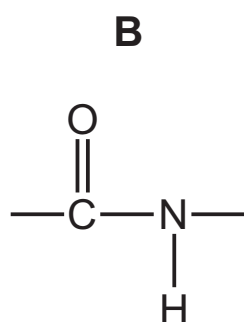
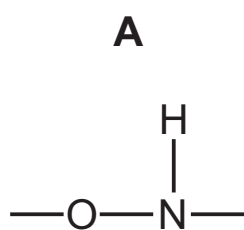
B 4

C 5

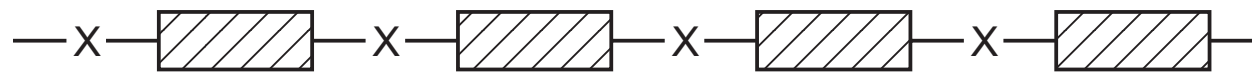
D 6

39 Proteins and nylon both possess the same amide linkages.

Which arrangement of atoms represents an amide linkage?



40 A carbohydrate such as starch can be represented as shown.



What is X?

- A carbon
- B hydrogen
- C nitrogen
- D oxygen

DATA SHEET
The Periodic Table of the Elements

		Group																													
		I	II	III	IV	V	VI	VII	VIII	IX	X																				
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		133 Cs Caesium 55	137 Ba Barium 56	139 La Lanthanum 57	178 Hf Hafnium 72	181 Ta Tantalum 73	184 W Tungsten 74	190 Os Osmium 76	192 Ir Iridium 77	195 Pt Platinum 78	197 Au Gold 79	201 Hg Mercury 80	204 Tl Thallium 81	207 Pb Lead 82	209 Bi Bismuth 83	210 Po Polonium 84	210 At Astatine 85	222 Rn Radon 86													
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		232 Th Thorium 90	238 U Uranium 92	238 Np Neptunium 93	238 Pu Plutonium 94	238 Am Americium 95	238 Cm Curium 96	238 Bk Berkelium 97	238 Cf Californium 98	238 Es Einsteinium 99	238 Fm Fermium 100	238 Md Mendelevium 101	238 No Nobelium 102	238 Lr Lawrencium 103																	

*58-71 Lanthanoid series
†90-103 Actinoid series

Key

a	X	b
---	----------	---

a = relative atomic mass
X = atomic symbol
b = proton (atomic) number

The volume of one mole of any gas is 24 dm³ at room temperature and pressure (r.t.p.).

CHEMISTRY

5070/12

Paper 1 Multiple Choice

May/June 2016

1 hour

Additional Materials: Multiple Choice Answer Sheet
 Soft clean eraser
 Soft pencil (type B or HB is recommended)

* 2 8 1 5 9 9 5 4 8 2 *



READ THESE INSTRUCTIONS FIRST

Write in soft pencil.

Do not use staples, paper clips, glue or correction fluid.

Write your name, Centre number and candidate number on the Answer Sheet in the spaces provided unless this has been done for you.

DO NOT WRITE IN ANY BARCODES.

There are **forty** questions on this paper. Answer **all** questions. For each question there are four possible answers **A, B, C** and **D**.

Choose the **one** you consider correct and record your choice in **soft pencil** on the separate Answer Sheet.

Read the instructions on the Answer Sheet very carefully.

Each correct answer will score one mark. A mark will not be deducted for a wrong answer.

Any rough working should be done in this booklet.

A copy of the Periodic Table is printed on page 16.

Electronic calculators may be used.

This document consists of **16** printed pages.

1 Which row correctly identifies the gas?

	gas	test	observation
A	Cl_2	damp litmus paper	the litmus paper turns blue
B	NH_3	damp litmus paper	the litmus paper turns red
C	O_2	limewater	no change is observed
D	SO_2	acidified aqueous potassium manganate(VII)	the colour of the solution changes from purple to colourless

2 A student plans two experiments.

experiment 1 find the concentration of a solution of sodium hydroxide by titration with dilute hydrochloric acid

experiment 2 find the rate of the reaction between pieces of calcium carbonate and dilute hydrochloric acid by measuring the volume of gas given off every minute

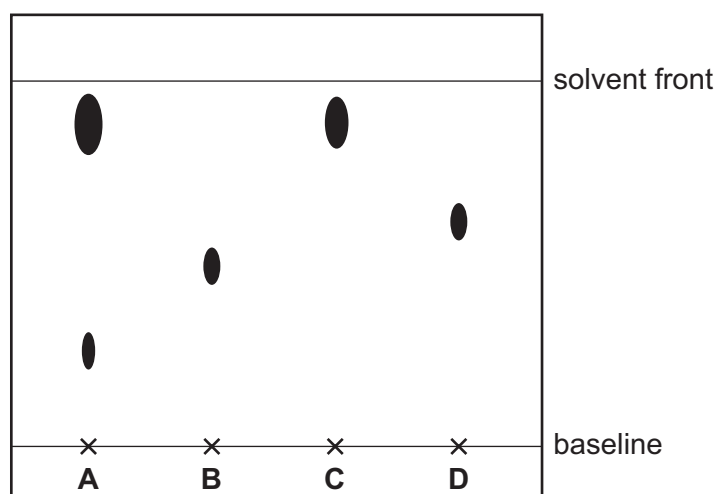
A flask is provided.

Which other apparatus is needed?

	experiment 1	experiment 2
A	balance, measuring cylinder, thermometer	gas syringe, clock
B	burette, pipette	balance, measuring cylinder, thermometer
C	burette, pipette	gas syringe, clock
D	gas syringe, clock	burette, pipette

3 Q is a pure sample of a substance that has a single R_f value of 0.9.

In the chromatogram shown, which letter represents Q?



4 Which statement about the isotopes of bromine is correct?

They are atoms with the same number of

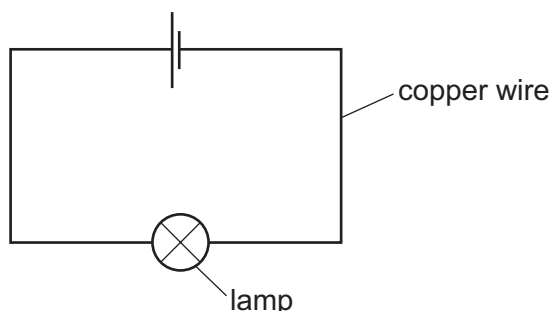
- A electrons and a different number of protons.
- B neutrons and the same number of electrons.
- C protons and the same chemical properties.
- D protons and the same physical properties.

5 Compound Z is made from element X and element Y. Compound Z is a good conductor of electricity when molten but not when solid.

Which statement is correct?

- A Compound Z has strong forces of attraction between electrons and positive ions.
- B Compound Z has strong forces of attraction between negative ions and positive ions.
- C Elements X and Y are both metals.
- D Elements X and Y are both non-metals.

6 Copper wire is used to complete an electrical circuit.



What happens in the copper wire?

- A Electrons move along the wire to the negative terminal. Positive ions stay in position.
- B Electrons move along the wire to the positive terminal. Positive ions move to the negative terminal.
- C Electrons move along the wire to the positive terminal. Positive ions stay in position.
- D Negative ions move along the wire to the positive terminal. Positive ions move to the negative terminal.

- 7 Which statement shows that graphite and diamond are different forms of the element carbon?
- A Both graphite and diamond have giant molecular structures.
 - B Complete combustion of equal masses of graphite and diamond produces equal masses of carbon dioxide and no other products.
 - C Graphite and diamond have different melting points.
 - D Graphite conducts electricity, whereas diamond does not.

- 8 Ethene, C_2H_4 , is a covalent compound with a simple molecular structure.

Which statement about ethene is correct?

- A Ethene is a liquid at room temperature and pressure.
 - B Liquid ethene conducts electricity.
 - C One ethene molecule contains sixteen protons.
 - D The total number of shared pairs of electrons in ethene is five.
- 9 An organic compound has the molecular formula $C_8H_{16}O_4$.

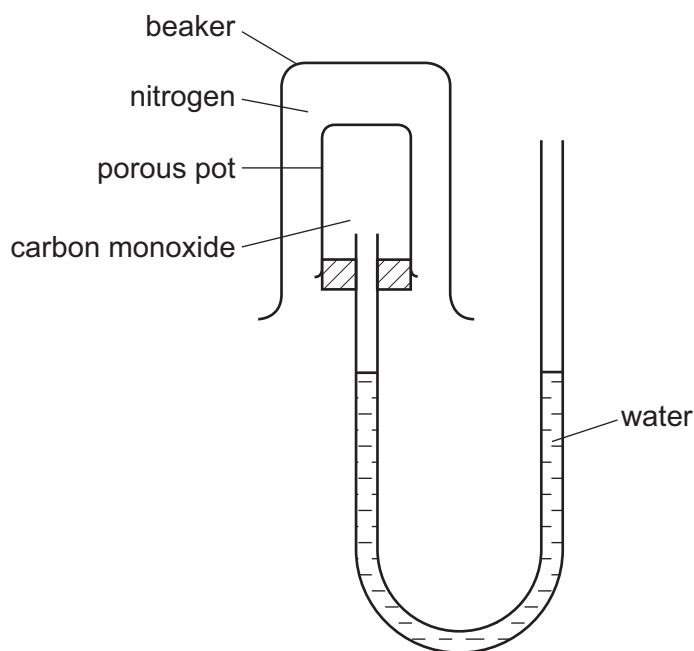
What is the empirical formula of the compound?

- A C_2H_4O
 - B $C_4H_8O_2$
 - C $C_6H_{12}O_3$
 - D $C_8H_{16}O_4$
- 10 Compound **P** is the only substance formed when two volumes of ammonia gas react with one volume of carbon dioxide gas (both volumes being measured at r.t.p.).

What is the formula of **P**?

- A $NH_2CO_2NH_4$
- B $(NH_2)_2CO$
- C $NH_4CO_2NH_4$
- D $(NH_4)_2CO_3$

- 11 Gases can diffuse through porous pots. The diagram shows a beaker full of nitrogen inverted over a porous pot containing carbon monoxide.



The water level does not move.

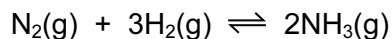
Which statement explains this?

- A Nitrogen is almost inert.
 - B The two gases have equal molecular masses.
 - C Both gases have two atoms in a molecule.
 - D Neither gas is soluble in water.
- 12 Copper is purified by electrolysis.
- Which statement is **not** correct?
- A Both electrodes contain copper.
 - B Copper is both oxidised and reduced in the process.
 - C Pure copper is deposited on the positive electrode.
 - D The electrolyte is aqueous copper(II) sulfate.
- 13 Concentrated aqueous sodium chloride is electrolysed using inert electrodes until no more chlorine gas is evolved.

What could be the pH of the resulting solution?

- A 1
- B 4
- C 7
- D 11

- 14 Ammonia can be produced industrially from nitrogen and hydrogen.

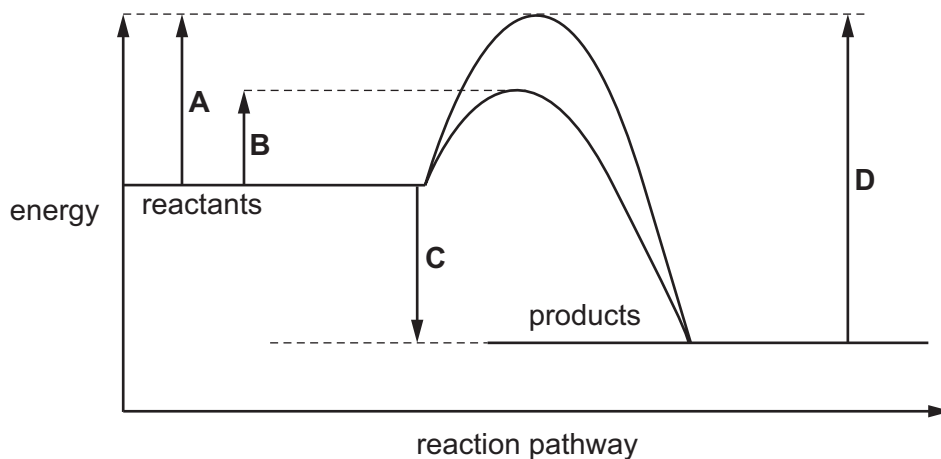


The forward reaction is exothermic.

Which change would **not** alter the yield of ammonia?

- A adding a catalyst
 B decreasing the pressure
 C decreasing the temperature
 D removing some ammonia during the reaction
- 15 The diagram shows an energy profile diagram for a chemical reaction, both with and without a catalyst.

Which energy change is the activation energy for the catalysed reaction?



- 16 Oil floats on water.

Which statement is **not** true of oil and water?

- A Oil and water are immiscible.
 B Oil is less dense than water.
 C Some molecules in oil have a higher relative molecular mass than water.
 D The type of bonding within water molecules is different from the type of bonding within molecules in oil.

- 17 Which process does **not** involve the use of a catalyst?
- A the extraction of iron from haematite in a blast furnace
 - B the manufacture of sulfur trioxide
 - C the production of ammonia from nitrogen and hydrogen
 - D the redox reactions that remove combustion pollutants from car exhausts

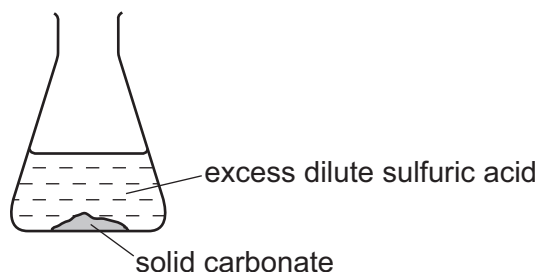
- 18 Which statement does **not** describe a reduction reaction?
- A Electrons are gained during the reaction.
 - B Hydrogen is gained during the reaction.
 - C It takes place at the negative electrode during electrolysis.
 - D Oxygen is gained during the reaction.

- 19 The pH of an aqueous solution of hydrochloric acid is 2.

What will be the pH of the acid after the addition of 10g of sodium chloride?

- A 1 B 2 C 7 D 9

- 20 One mole samples of each of the solid carbonates of lead, calcium, barium and magnesium are reacted in turn with excess dilute sulfuric acid.

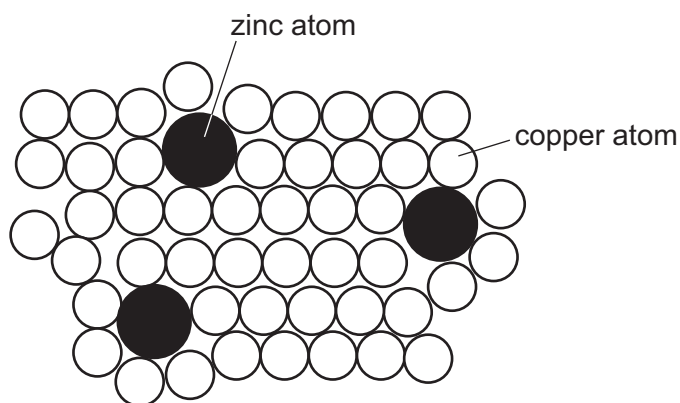


Which sample of carbonate will release the greatest volume of carbon dioxide?

- A barium
- B calcium
- C lead
- D magnesium

- 21 In which reaction are two of the products salts?
- A aqueous lead(II) nitrate and aqueous copper(II) sulfate
 - B aqueous sodium hydroxide and solid ammonium sulfate
 - C dilute hydrochloric acid and aqueous sodium carbonate
 - D dilute hydrochloric acid and magnesium

- 22 The diagram shows the structure of brass.



Why is brass harder than pure copper?

- A The zinc atoms form strong covalent bonds with the copper atoms.
 - B The zinc atoms prevent layers of copper atoms from sliding over each other easily.
 - C The zinc atoms prevent the 'sea of electrons' from moving freely in the solid.
 - D The zinc atoms have more electrons than the copper atoms.
- 23 From their position in the Periodic Table, which statement is correct?
- A Atoms of elements in Group VII react to form ions by losing one electron.
 - B Iodine can displace bromine from its salts.
 - C Potassium reacts more rapidly than lithium with water to form the hydroxide and hydrogen.
 - D The melting point of caesium is greater than that of potassium.

24 The table gives the melting points, densities and electrical conductivities of four elements.

Which element is copper?

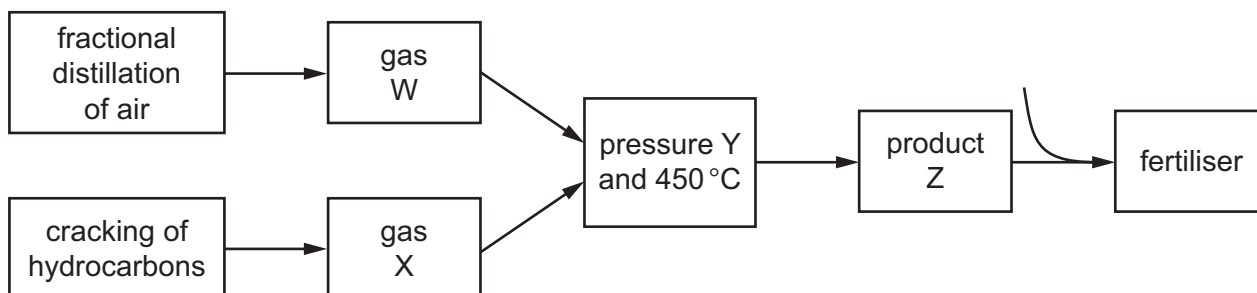
	melting point in °C	density in g/cm ³	electrical conductivity
A	-38.9	13.6	good
B	-7.2	3.12	poor
C	97.8	0.97	good
D	1083	8.96	good

25 An atom of an element has eight electrons only.

Which statement about this element is correct?

- A** It forms an ion with two negative charges.
- B** It has a full outer shell of electrons.
- C** It is a metal.
- D** It is in Group VIII of the Periodic Table.

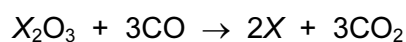
26 The diagram shows a flow chart for the manufacture of fertiliser.



In the flow chart, what are W, X, Y and Z?

	W	X	Y	Z
A	H ₂	N ₂	high	NH ₃
B	O ₂	SO ₂	high	SO ₃
C	O ₂	SO ₂	low	SO ₃
D	N ₂	H ₂	high	NH ₃

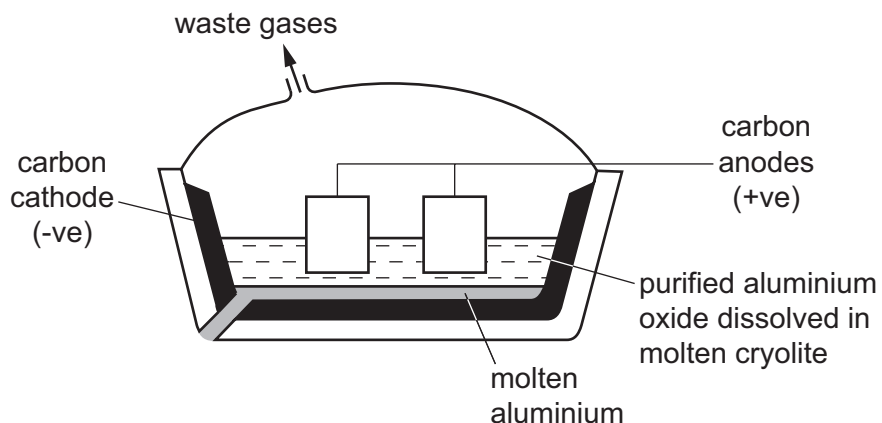
- 27 Which oxide can be reduced to the metal by roasting with powdered iron?
- A calcium oxide
 - B copper(II) oxide
 - C magnesium oxide
 - D zinc oxide
- 28 Which element, if attached to iron immersed in salt water, would prevent the iron from corroding?
- A carbon
 - B copper
 - C magnesium
 - D sulfur
- 29 The final reaction in the extraction of metal X is represented by the following equation.



What is X?

- A aluminium
 - B copper
 - C iron
 - D sodium
- 30 Hydrated sodium carbonate decomposes when heated in a Bunsen burner flame.
- Which equation shows this decomposition correctly?
- A $2Na_2CO_3 \cdot 10H_2O(s) \rightarrow 4Na(s) + 2CO_2(g) + O_2(g) + 10H_2O(g)$
 - B $Na_2CO_3 \cdot 10H_2O(s) \rightarrow Na_2CO_3(s) + 10H_2O(g)$
 - C $Na_2CO_3 \cdot 10H_2O(s) \rightarrow NaHCO_3(s) + NaOH(s) + 9H_2O(g)$
 - D $Na_2CO_3 \cdot 10H_2O(s) \rightarrow Na_2O(s) + CO_2(g) + 10H_2O(g)$

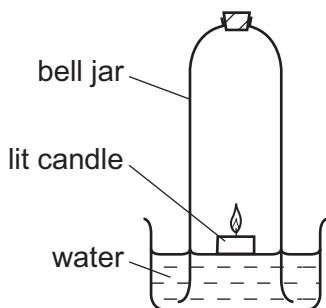
31 Aluminium is extracted from aluminium oxide by electrolysis.



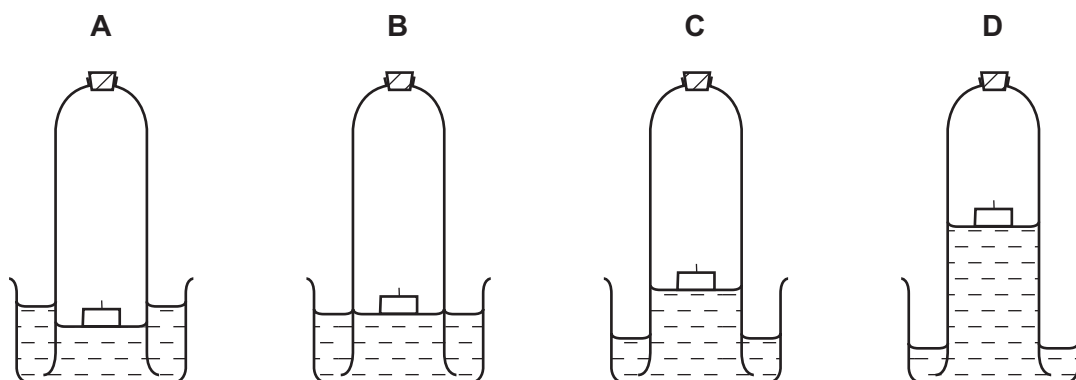
Which statement about this electrolysis is correct?

- A Aluminium ions gain electrons to form aluminium.
 - B Cryolite is added to increase the melting point of the electrolyte.
 - C Cryolite is added to react with impurities to form slag.
 - D The carbon cathode has to be replaced regularly as it reacts with oxygen.
- 32 Which ion is present in both sewage and fertilisers and can cause eutrophication when it enters rivers?
- A carbonate
 - B chloride
 - C nitrate
 - D sulfate

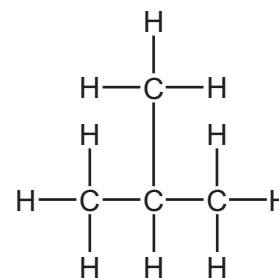
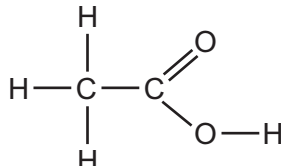
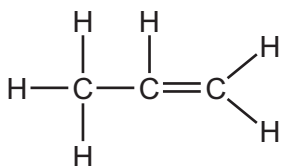
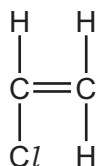
33 The diagram shows an experiment to determine the percentage of oxygen in air.



Which diagram shows the correct level of water after the candle stops burning?



34 How many of the structures show an unsaturated hydrocarbon molecule?



A 1

B 2

C 3

D 4

35 Which statements are correct for alkenes but **not** for alkanes?

- 1 They turn aqueous bromine from brown to colourless.
- 2 Their general formula is C_nH_{2n} .
- 3 They burn in air to form carbon dioxide and water.

A 1, 2 and 3

B 1 and 2 only

C 1 and 3 only

D 2 and 3 only

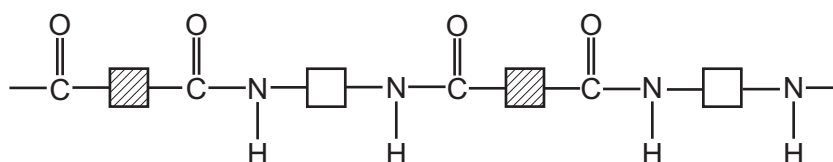
- 36 Wine is an alcoholic drink that contains ethanol. If wine is left exposed to the air for too long, it can become acidic.

This is because the ethanol is1..... to the acid2..... .

Which word and formula correctly complete gaps 1 and 2?

	1	2
A	oxidised	CH ₃ COOH
B	oxidised	CH ₃ CH ₂ COOH
C	reduced	CH ₃ COOH
D	reduced	CH ₃ CH ₂ COOH

- 37 Polymer Z has the structure shown.



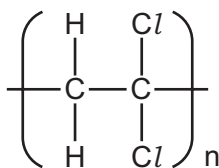
These four terms can be used to describe polymers.

- 1 addition polymer
- 2 condensation polymer
- 3 polyamide
- 4 polyester

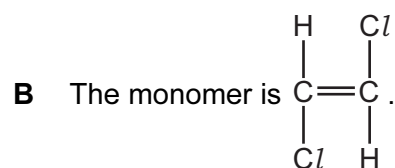
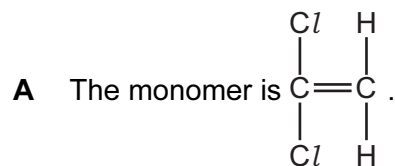
Which two terms can be applied to polymer Z?

- A** 1 and 3 **B** 1 and 4 **C** 2 and 3 **D** 2 and 4

38 The diagram shows the structure of poly(dichloroethene).



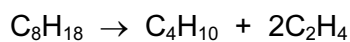
Which statement about this polymer is correct?



C The polymer is formed by a condensation reaction.

D The polymer has a lower melting point than the monomer.

39 How can the following reaction be described?



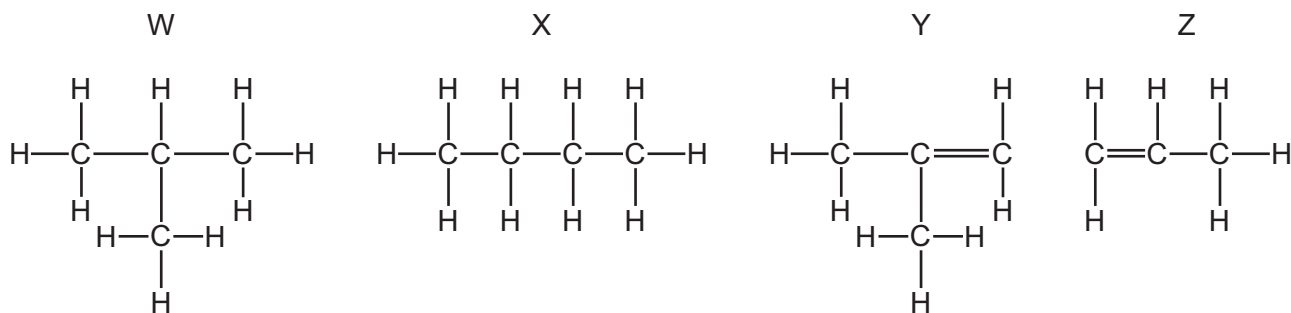
A combustion

B cracking

C oxidation

D reduction

40 The structures of four hydrocarbons, W, X, Y and Z, are shown.



Which row is correct?

	isomers of each other	decolourise bromine	branched structures
A	W and X	Y and Z	W and Y
B	W and X	Y and Z	X and Z
C	Y and Z	W and Y	X and Z
D	Y and Z	W and Z	W and Y

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The Periodic Table of Elements

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3 Li lithium 7	4 Be beryllium 9	<div style="border: 1px solid black; padding: 5px; width: fit-content; margin: auto;"> Key atomic number atomic symbol name relative atomic mass </div>										6 C carbon 12	7 N nitrogen 14	8 O oxygen 16	9 F fluorine 19	10 Ne neon 20																																																																																																																																																																																																																																																																																																																																																										
11 Na sodium 23	12 Mg magnesium 24	13 Al aluminium 27	14 Si silicon 28	15 P phosphorus 31	16 S sulfur 32	17 Cl chlorine 35.5	18 Ar argon 40	19 K potassium 39	20 Ca calcium 40	21 Sc scandium 45	22 Ti titanium 48	23 V vanadium 51	24 Cr chromium 52	25 Mn manganese 55	26 Fe iron 56	27 Co cobalt 59	28 Ni nickel 59	29 Cu copper 64	30 Zn zinc 65	31 Ga gallium 70	32 Ge germanium 73	33 As arsenic 75	34 Se selenium 79	35 Br bromine 80	36 Kr krypton 84																																																																																																																																																																																																																																																																																																																																																	
37 Rb rubidium 85	38 Sr strontium 88	39 Y yttrium 89	40 Zr zirconium 91	41 Nb niobium 93	42 Mo molybdenum 96	43 Tc technetium —	44 Ru ruthenium 101	45 Rh rhodium 103	46 Pd palladium 106	47 Ag silver 108	48 Cd cadmium 112	49 In indium 115	50 Sn tin 119	51 Sb antimony 122	52 Te tellurium 128	53 I iodine 127	54 Xe xenon 131	55 Cs caesium 133	56 Ba barium 137	57–71 lanthanoids	72 Hf hafnium 178	73 Ta tantalum 181	74 W tungsten 184	75 Re rhenium 186	76 Os osmium 190	77 Ir iridium 192	78 Pt platinum 195	79 Au gold 197	80 Hg mercury 201	81 Tl thallium 204	82 Pb lead 207	83 Bi bismuth 209	84 Po polonium —	85 At astatine —	86 Rn radon —																																																																																																																																																																																																																																																																																																																																							
87 Fr francium —	88 Ra radium —	89–103 actinoids	104 Rf rutherfordium —	105 Db dubnium —	106 Sg seaborgium —	107 Bh bohrium —	108 Hs hassium —	109 Mt meitnerium —	110 Ds darmstadtium —	111 Rg roentgenium —	112 Cn copernicium —	113 Nh nihonium —	114 Fl flerovium —	115 Mc moscovium —	116 Lv livermorium —	117 Ts tennessine —	118 Og oganesson —	119 Uue unbinilium —	120 Uub ununilium —	121 Uut unununium —	122 Uuq ununquadium —	123 Uup ununpentium —	124 Uuq ununhexium —	125 Uuh ununheptium —	126 Uuo ununoctium —	127 Uuq ununnonium —	128 Uuq unundecium —	129 Uuq ununtridecium —	130 Uuq ununpentadecium —	131 Uuq ununheptadecium —	132 Uuq ununnonadecium —	133 Uuq ununundecium —	134 Uuq ununtridecium —	135 Uuq ununpentadecium —	136 Uuq ununheptadecium —	137 Uuq ununnonadecium —	138 Uuq ununundecium —	139 Uuq ununtridecium —	140 Uuq ununpentadecium —	141 Uuq ununheptadecium —	142 Uuq ununnonadecium —	143 Uuq ununundecium —	144 Uuq ununtridecium —	145 Uuq ununpentadecium —	146 Uuq ununheptadecium —	147 Uuq ununnonadecium —	148 Uuq ununundecium —	149 Uuq ununtridecium —	150 Uuq ununpentadecium —	151 Uuq ununheptadecium —	152 Uuq ununnonadecium —	153 Uuq ununundecium —	154 Uuq ununtridecium —	155 Uuq ununpentadecium —	156 Uuq ununheptadecium —	157 Uuq ununnonadecium —	158 Uuq ununundecium —	159 Uuq ununtridecium —	160 Uuq ununpentadecium —	161 Uuq ununheptadecium —	162 Uuq ununnonadecium —	163 Uuq ununundecium —	164 Uuq ununtridecium —	165 Uuq ununpentadecium —	166 Uuq ununheptadecium —	167 Uuq ununnonadecium —	168 Uuq ununundecium —	169 Uuq ununtridecium —	170 Uuq ununpentadecium —	171 Uuq ununheptadecium —	172 Uuq ununnonadecium —	173 Uuq ununundecium —	174 Uuq ununtridecium —	175 Uuq ununpentadecium —	176 Uuq ununheptadecium —	177 Uuq ununnonadecium —	178 Uuq ununundecium —	179 Uuq ununtridecium —	180 Uuq ununpentadecium —	181 Uuq ununheptadecium —	182 Uuq ununnonadecium —	183 Uuq ununundecium —	184 Uuq ununtridecium —	185 Uuq ununpentadecium —	186 Uuq ununheptadecium —	187 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CHEMISTRY

5070/12

Paper 1 Multiple Choice

October/November 2016

1 hour

Additional Materials: Multiple Choice Answer Sheet
 Soft clean eraser
 Soft pencil (type B or HB recommended)

READ THESE INSTRUCTIONS FIRST

Write in soft pencil.

Do not use staples, paper clips, glue or correction fluid.

Write your name, Centre number and candidate number on the Answer Sheet in the spaces provided unless this has been done for you.

DO NOT WRITE IN ANY BARCODES.

There are **forty** questions on this paper. Answer **all** questions. For each question there are four possible answers **A, B, C** and **D**.

Choose the **one** you consider correct and record your choice in **soft pencil** on the separate Answer Sheet.

Read the instructions on the Answer Sheet very carefully.

Each correct answer will score one mark. A mark will not be deducted for a wrong answer.

Any rough working should be done in this booklet.

A copy of the Periodic Table is printed on page 16.

Electronic calculators may be used.

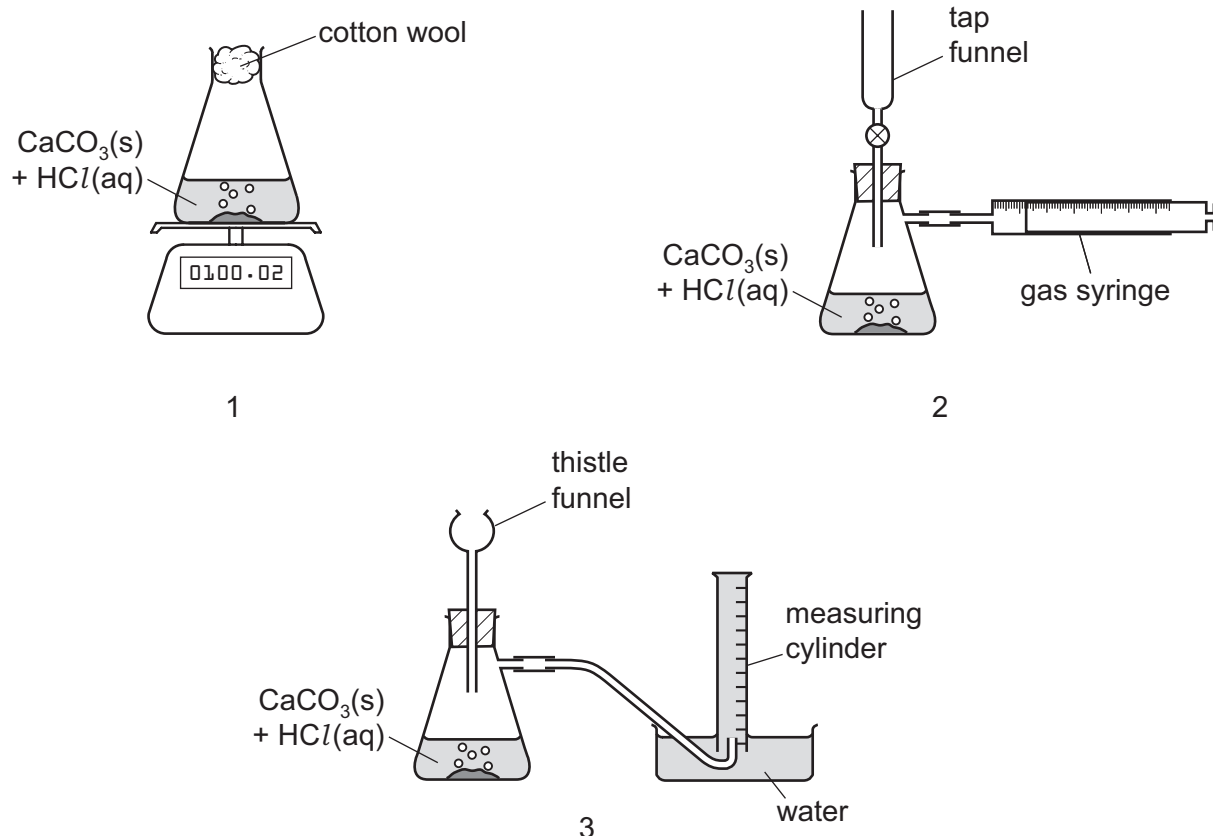
This document consists of **15** printed pages and **1** blank page.

1 When measured under the same conditions, which gas diffuses at the same rate as nitrogen?

- A ammonia, NH_3
- B carbon monoxide, CO
- C ethane, C_2H_6
- D oxygen, O_2

2 When calcium carbonate is added to dilute hydrochloric acid, carbon dioxide gas is released.

Three sets of apparatus are shown.



Which sets of apparatus are suitable, together with a stopwatch, for following the rate of this reaction?

- A 1, 2 and 3
- B 1 and 2 only
- C 2 only
- D 2 and 3 only

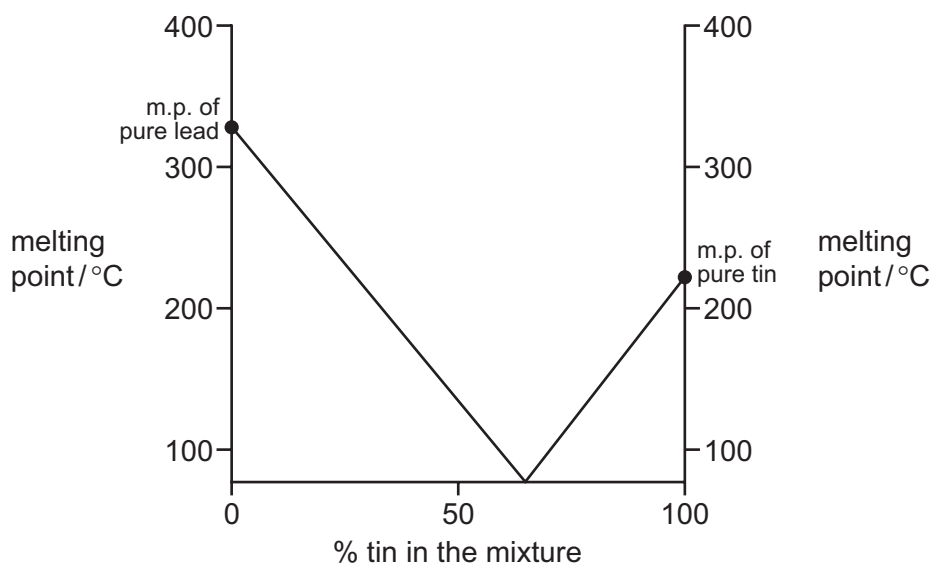
3 Which statement is correct?

- A Carbon monoxide reduces sodium oxide to sodium.
- B During the electrolysis of copper(II) sulfate solution, hydrogen is liberated at the positive electrode.
- C Recycling aluminium conserves the Earth's finite supply of haematite.
- D Iron oxide is reduced to iron in the blast furnace.

- 4 Benzene and cyclohexane are both flammable liquids. They are able to mix with each other without separating into two layers. They have very similar boiling points. It is difficult to separate a mixture of these two liquids by fractional distillation.

Why is it difficult to separate a mixture of benzene and cyclohexane by fractional distillation?

- A They are both flammable.
 B They are both liquids.
 C They have very similar boiling points.
 D They mix with each other completely.
- 5 The graph gives the melting points (m.p.) of mixtures of lead and tin.



The graph shows that any mixture of lead and tin must have a melting point that is

- A above that of tin.
 B below that of lead.
 C below that of both tin and lead.
 D between that of tin and lead.
- 6 Which statement about chlorine atoms and chloride ions is correct?
- A They are both isotopes of chlorine.
 B They undergo the same chemical reactions.
 C They have the same number of protons.
 D They have the same physical properties.

- 7 When substance Q melts, only weak forces of attraction between its molecules are overcome.

Which row correctly describes Q?

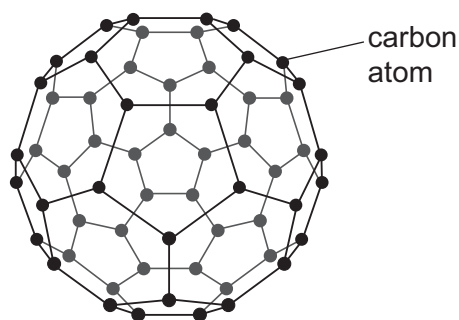
	melting point / °C	electrical conduction of solid Q
A	44	non-conductor
B	98	conductor
C	660	conductor
D	714	non-conductor

- 8 A solution containing lead(II) ions is added to a solution containing iodide ions. A yellow precipitate is formed.

What is the equation for the reaction that occurs?

- A** $\text{Pb}^+ + \text{I}^- \rightarrow \text{PbI}$
- B** $\text{Pb}^+ + 2\text{I}^- \rightarrow \text{PbI}_2$
- C** $\text{Pb}^{2+} + \text{I}^- \rightarrow \text{PbI}$
- D** $\text{Pb}^{2+} + 2\text{I}^- \rightarrow \text{PbI}_2$

- 9 Buckminsterfullerene has the chemical formula C_{60} .

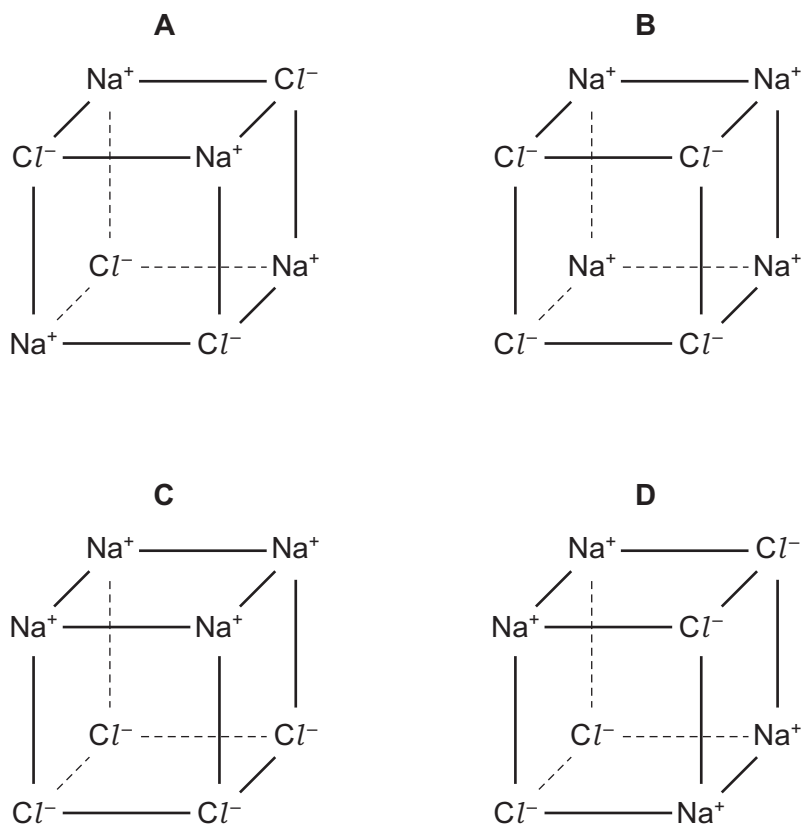


buckminsterfullerene

How is the structure of buckminsterfullerene best described?

- A** a covalent compound
- B** an ionic compound
- C** a polymer
- D** molecular

10 Which diagram correctly shows the arrangement of the ions in solid sodium chloride?



11 Aqueous sodium hydroxide is added to a sample of a colourless solution. Aqueous ammonia is added to a separate sample of the colourless solution.

In both cases a white precipitate forms which is soluble in excess reagent.

Which positive ion is present in the solution?

- A aluminium
- B calcium
- C copper(II)
- D zinc

12 In an experiment, 1 cm^3 of a gaseous hydrocarbon, **Z**, requires 4 cm^3 of oxygen for complete combustion to give 3 cm^3 of carbon dioxide. All gas volumes are measured at r.t.p.

Which formula represents **Z**?

- A C_2H_2
- B C_2H_4
- C C_3H_4
- D C_3H_8

13 Which is the best conductor of electricity?

- A diamond
- B magnesium
- C pure ethanoic acid
- D solid sodium chloride

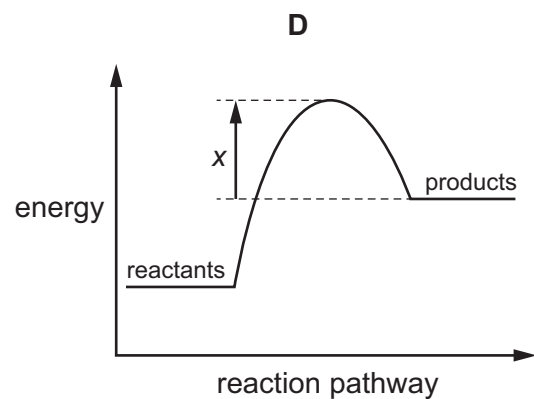
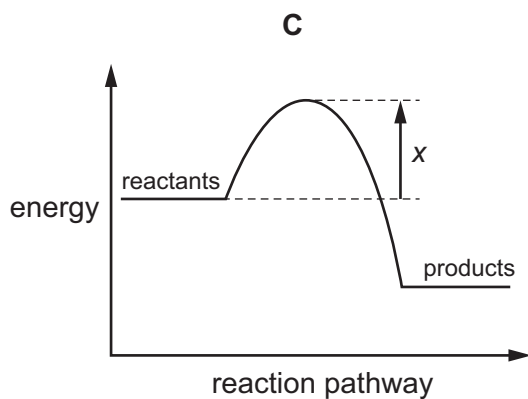
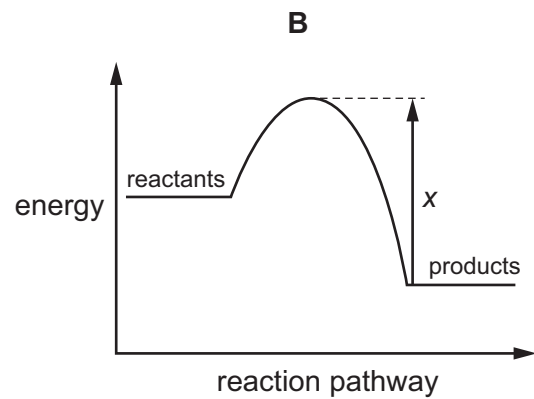
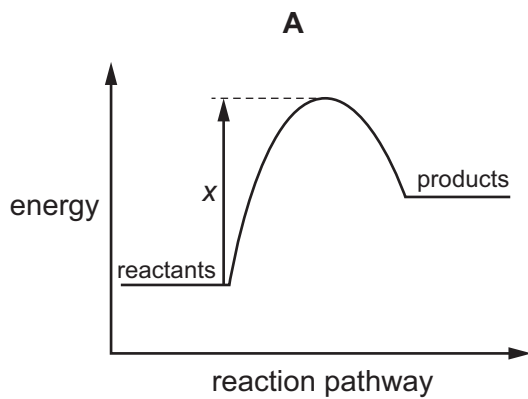
14 Molten salts of four metals are electrolysed.

The ions of which metal require the smallest number of electrons for one mole of atoms to be liberated during electrolysis?

- A aluminium
- B calcium
- C iron
- D sodium

15 An endothermic reaction has an activation energy of x .

Which energy profile diagram is correct for this reaction?



16 The following statements refer to the use of catalysts in chemical reactions.

- 1 A catalyst increases the activation energy of a reaction.
- 2 A catalyst increases the rate of a reaction.
- 3 A catalyst increases the yield of a reaction.

Which statements are correct?

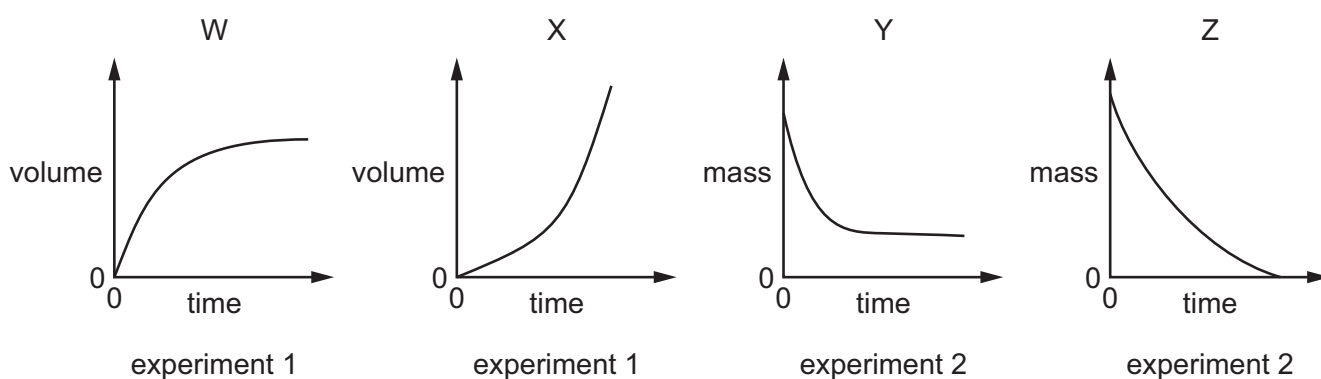
- A** 1, 2 and 3 **B** 2 and 3 only **C** 2 only **D** 3 only

17 In two experiments, 1 and 2, an excess of powdered calcium carbonate was reacted in a flask with dilute hydrochloric acid.

In experiment 1, the carbon dioxide evolved was collected and the volume of gas measured at regular intervals.

In experiment 2, the mass of the flask and its contents was measured at regular intervals.

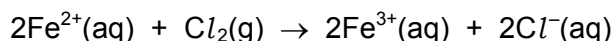
The results of both experiments were plotted on graphs.



Which graphs correctly show the results of these two experiments?

	experiment 1	experiment 2
A	W	Y
B	W	Z
C	X	Y
D	X	Z

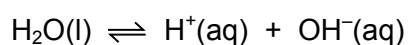
18 Iron(II) ions react with chlorine.



Which statement about this reaction is correct?

- A Chlorine is reduced by iron(II) ions.
- B Chlorine is the reducing agent.
- C Iron(II) ions are reduced by chlorine.
- D Iron(II) ions are the oxidising agent.

19 When water is liquid, it ionises slightly.



The forward reaction is endothermic.

When the temperature of water is increased, which change(s) take place?

- 1 The water becomes acidic.
- 2 The water becomes alkaline.
- 3 More water molecules form ions.

- A 1 and 3 B 1 only C 2 and 3 D 3 only

20 The table shows some properties of four metal chlorides.

Which row is magnesium chloride?

	colour	solubility in water	method of preparation
A	green	insoluble	precipitation
B	green	soluble	metal and acid
C	white	insoluble	precipitation
D	white	soluble	metal and acid

21 Which statement about the uses of metals is **not** correct?

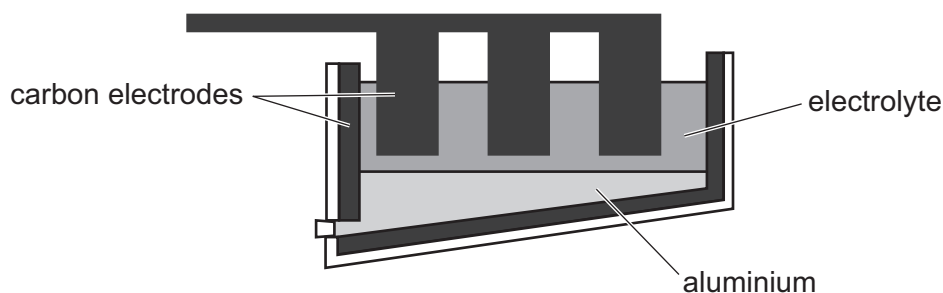
- A Aluminium is used for making food containers and electrical cables.
- B Copper is used for making brass.
- C Iron is used as a catalyst in the contact process.
- D Nickel is used as a catalyst in the hydrogenation of alkenes.

- 25 The table shows the observations made when an aqueous solution of salt Z has different reagents added to it.

reagent(s) added	observation
aqueous sodium hydroxide	green precipitate formed
dilute nitric acid then aqueous barium nitrate	white precipitate formed

What is Z?

- A copper(II) chloride
 B copper(II) sulfate
 C iron(II) chloride
 D iron(II) sulfate
- 26 The diagram shows the apparatus used to extract aluminium from aluminium oxide.



Which statement about this process is correct?

- A The electrolyte is a solid mixture of aluminium oxide and cryolite.
 B The electrolyte is aluminium oxide dissolved in water.
 C The equation for the reaction at the positive electrode is $Al^{3+} + 3e^{-} \rightarrow Al$.
 D The positive carbon electrodes lose mass during the process and need regular replacement.
- 27 Which reaction is **not** a redox reaction?
- A $CaCO_3 \rightarrow CaO + CO_2$
 B $2C + O_2 \rightarrow 2CO$
 C $C + CO_2 \rightarrow 2CO$
 D $Fe_2O_3 + 3CO \rightarrow 2Fe + 3CO_2$

28 Aqueous copper(II) sulfate solution is placed in an iron container and left to stand for several days.

Which statement describes what happens?

- A Atmospheric oxygen reacts with the copper(II) sulfate to give black copper(II) oxide.
- B Some fine iron particles are formed in the solution.
- C The part of the container in contact with the solution is coated with copper.
- D The solution turns from green to blue.

29 In the manufacture of paper, sulfur dioxide is used to remove the yellow colour from the wood pulp.

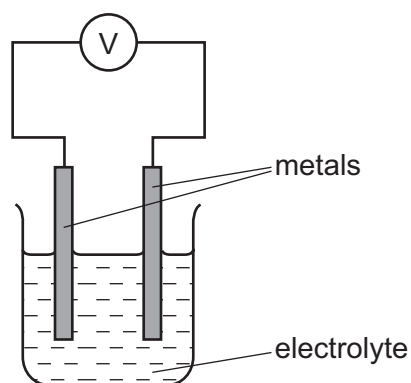
Which term can be used to describe sulfur dioxide in this process?

- A a bleach
- B a catalyst
- C an oxidising agent
- D a solvent

30 Which statement about the uses of gases is **not** correct?

- A Helium is used in balloons because it is unreactive and less dense than air.
- B Hydrogen is used in an addition reaction with saturated vegetable oils to form margarine.
- C Nitrogen from the air is used in the manufacture of ammonia.
- D Oxygen is used in making steel and welding.

31 Electrical energy can be generated using simple cells as shown.



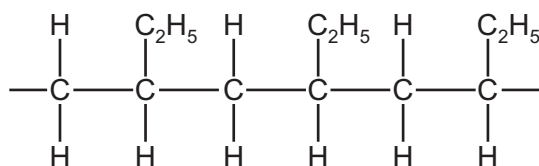
Which pair of metals, when used as electrodes, will give the largest reading on the voltmeter, V?

- A lead and sodium
 - B magnesium and copper
 - C potassium and silver
 - D sodium and potassium
- 32 When reacted with an excess of dilute hydrochloric acid, 0.002 moles of a metal M liberated 48 cm^3 of hydrogen measured at r.t.p.

Which equation is correct for this reaction?

- A $2M + 2\text{H}^+ \rightarrow 2\text{M}^+ + \text{H}_2$
- B $M + \text{H}^+ \rightarrow \text{M}^+ + \text{H}$
- C $M + 2\text{H}^+ \rightarrow \text{M}^{2+} + \text{H}_2$
- D $M + 2\text{H}^+ \rightarrow \text{M}^{2+} + 2\text{H}$

33 The diagram shows a section of a polymer.



Which alkene is used to make this polymer?

- A $\text{CH}_3\text{CH}=\text{CH}_2$
- B $\text{CH}_3\text{CH}_2\text{CH}=\text{CH}_2$
- C $\text{CH}_3\text{CH}_2\text{CH}=\text{CHCH}_3$
- D $\text{CH}_3\text{CH}=\text{CHCH}_3$

34 The table shows some atmospheric pollutants and their possible effects.

Which row is **not** correct?

	pollutant	effect
A	CFCs	cause depletion of the ozone layer
B	CO ₂	forms photochemical smog
C	CO	is poisonous to humans
D	NO ₂	forms acid rain

35 Which compound is the most viscous and the least flammable?

- A** C₆H₁₄ **B** C₈H₁₈ **C** C₁₀H₂₂ **D** C₁₂H₂₆

36 How many moles of ethanoic acid, CH₃CO₂H, react with one mole of magnesium?

- A** 1 **B** 2 **C** 3 **D** 4

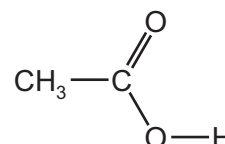
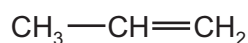
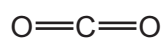
37 With which substance will ethene react to form more than one product?

- A** argon
B hydrogen
C oxygen
D steam

38 Which statement about isomers of a compound is always correct?

- A** They have different empirical formulae.
B They have different relative molecular masses.
C They have only carbon and hydrogen in their molecules.
D They have the same molecular formula.

39 How many of the structures show an unsaturated hydrocarbon molecule?



- A** 1 **B** 2 **C** 3 **D** 4

40 Which type of polymer is made by reacting amino acids together?

- A an addition polymer
- B a carbohydrate
- C a polyamide
- D a polyester

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CHEMISTRY

5070/12

Paper 1 Multiple Choice

May/June 2017

1 hour

Additional Materials: Multiple Choice Answer Sheet
Soft clean eraser
Soft pencil (type B or HB is recommended)

READ THESE INSTRUCTIONS FIRST

Write in soft pencil.

Do not use staples, paper clips, glue or correction fluid.

Write your name, Centre number and candidate number on the Answer Sheet in the spaces provided unless this has been done for you.

DO NOT WRITE IN ANY BARCODES.

There are **forty** questions on this paper. Answer **all** questions. For each question there are four possible answers **A, B, C** and **D**.

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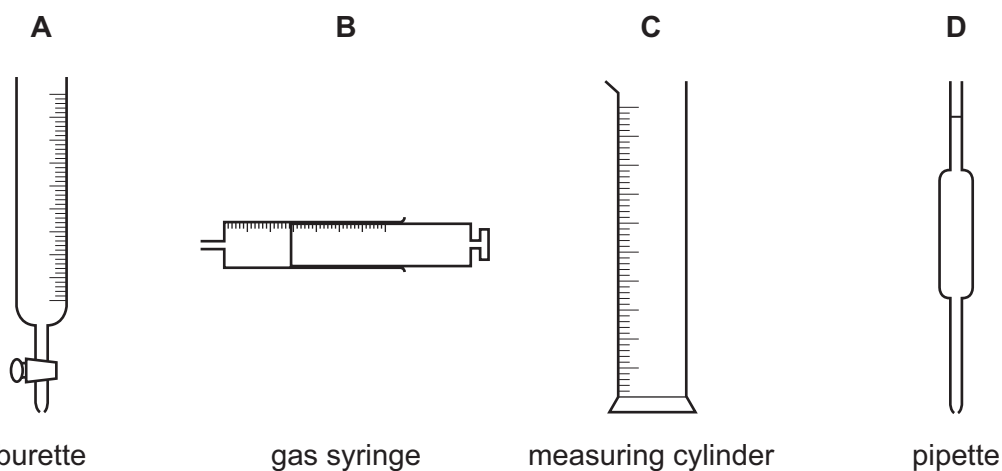
A copy of the Periodic Table is printed on page 16.

Electronic calculators may be used.

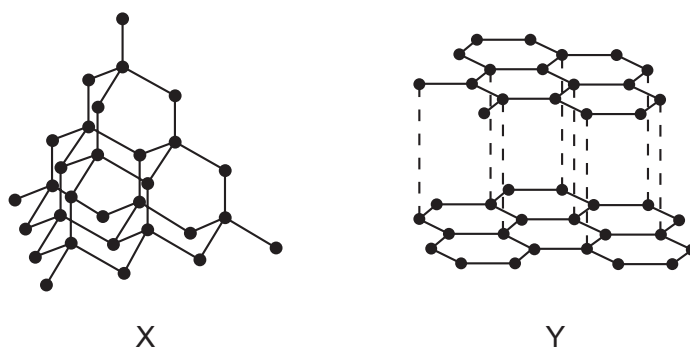
This document consists of **14** printed pages and **2** blank pages.

- 1 The diagram shows four pieces of apparatus that are used to measure the volume of a gas or liquid.

Which piece of apparatus should always be filled to the same level?



- 2 The diagrams show the structures of two forms of carbon.



Which of X and Y conduct electricity?

	X	Y
A	✓	✓
B	✓	x
C	x	✓
D	x	x

3 An aqueous solution of zinc chloride is tested by adding reagents.

Which observation is correct?

	reagent added to zinc chloride (aq)	observations
A	acidified aqueous barium nitrate	forms a white precipitate
B	aqueous ammonia	forms a white precipitate, soluble in excess of the reagent
C	aqueous sodium hydroxide	forms a white precipitate, insoluble in excess of the reagent
D	powdered copper	forms a grey precipitate

4 Which statement about the particles ${}^{19}_9\text{F}^-$, ${}^{20}_{10}\text{Ne}$ and ${}^{23}_{11}\text{Na}^+$ is correct?

- A** They all contain more electrons than protons.
- B** They all contain more neutrons than protons.
- C** They all contain the same number of electrons.
- D** They all contain the same number of protons.

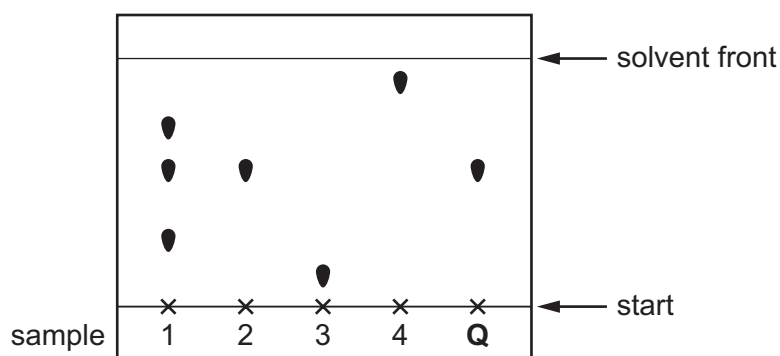
5 The table shows some properties of four substances.

Which substance is an ionic compound?

	melting point / °C	conducts electricity when solid	dissolves in water	conducts electricity in aqueous solution
A	-102	x	✓	✓
B	801	x	✓	✓
C	842	✓	✓	✓
D	3000	✓	x	x

- 6 Four samples are spotted onto chromatography paper. It is known that one of these samples is pure compound **Q**. A separate sample of pure compound **Q** is also spotted onto the paper. The paper is placed in a solvent.

The diagram shows the chromatogram produced.



Which statement is correct?

- A** Sample 2 has travelled the furthest and sample 3 is pure compound **Q**.
B Sample 3 has travelled the furthest and sample 2 is pure compound **Q**.
C Sample 4 has travelled the furthest and sample 1 is pure compound **Q**.
D Sample 4 has travelled the furthest and sample 2 is pure compound **Q**.
- 7 How many of the molecules shown contain only one covalent bond?



- A** 2 **B** 3 **C** 4 **D** 5

- 8 Which statements about sulfur and its compounds are correct?

- 1 Sulfur is in Group VI of the Periodic Table and has six outer shell electrons.
- 2 In hydrogen sulfide, H_2S , sulfur shares one electron with each hydrogen atom.
- 3 Sulfur dioxide is used as a bleach.

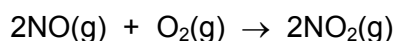
- A** 1, 2 and 3 **B** 1 and 2 only **C** 1 and 3 only **D** 2 and 3 only

- 9 50.0 cm³ of 0.10 mol/dm³ silver nitrate, AgNO₃, is added to 150.0 cm³ of 0.05 mol/dm³ sodium chloride, NaCl, in a beaker.

As well as solid silver chloride, what is present in the beaker after reaction?

- A aqueous silver nitrate and aqueous sodium nitrate
 B aqueous sodium chloride and aqueous sodium nitrate
 C aqueous sodium chloride only
 D aqueous sodium nitrate only

- 10 Nitrogen monoxide and oxygen react to form nitrogen dioxide.



What is the maximum volume of nitrogen dioxide that could be obtained when 1 dm³ of nitrogen monoxide reacts with 2 dm³ of oxygen?

- A 1 dm³ B 2 dm³ C 3 dm³ D 4 dm³

- 11 Dilute sulfuric acid is electrolysed between inert electrodes.

Which statements are correct?

- 1 Hydrogen is released at the negative electrode.
- 2 Oxygen is released at the positive electrode.
- 3 Sulfur dioxide is released at the positive electrode.
- 4 The acid becomes more concentrated.

- A 1, 2 and 4 B 1 and 2 only C 2 and 3 D 3 and 4

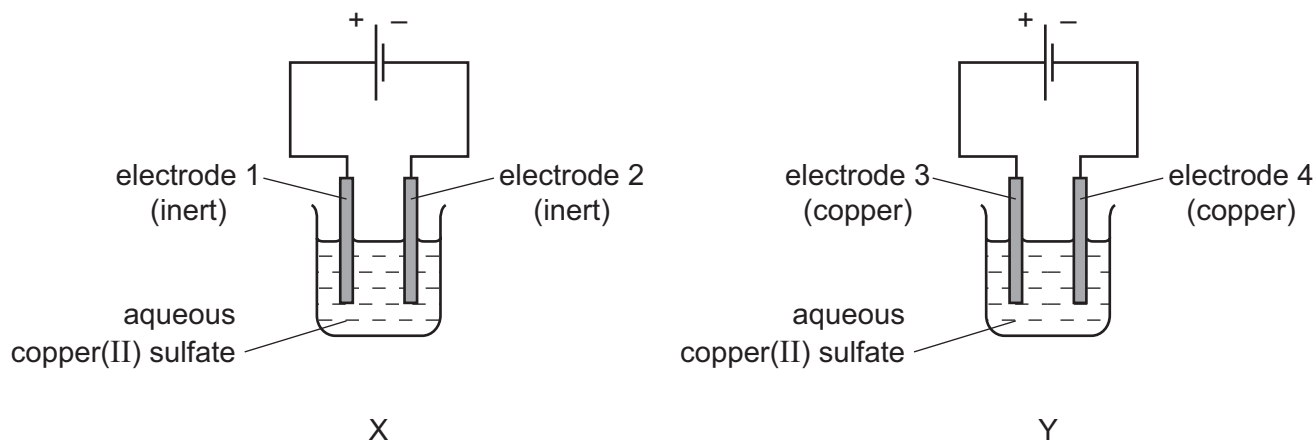
- 12 Caesium, Cs, is in the same group of the Periodic Table as sodium.

Which products are obtained from the electrolysis of concentrated aqueous caesium chloride?

	product at negative electrode	solution remaining
A	caesium	hydrochloric acid
B	chlorine	caesium hydroxide
C	hydrogen	caesium hydroxide
D	hydrogen	hydrochloric acid

13 The diagrams show the apparatus for the electrolysis of aqueous copper(II) sulfate.

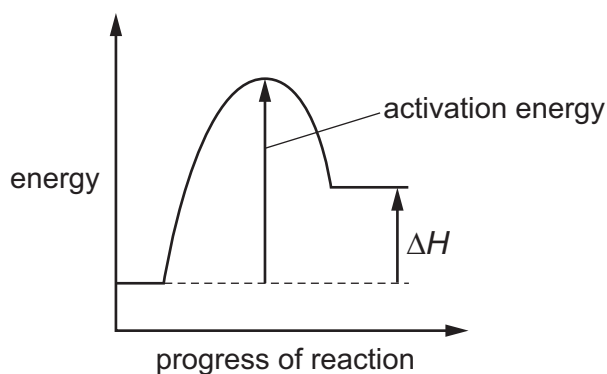
In experiment X both electrodes are inert. In experiment Y both electrodes are made of copper.



On which electrodes is solid metal deposited?

- A** 1 and 2 **B** 1 and 3 **C** 2 and 4 **D** 3 and 4

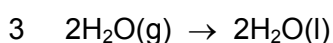
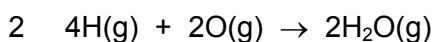
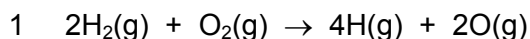
14 The energy profile diagram for the **forward** direction of a reversible reaction is shown.



For the **reverse** reaction, which row correctly shows the sign of the activation energy and the type of enthalpy change?

	sign of activation energy	type of enthalpy change
A	negative	endothermic
B	negative	exothermic
C	positive	endothermic
D	positive	exothermic

15 The formation of liquid water from hydrogen and oxygen may occur in three stages.



Which stages would be exothermic?

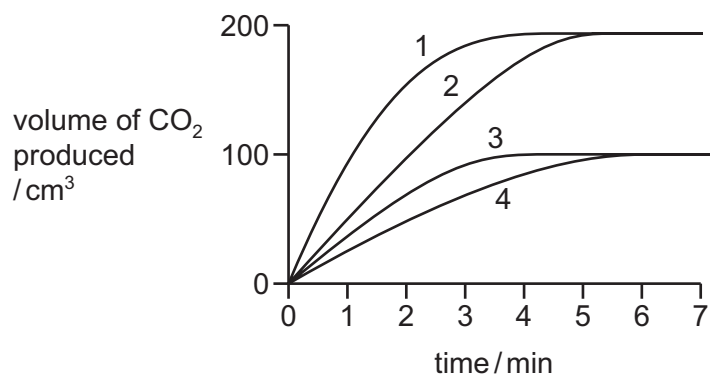
- A** 1, 2 and 3 **B** 1 and 2 only **C** 2 and 3 only **D** 2 only

16 In four separate experiments, 1, 2, 3 and 4, nitric acid was added to excess marble chips and the volume of carbon dioxide formed was measured.

In all four experiments the same volume of nitric acid was used.

Its concentration, or temperature, or both concentration and temperature, were changed.

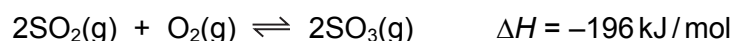
The results of the experiments are shown on the graph.



Which statement is correct?

- A** A lower concentration of acid was used in experiment 3 than in experiment 1.
B Experiment 4 was faster than experiment 3.
C The acid used in experiment 2 was of a lower concentration than in experiment 1.
D The temperature of the acid was the same in experiments 1 and 2.

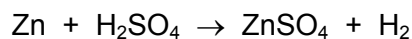
17 The equation shows the formation of sulfur trioxide in the contact process.



What would **decrease** the yield of sulfur trioxide?

- A** addition of more oxygen
B an increase in pressure
C an increase in temperature
D removal of sulfur trioxide from the reaction chamber

18 Zinc reacts with dilute sulfuric acid.



From this equation, what can be deduced about the reaction?

- A It is a redox reaction.
- B It is exothermic.
- C Zinc is acting as a base.
- D Zinc is acting as a catalyst.

19 Consider the three reactions.

- 1 reaction between ammonium chloride and calcium hydroxide
- 2 ethane burning in air
- 3 reaction between ethanoic acid and ethanol

What is true for all three reactions?

- A Carbon dioxide is formed.
- B Neutralisation takes place.
- C Oxidation takes place.
- D Water is formed.

20 Which statement about weak acids is correct?

- A They are partially ionised.
- B They do not react with metals.
- C They do not react with strong alkalis.
- D Their solutions have pH values in the range 0 to 2.

21 Which gas dissolves in water to give a solution with a pH greater than 7?

- A ammonia
- B carbon dioxide
- C nitrogen dioxide
- D sulfur dioxide

22 Element X forms an oxide of formula X_2O_5 .

In which group of the Periodic Table is X likely to be found?

- A Group II
- B Group III
- C Group V
- D Group VIII

23 Element M is a typical transition metal.

Which property will it **not** have?

- A a low melting point
- B coloured compounds
- C good electrical conductivity
- D variable oxidation states

24 An atom of element **E** forms a white oxide of formula **EO**.

What is **E**?

- A argon
- B calcium
- C copper
- D potassium

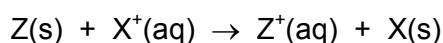
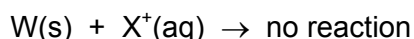
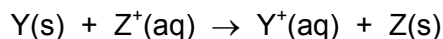
25 The table shows the proton numbers of four elements.

element	Q	R	T	Z
proton number	9	11	17	19

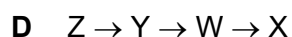
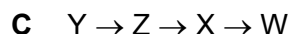
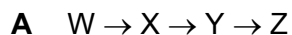
Which statement is correct?

- A Q is a metal.
- B Q is more reactive than T.
- C R is more reactive than Z.
- D T and Z are in the same period.

26 The results of experiments involving four metals, W, X, Y and Z, and their ions are shown.



What is the order of reactivity of the four metals, most reactive to least reactive?



27 Metals have a structure of positive ions in a 'sea of electrons'. Metals are malleable because it is possible to force the ions to slide over each other.

The alloy brass is1..... malleable than pure copper and than pure zinc.

Brass is2..... to conduct electricity.

Which words correctly complete gaps 1 and 2?

	1	2
A	less	unable
B	less	able
C	more	unable
D	more	able

28 Which two substances are removed from the bottom of a blast furnace?

1 coke

2 iron

3 limestone

4 slag

A 1 and 3

B 1 and 4

C 2 and 3

D 2 and 4

29 Aluminium is used in the manufacture of aeroplanes.

What is a property of aluminium and is also a reason for this use?

- A It has a low density.
- B It is a good conductor of electricity.
- C It is a poor conductor of heat.
- D It is covered in an unreactive layer of aluminium carbonate.

30 How can the reaction between nitrogen and hydrogen be described?

- A a displacement reaction
- B a neutralisation reaction
- C a precipitation reaction
- D a reversible reaction

31 Bottled fruit juice may have small amounts of sulfur dioxide added.

What is the purpose of this?

- A to adjust the acidity of the fruit juice
- B to kill any bacteria present
- C to improve the flavour of the fruit juice
- D to neutralise any alkalis present

32 Dissolved substances in water can cause eutrophication.

How many of the ions shown cause this effect?

- Cl^- CO_3^{2-} Na^+ NO_3^- PO_4^{3-}
- A 1 B 2 C 3 D 4

33 Which list contains only gases that are always present in unpolluted air?

- A oxygen, nitrogen, carbon dioxide, argon, carbon monoxide, nitrogen dioxide
- B oxygen, nitrogen, carbon dioxide, argon, neon
- C oxygen, nitrogen, carbon dioxide, nitrogen dioxide, ozone
- D oxygen, nitrogen, carbon monoxide, methane, sulfur dioxide

34 One mole of each alkane undergoes complete combustion.

Which alkane will produce seven moles of products?

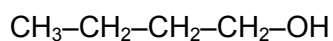
- A CH_4 B C_2H_6 C C_3H_8 D C_4H_{10}

35 Ethanoic acid is formed when ethanol is reacted with acidified potassium manganate(VII).

What is the name of this process?

- A combustion
B condensation
C oxidation
D polymerisation

36 The structure of compound X is shown.



Which statement is **not** correct?

- A X is an alcohol because it contains an ---OH group.
B X is an isomer of propanol.
C X would burn in air to form carbon dioxide and water.
D X would have a higher boiling point than ethanol.

37 After which conversion does the product contain more carbon atoms than the reactant?

- A ethanol to ethanoic acid
B ethanol to ethyl ethanoate
C ethene to ethane
D ethene to ethanol

38 Molecules 1–4 are unbranched hydrocarbons.

- 1 $C_{10}H_{22}$
- 2 $C_{10}H_{20}$
- 3 C_9H_{20}
- 4 C_8H_{16}

Which row correctly identifies these hydrocarbons as alkanes or alkenes?

	alkane	alkene
A	1 and 2	3 and 4
B	1 and 3	2 and 4
C	1 and 4	2 and 3
D	2 and 3	1 and 4

39 Which polymer contains only three different elements?

- A** protein
- B** poly(ethene)
- C** poly(propene)
- D** starch

40 Which statement about macromolecules is correct?

- A** Nylon and *Terylene* are both polyesters.
- B** Proteins and nylon have the same monomer units.
- C** Proteins have the same amide linkages as nylon.
- D** *Terylene* and fats are esters but with different linkages.

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The Periodic Table of Elements

Group																			
I	II	III	IV	V	VI	VII	VIII												
3 Li lithium 7	4 Be beryllium 9	1 H hydrogen 1	5 B boron 11	6 C carbon 12	7 N nitrogen 14	8 O oxygen 16	9 F fluorine 19	10 Ne neon 20											
11 Na sodium 23	12 Mg magnesium 24	Key atomic number atomic symbol name relative atomic mass		13 Al aluminium 27	14 Si silicon 28	15 P phosphorus 31	16 S sulfur 32	17 Cl chlorine 35.5	18 Ar argon 40										
19 K potassium 39	20 Ca calcium 40	21 Sc scandium 45	22 Ti titanium 48	23 V vanadium 51	24 Cr chromium 52	25 Mn manganese 55	26 Fe iron 56	27 Co cobalt 59	28 Ni nickel 59	29 Cu copper 64	30 Zn zinc 65	31 Ga gallium 70	32 Ge germanium 73	33 As arsenic 75	34 Se selenium 79	35 Br bromine 80	36 Kr krypton 84		
37 Rb rubidium 85	38 Sr strontium 88	39 Y yttrium 89	40 Zr zirconium 91	41 Nb niobium 93	42 Mo molybdenum 96	43 Tc technetium —	44 Ru ruthenium 101	45 Rh rhodium 103	46 Pd palladium 106	47 Ag silver 108	48 Cd cadmium 112	49 In indium 115	50 Sn tin 119	51 Sb antimony 122	52 Te tellurium 128	53 I iodine 127	54 Xe xenon 131		
55 Cs caesium 133	56 Ba barium 137	57–71 lanthanoids	72 Hf hafnium 178	73 Ta tantalum 181	74 W tungsten 184	75 Re rhenium 186	76 Os osmium 190	77 Ir iridium 192	78 Pt platinum 195	79 Au gold 197	80 Hg mercury 201	81 Tl thallium 204	82 Pb lead 207	83 Bi bismuth 209	84 Po polonium —	85 At astatine —	86 Rn radon —		
87 Fr francium —	88 Ra radium —	89–103 actinoids	104 Rf rutherfordium —	105 Db dubnium —	106 Sg seaborgium —	107 Bh bohrium —	108 Hs hassium —	109 Mt meitnerium —	110 Ds darmstadtium —	111 Rg roentgenium —	112 Cn copernicium —	114 Fl flerovium —	116 Lv livermorium —						

lanthanoids	57 La lanthanum 139	58 Ce cerium 140	59 Pr praseodymium 141	60 Nd neodymium 144	61 Pm promethium —	62 Sm samarium 150	63 Eu europium 152	64 Gd gadolinium 157	65 Tb terbium 159	66 Dy dysprosium 163	67 Ho holmium 165	68 Er erbium 167	69 Tm thulium 169	70 Yb ytterbium 173	71 Lu lutetium 175
actinoids	89 Ac actinium —	90 Th thorium 232	91 Pa protactinium 231	92 U uranium 238	93 Np neptunium —	94 Pu plutonium —	95 Am americium —	96 Cm curium —	97 Bk berkelium —	98 Cf californium —	99 Es einsteinium —	100 Fm fermium —	101 Md mendelevium —	102 No nobelium —	103 Lr lawrencium —

The volume of one mole of any gas is 24 dm³ at room temperature and pressure (r.t.p.).

CHEMISTRY

5070/12

Paper 1 Multiple Choice

October/November 2017

1 hour

Additional Materials: Multiple Choice Answer Sheet
 Soft clean eraser
 Soft pencil (type B or HB recommended)

READ THESE INSTRUCTIONS FIRST

Write in soft pencil.

Do not use staples, paper clips, glue or correction fluid.

Write your name, Centre number and candidate number on the Answer Sheet in the spaces provided unless this has been done for you.

DO NOT WRITE IN ANY BARCODES.

There are **forty** questions on this paper. Answer **all** questions. For each question there are four possible answers **A, B, C** and **D**.

Choose the **one** you consider correct and record your choice in **soft pencil** on the separate Answer Sheet.

Read the instructions on the Answer Sheet very carefully.

Each correct answer will score one mark. A mark will not be deducted for a wrong answer.

Any rough working should be done in this booklet.

A copy of the Periodic Table is printed on page 16.

Electronic calculators may be used.

This document consists of **15** printed pages and **1** blank page.

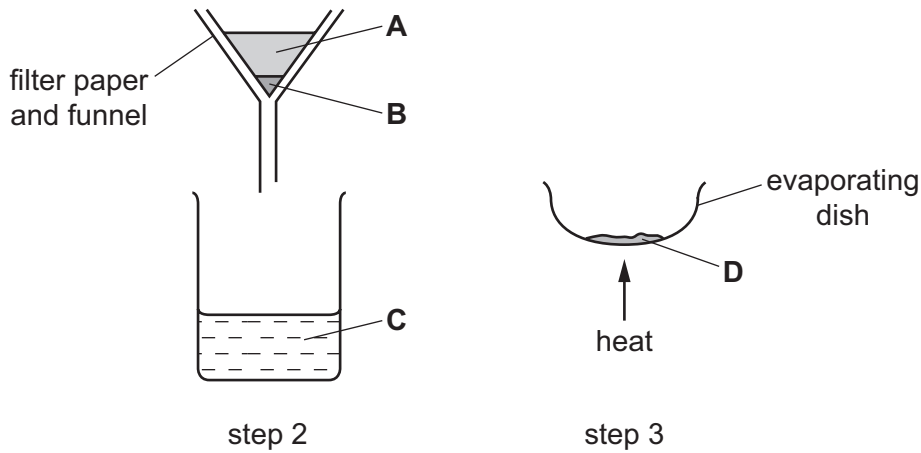


- 1 A mixture of sand and sodium chloride can be separated in three steps.

Step 1 is to add water to the mixture.

The diagram shows step 2 and step 3.

Where is pure sodium chloride collected?



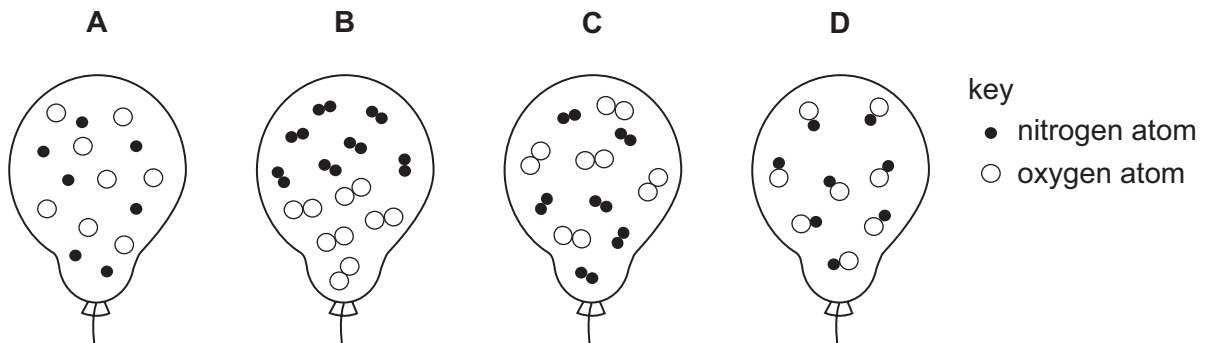
- 2 The results of two tests on solution X are shown.

reagent added	observation on adding a few drops of reagent	observation on adding an excess of reagent
aqueous sodium hydroxide	white precipitate	precipitate dissolves
aqueous ammonia	white precipitate	precipitate remains

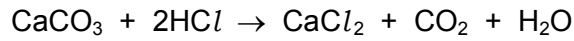
Which ion is present in solution X?

- A Al^{3+} B Ca^{2+} C Cu^{2+} D Zn^{2+}

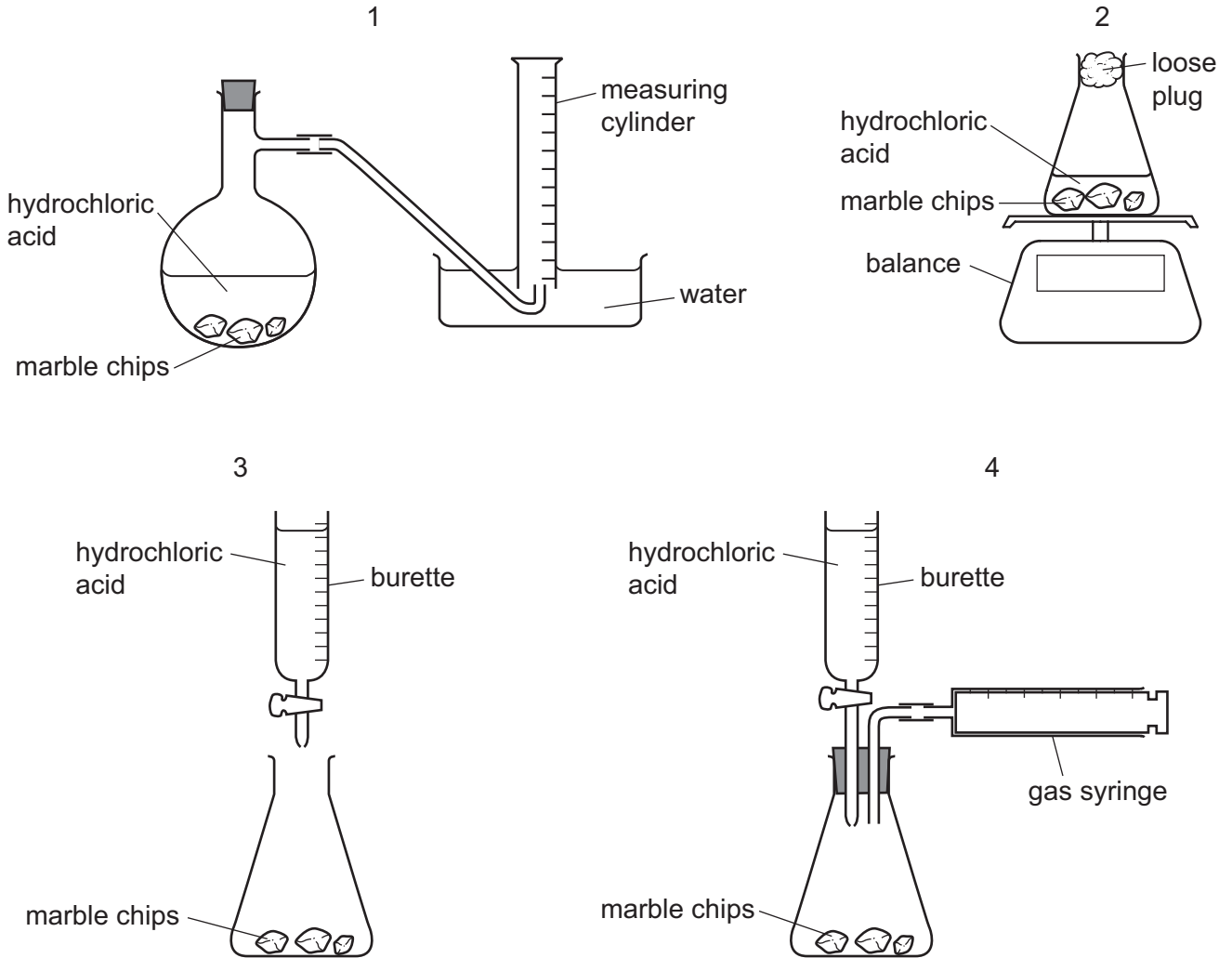
- 3 Which diagram shows the arrangement of particles inside a balloon containing a mixture of the gases nitrogen and oxygen?



- 4 A student follows the rate of the reaction between marble chips, CaCO_3 , and dilute hydrochloric acid.

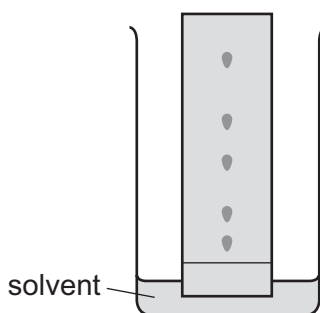


Which diagrams show apparatus that is suitable for this experiment?



- A** 1 and 2 only **B** 1 and 3 **C** 1 and 4 only **D** 1, 2 and 4

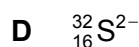
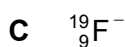
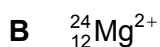
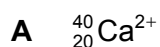
- 5 A chemist wishes to separate and identify a mixture of substances using paper chromatography. The diagram shows the apparatus used. The solvent is water.



The solvent front is allowed to reach the top of the paper before the chemist removes the paper from the solvent.

Which problem does this cause?

- A This causes the spot nearest the bottom of the paper to catch up with the spot above it.
 B This makes it impossible to calculate R_f values.
 C This makes it impossible to use a locating agent.
 D This results in a safety hazard caused by solvent fumes.
- 6 Which particle contains the same number of both neutrons and electrons?



- 7 Which statement is correct for all metals?

- A They are hard and brittle.
 B They are made up of a lattice of positive and negative ions.
 C They conduct electricity by movement of electrons.
 D They conduct electricity by movement of ions.

- 8 X represents the element of atomic number 8 and Y represents the element of atomic number 19.

The two elements react together to form a compound.

Which row is correct for the compound formed?

	formula	type of bonding
A	Y_2X	covalent
B	Y_2X	ionic
C	X_2Y	covalent
D	X_2Y	ionic

- 9 The empirical formula of a liquid compound is C_2H_4O .

To find the empirical formula, it is necessary to know

- A** the density of the compound.
B the percentage composition by mass of the compound.
C the relative molecular mass of the compound.
D the volume occupied by 1 mole of the compound.
- 10 25.0 g of hydrated copper(II) sulfate crystals are heated to produce anhydrous copper(II) sulfate and water vapour.



What is the mass of anhydrous copper(II) sulfate formed?

[M_r : $CuSO_4$, 160; H_2O , 18]

- A** 9.0 g **B** 16.0 g **C** 22.5 g **D** 25.0 g
- 11 Which sample contains the most atoms?
- A** 0.5 moles of water
B 1.0 moles of carbon dioxide
C 1.0 moles of methane
D 2.0 moles of hydrogen chloride
- 12 The relative atomic mass of chlorine is 35.5.
- What is the mass of 2 moles of chlorine gas?
- A** 17.75 g **B** 35.5 g **C** 71 g **D** 142 g

- 13 One mole of an organic compound, **Q**, is completely burnt in oxygen and produces exactly three moles of water.

Which compound is **Q**?

- A butane, C_4H_{10}
- B ethanol, C_2H_5OH
- C propane, C_3H_8
- D propanol, C_3H_7OH

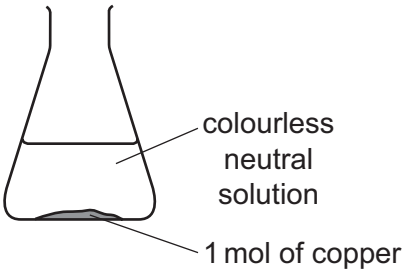
- 14 In an experiment, 1 mol of powdered copper and 1 mol of powdered zinc are placed in a flask.

Dilute acid, containing 1 mol of acid, is added to the flask.

The flask is left until all the reactions, if any, are complete.

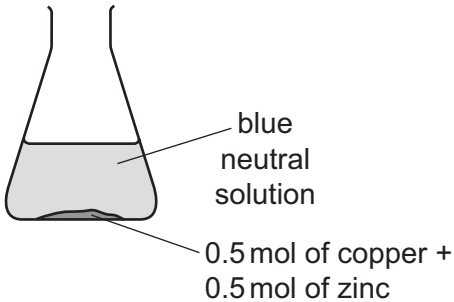
Which diagram shows the result of the experiment?

A



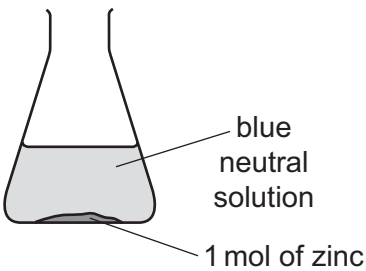
colourless neutral solution
1 mol of copper

B



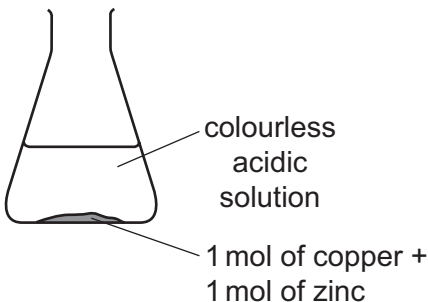
blue neutral solution
0.5 mol of copper + 0.5 mol of zinc

C



blue neutral solution
1 mol of zinc

D



colourless acidic solution
1 mol of copper + 1 mol of zinc

- 15 A simple cell can be made using two different metals as the electrodes and an aqueous solution as the electrolyte.

Which statements about simple cells are correct?

- 1 A greater voltage is produced using magnesium and silver than using magnesium and copper.
- 2 The electrolyte is an aqueous solution containing both positive and negative ions.
- 3 The more reactive metal will release electrons.

A 1, 2 and 3 **B** 1 and 3 only **C** 1 only **D** 2 and 3 only

- 16 Magnesium can be produced by electrolysis of molten magnesium chloride, MgCl_2 .

What are the equations for the reactions that occur at the positive electrode and at the negative electrode?

	positive electrode	negative electrode
A	$2\text{Cl}^- \rightarrow \text{Cl}_2 + 2\text{e}^-$	$2\text{H}^+ + 2\text{e}^- \rightarrow \text{H}_2$
B	$\text{Cl}_2 + 2\text{e}^- \rightarrow 2\text{Cl}^-$	$\text{Mg}^{2+} + 2\text{e}^- \rightarrow \text{Mg}$
C	$2\text{Cl}^- \rightarrow \text{Cl}_2 + 2\text{e}^-$	$\text{Mg}^{2+} + 2\text{e}^- \rightarrow \text{Mg}$
D	$2\text{Cl}^- \rightarrow \text{Cl}_2 + 2\text{e}^-$	$\text{Mg}^{2+} + 2\text{e}^- \rightarrow 2\text{Mg}$

- 17 Three different solutions were electrolysed using inert electrodes.

- solution 1 aqueous sodium chloride
 solution 2 concentrated hydrochloric acid
 solution 3 dilute sulfuric acid

Which solutions produce hydrogen at the negative electrode?

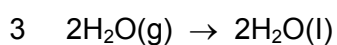
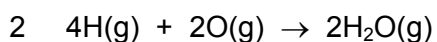
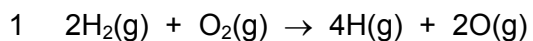
A 1, 2 and 3 **B** 1 and 2 only **C** 1 only **D** 2 and 3 only

- 18 Compound **Y** reacts with oxygen. This reaction has a positive enthalpy change of reaction, ΔH .

What information can be deduced about **Y** and its reaction with oxygen?

- A** Compound **Y** can be used as a fuel.
B Compound **Y** could be a hydrocarbon.
C In the reaction the energy needed to break bonds is greater than the energy released when bonds are made.
D In the reaction the products are at a lower energy level than the reactants.

19 The formation of liquid water from hydrogen and oxygen may occur in three stages.



Which stages are endothermic?

- A** 1, 2 and 3 **B** 1 only **C** 2 only **D** 3 only

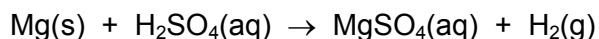
20 Sulfur trioxide is produced by the following reaction.



Which change in conditions would produce a greater amount of SO_3 at equilibrium?

- A** adding a catalyst
B increasing the pressure
C increasing the temperature
D removing some SO_2 and O_2

21 Magnesium reacts with dilute sulfuric acid.



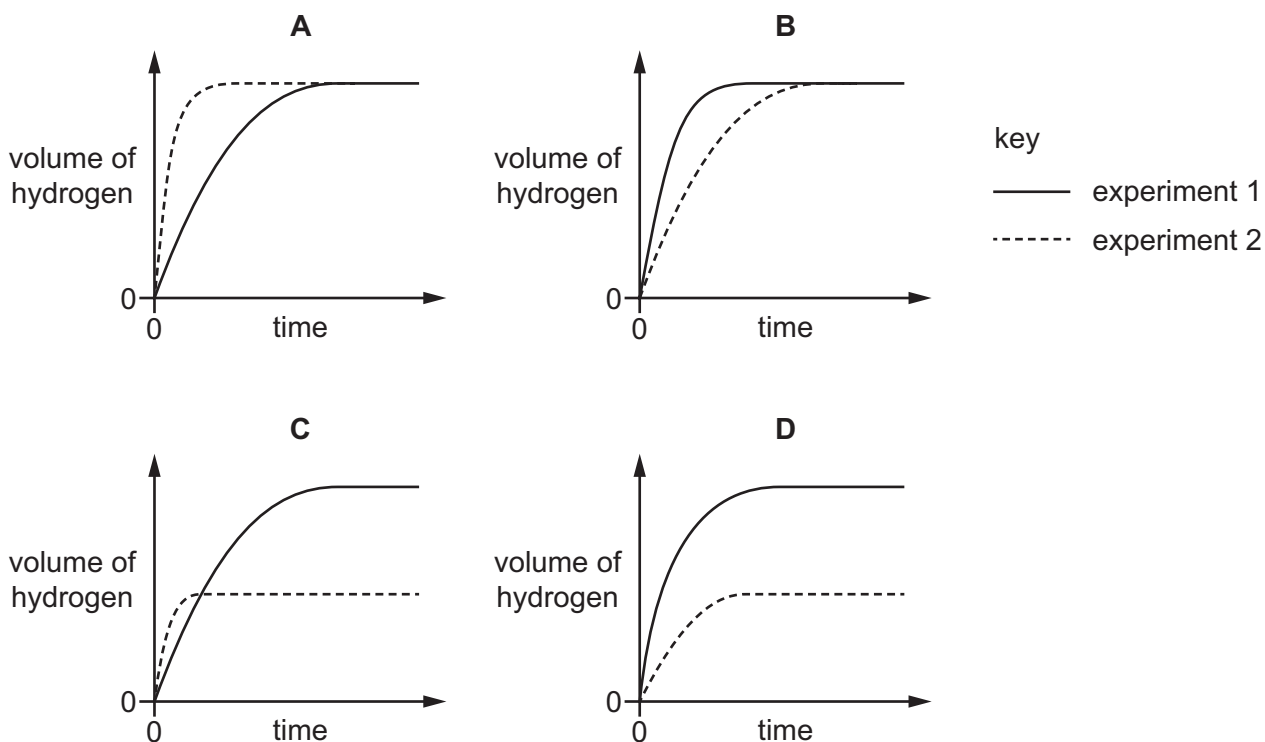
Two experiments were carried out.

experiment 1 24.0 g of magnesium was reacted with 100 cm³ of 1.0 mol/dm³ sulfuric acid.

experiment 2 24.0 g of magnesium was reacted with 50 cm³ of 2.0 mol/dm³ sulfuric acid.

In each experiment the volume of hydrogen was measured at various times. The results were plotted on a graph.

Which graph is correct?



22 Which statement is correct for both aluminium and iron?

- A Both form 2+ ions.
- B Both have amphoteric oxides.
- C The manufacture of both metals involves the reduction of the metal ions.
- D They are both normally manufactured by electrolysis.

- 23 A household cleaning compound is used to remove calcium carbonate from bathroom surfaces.

The compound reacts with the calcium carbonate to form a soluble salt, carbon dioxide and water.

What is the pH of this cleaning compound?

- A pH 2 B pH 7 C pH 10 D pH 14

- 24 Dilute hydrochloric acid is added separately to samples of copper, copper(II) oxide and copper(II) carbonate.

Which row correctly shows whether copper(II) chloride is produced?

	Cu	CuO	CuCO ₃
A	✓	✓	✓
B	x	✓	x
C	✓	x	✓
D	x	✓	✓

key

✓ = copper(II) chloride produced

x = copper(II) chloride not produced

- 25 Which ions are present when hydrochloric acid has exactly neutralised aqueous sodium hydroxide?

- A Na⁺, Cl⁻, H⁺ and OH⁻
 B Na⁺, Cl⁻ and H⁺ only
 C Na⁺ and Cl⁻ only
 D H⁺ and OH⁻ only

- 26 Which experiment will result in the formation of a white precipitate?

- A aqueous barium nitrate added to aqueous sodium chloride
 B aqueous sodium carbonate added to aqueous calcium chloride
 C carbon dioxide passed through aqueous potassium chloride
 D dilute hydrochloric acid added to aqueous ammonia

- 27 Which statement about both the Group I and Group VII elements is correct?

- A They conduct electricity when molten.
 B They form covalent compounds when bonded to non-metals.
 C They exist as diatomic molecules.
 D When Group I elements combine with Group VII elements, ionic compounds form.

28 The elements helium, argon and neon are noble gases.

Which statement is correct?

- A All these elements have eight electrons in their outer shell.
- B Argon is used to react with impurities in the manufacture of steel.
- C Helium is used in balloons as it is more dense than air.
- D Neon is used in light bulbs to give an inert atmosphere.

29 Which row shows the correct catalyst for each industrial process?

	manufacture of sulfuric acid	manufacture of ammonia	manufacture of margarine
A	nickel	iron	vanadium(V) oxide
B	nickel	vanadium(V) oxide	iron
C	vanadium(V) oxide	iron	nickel
D	vanadium(V) oxide	nickel	iron

30 In the solid state, germanium has the same structure as diamond.

What is the likely melting point of germanium?

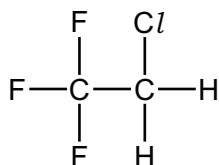
- A above 800 °C
- B between 100 °C and 800 °C
- C 100 °C
- D below 100 °C

31 Aluminium is a metal that is often used to make caps for bottles. When thrown away and buried in the soil, the caps do not corrode.

Why is this?

- A Aluminium does not react with acids.
- B Aluminium does not react with alkalis.
- C Aluminium is alloyed with other metals.
- D Aluminium is protected by a layer of oxide.

- 32 Which statement about Group I metals is correct?
- A They are hard compared with most other metals.
 - B They form coloured compounds.
 - C They have high densities compared with most other metals.
 - D They only form ions with a charge of +1.
- 33 CFC compounds were used as aerosol propellants. The structure of one CFC compound is shown.



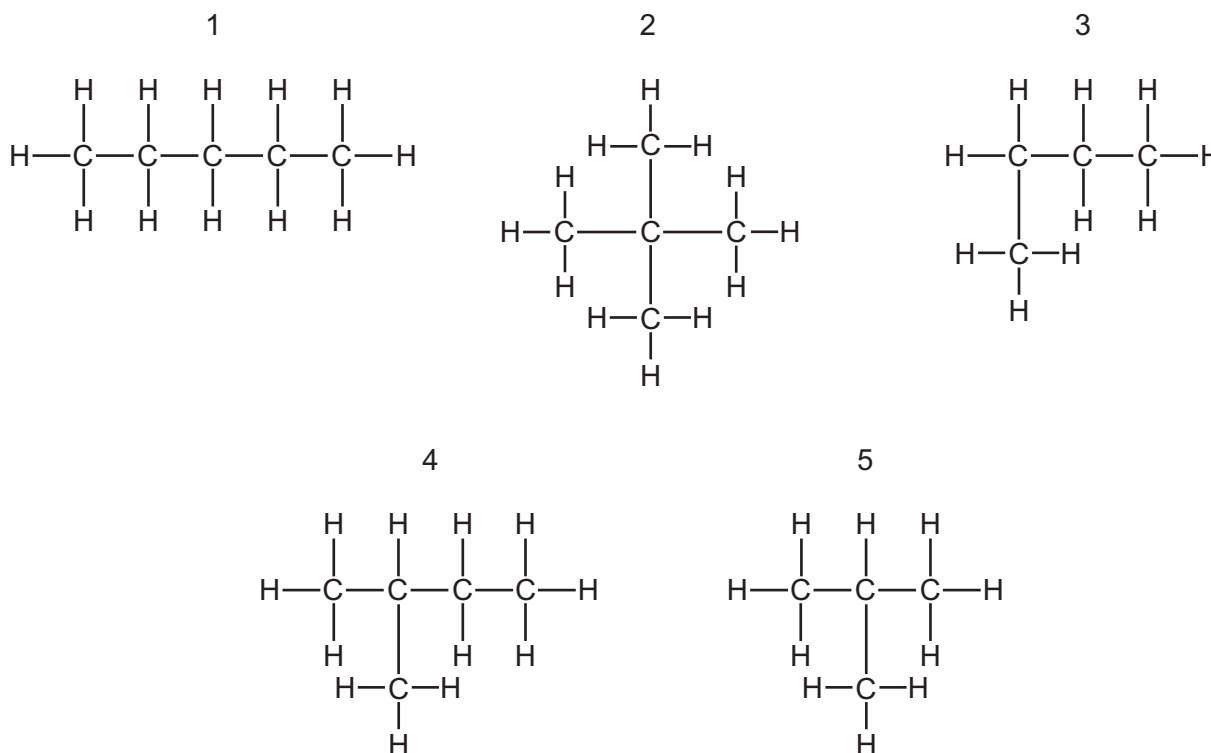
Which element in this compound causes a depletion of ozone in the atmosphere?

- A carbon
 - B chlorine
 - C fluorine
 - D hydrogen
- 34 Dry air is a mixture of gases of which 99% is nitrogen and oxygen.
- What is the main constituent of the remaining 1%?
- A argon
 - B helium
 - C hydrogen
 - D water vapour
- 35 Why is chlorine added to the water supply?
- A Chlorine is used to desalinate the water.
 - B Chlorine kills bacteria that may be present in the water.
 - C Chlorine precipitates solids that may be present in the water.
 - D Chlorine removes tastes and odours from the water.

36 When the alcohol of molecular formula $C_4H_{10}O$ is oxidised, what is the molecular formula of the acid formed?

- A $C_4H_{12}O_2$ B $C_4H_{10}O_2$ C $C_4H_8O_2$ D $C_4H_6O_2$

37 The diagrams show the structures of five hydrocarbons.



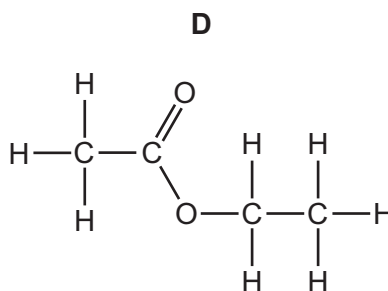
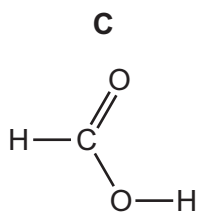
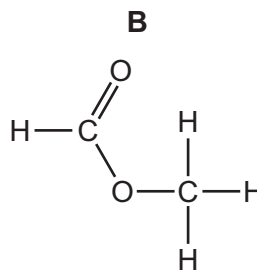
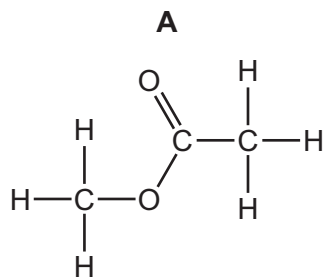
Which three hydrocarbons are isomers of each other?

- A 1, 2 and 4 B 2, 3 and 5 C 2, 3 and 4 D 3, 4 and 5

38 Which alcohol and acid will react together to make the ester $CH_3COOC_2H_5$?

- A CH_3OH and CH_3COOH
 B CH_3OH and C_2H_5COOH
 C C_2H_5OH and CH_3COOH
 D C_2H_5OH and C_2H_5COOH

39 Which compound has a pH of less than 7 in aqueous solution?



40 Which statement about polymers is correct?

- A** Nylon and *Terylene* are produced by addition polymerisation.
- B** Nylon and *Terylene* both contain the amide linkage.
- C** Simple sugars can be produced by hydrolysing proteins.
- D** Starch contains the elements carbon, hydrogen and oxygen.

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The Periodic Table of Elements

		Group													
I	II	III	IV	V	VI	VII	VIII								
		1 H hydrogen 1													
3 Li lithium 7	4 Be beryllium 9	Key atomic number atomic symbol name relative atomic mass													
11 Na sodium 23	12 Mg magnesium 24	5 B boron 11	6 C carbon 12	7 N nitrogen 14	8 O oxygen 16	9 F fluorine 19	10 Ne neon 20	13 Al aluminium 27	14 Si silicon 28	15 P phosphorus 31	16 S sulfur 32	17 Cl chlorine 35.5	18 Ar argon 40		
19 K potassium 39	20 Ca calcium 40	26 Fe iron 56	27 Co cobalt 59	28 Ni nickel 59	29 Cu copper 64	30 Zn zinc 65	31 Ga gallium 70	32 Ge germanium 73	33 As arsenic 75	34 Se selenium 79	35 Br bromine 80	36 Kr krypton 84			
37 Rb rubidium 85	38 Sr strontium 88	44 Ru ruthenium 101	45 Rh rhodium 103	46 Pd palladium 106	47 Ag silver 108	48 Cd cadmium 112	49 In indium 115	50 Sn tin 119	51 Sb antimony 122	52 Te tellurium 128	53 I iodine 127	54 Xe xenon 131			
55 Cs caesium 133	56 Ba barium 137	76 Os osmium 190	77 Ir iridium 192	78 Pt platinum 195	79 Au gold 197	80 Hg mercury 201	81 Tl thallium 204	82 Pb lead 207	83 Bi bismuth 209	84 Po polonium —	85 At astatine —	86 Rn radon —			
87 Fr francium —	88 Ra radium —	104 Rf rutherfordium —	105 Db dubnium —	106 Sg seaborgium —	107 Bh bohrium —	108 Hs hassium —	109 Mt meitnerium —	110 Ds darmstadtium —	111 Rg roentgenium —	112 Cn copernicium —	116 Lv livermorium —	—			

57 La lanthanum 139	58 Ce cerium 140	59 Pr praseodymium 141	60 Nd neodymium 144	61 Pm promethium —	62 Sm samarium 150	63 Eu europium 152	64 Gd gadolinium 157	65 Tb terbium 159	66 Dy dysprosium 163	67 Ho holmium 165	68 Er erbium 167	69 Tm thulium 169	70 Yb ytterbium 173	71 Lu lutetium 175
89 Ac actinium —	90 Th thorium 232	91 Pa protactinium 231	92 U uranium 238	93 Np neptunium —	94 Pu plutonium —	95 Am americium —	96 Cm curium —	97 Bk berkelium —	98 Cf californium —	99 Es einsteinium —	100 Fm fermium —	101 Md mendelevium —	102 No nobelium —	103 Lr lawrencium —

lanthanoids

actinoids

The volume of one mole of any gas is 24 dm³ at room temperature and pressure (r.t.p.).

CHEMISTRY

5070/12

Paper 1 Multiple Choice

May/June 2018

1 hour

Additional Materials: Multiple Choice Answer Sheet
 Soft clean eraser
 Soft pencil (type B or HB is recommended)

* 7 1 7 5 0 4 3 8 3 1 *



READ THESE INSTRUCTIONS FIRST

Write in soft pencil.

Do not use staples, paper clips, glue or correction fluid.

Write your name, Centre number and candidate number on the Answer Sheet in the spaces provided unless this has been done for you.

DO NOT WRITE IN ANY BARCODES.

There are **forty** questions on this paper. Answer **all** questions. For each question there are four possible answers **A, B, C** and **D**.

Choose the **one** you consider correct and record your choice in **soft pencil** on the separate Answer Sheet.

Read the instructions on the Answer Sheet very carefully.

Each correct answer will score one mark. A mark will not be deducted for a wrong answer.

Any rough working should be done in this booklet.

A copy of the Periodic Table is printed on page 16.

Electronic calculators may be used.

This document consists of **16** printed pages.

- 1 A student wants to show that the rate of the reaction between calcium carbonate and dilute hydrochloric acid doubles for every 10 °C rise in temperature.

The method the student uses is to measure the volume of carbon dioxide released.

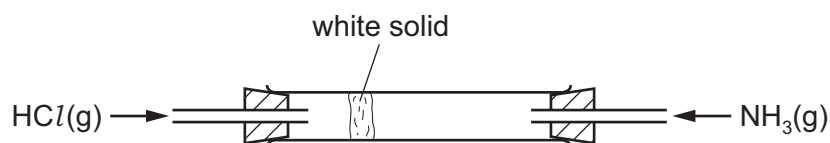
The student has a Bunsen burner and a gas syringe.

What other essential apparatus must the student use?

- A** balance, burette, pipette, measuring cylinder
B balance, measuring cylinder, clock, thermometer
C burette, pipette, clock, thermometer
D pipette, measuring cylinder, clock, thermometer
- 2 Which mixture can be separated into its components by adding water, stirring and filtering?
- A** calcium carbonate and sodium chloride
B magnesium and iron
C sodium chloride and copper(II) sulfate
D sulfuric acid and hydrochloric acid
- 3 Which row gives the correct tests to identify both ammonia and sulfur dioxide?

	test to identify ammonia	test to identify sulfur dioxide
A	damp blue litmus paper	acidified potassium manganate(VII)
B	damp blue litmus paper	damp red litmus paper
C	damp red litmus paper	acidified potassium manganate(VII)
D	damp red litmus paper	damp blue litmus paper

- 4 Two gases, ammonia and hydrogen chloride, at an equal pressure, are allowed to enter the apparatus shown.



After a time, a white solid forms on the inside of the tube.

Which statements explain why a white solid forms in the position shown?

- 1 Ammonia and hydrogen chloride react to form solid ammonium chloride.
- 2 Ammonia diffuses faster than hydrogen chloride.
- 3 Ammonia has a lower relative molecular mass than hydrogen chloride.

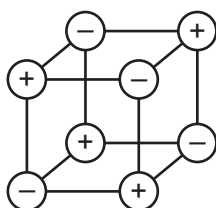
A 1, 2 and 3 **B** 1 and 2 only **C** 1 only **D** 2 and 3 only

- 5 The atomic number of cerium, Ce, is 58. A Ce^{4+} ion has 140 nucleons in its nucleus.

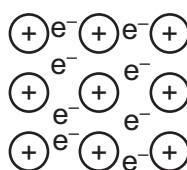
How many protons, neutrons, and electrons are there in one Ce^{4+} ion?

	protons	neutrons	electrons
A	58	82	54
B	58	82	62
C	82	58	54
D	82	58	62

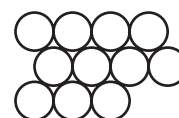
- 6 The diagrams show the arrangement of particles in three **solids**: X, Y and Z. The three solids are krypton, potassium and sodium chloride.



X



Y



Z

Which row correctly identifies X, Y and Z?

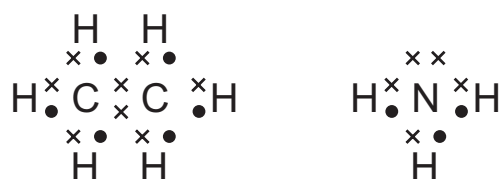
	X	Y	Z
A	krypton	potassium	sodium chloride
B	krypton	sodium chloride	potassium
C	sodium chloride	krypton	potassium
D	sodium chloride	potassium	krypton

7 Which statement about solid calcium chloride is correct?

- A It conducts electricity.
- B It has a low melting point.
- C It has an ionic lattice structure.
- D It is insoluble in water.

8 Ethane, C_2H_6 , and ammonia, NH_3 , are covalent compounds.

The dot-and-cross diagrams of these compounds are shown.



Which statements are correct?

- 1 A molecule of ethane contains twice as many hydrogen atoms as a molecule of ammonia.
- 2 An unreacted nitrogen atom has five outer electrons.
- 3 In a molecule of ethane, the bond between the carbon atoms is formed by sharing two electrons, one from each carbon atom.

A 1, 2 and 3 B 1 and 2 only C 1 and 3 only D 2 and 3 only

9 Which statement about the structure or bonding of metals is correct?

- A A metal lattice consists of atoms in a 'sea of electrons'.
- B Electrons in a metal move randomly through the lattice.
- C Metals are malleable because the particles present are mobile.
- D The ions in a metal move when positive and negative electrodes are attached.

10 When 1 volume of gas **R** reacts with exactly 5 volumes of oxygen, it forms carbon dioxide and water only.

What is **R**?

- A butane, C_4H_{10}
- B ethane, C_2H_6
- C methane, CH_4
- D propane, C_3H_8

11 The relative molecular mass of a compound is 166.

What is a possible molecular formula of this compound?

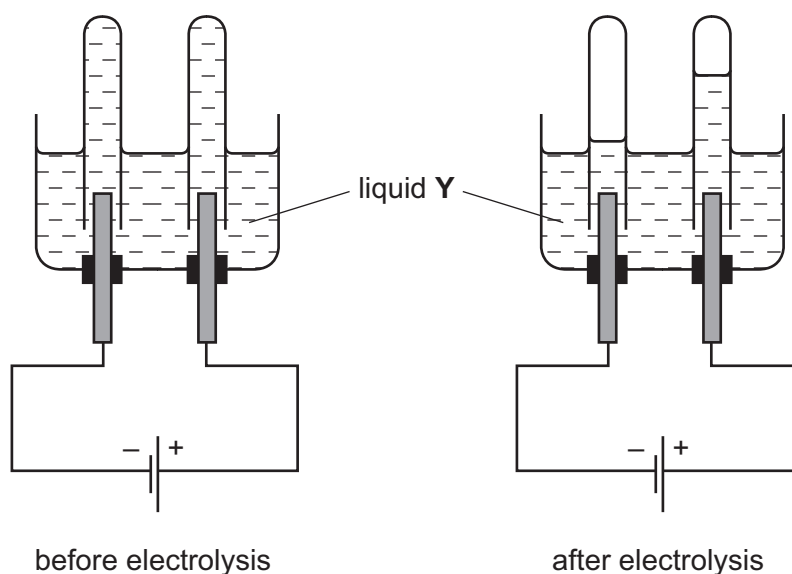
- A $C_4H_3O_2$ B $C_6H_4O_4$ C $C_6H_8O_2$ D $C_8H_6O_4$

12 A mass of 63 g of potassium manganate(VII), $KMnO_4$, is needed for the complete oxidation of 23 g of ethanol, C_2H_5OH , under acidic conditions.

How many moles of ethanol can be completely oxidised by one mole of potassium manganate(VII) under these conditions?

- A 0.37 B 0.80 C 1.00 D 1.25

13 The diagrams show an electrolysis experiment using inert electrodes.



What could liquid Y be?

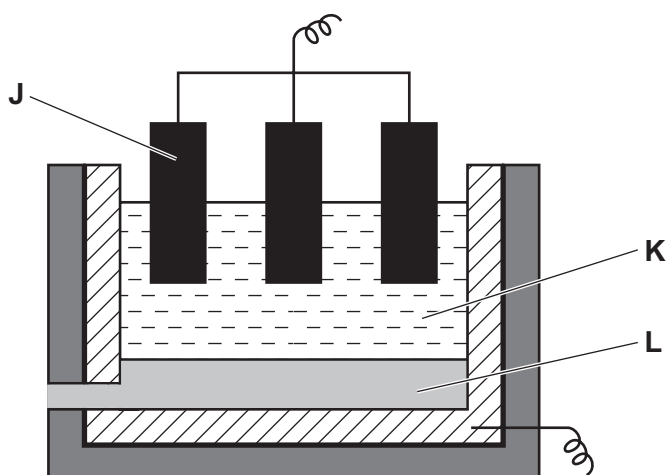
- A aqueous copper(II) sulfate
 B concentrated aqueous sodium chloride
 C dilute sulfuric acid
 D ethanol

14 Magnesium can be produced by the electrolysis of molten magnesium chloride, MgCl_2 .

What are the products formed at the anode and at the cathode during the electrolysis of molten magnesium chloride?

	anode	cathode
A	chlorine	hydrogen
B	chlorine	magnesium
C	magnesium	chlorine
D	oxygen	hydrogen

15 The diagram shows apparatus that can be used to extract aluminium from its ore.

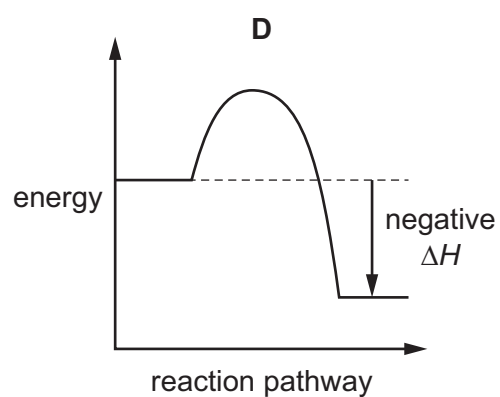
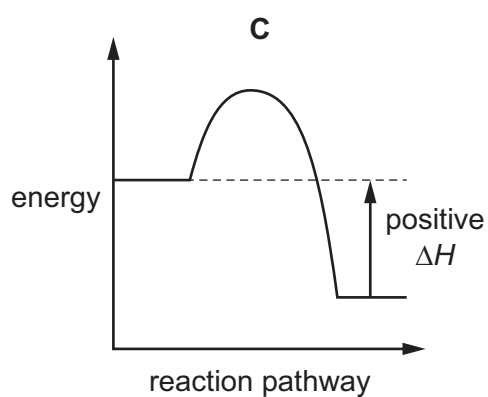
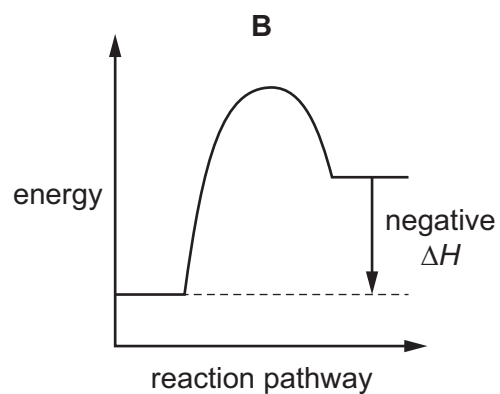
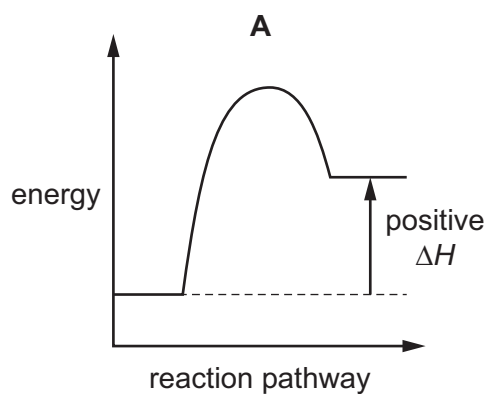


What are J, K and L?

	J	K	L
A	negative electrode	aluminium oxide + cryolite	aluminium
B	negative electrode	cryolite	aluminium oxide
C	positive electrode	aluminium oxide	cryolite
D	positive electrode	aluminium oxide + cryolite	aluminium

16 A reaction is exothermic.

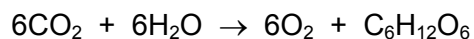
Which diagram shows the correct energy profile diagram for the reaction and the correct enthalpy change?



17 Which fraction of petroleum (crude oil) is used as a fuel in aircraft engines?

- A bitumen
- B naphtha
- C paraffin (kerosene)
- D petrol (gasoline)

18 The equation for photosynthesis is shown.



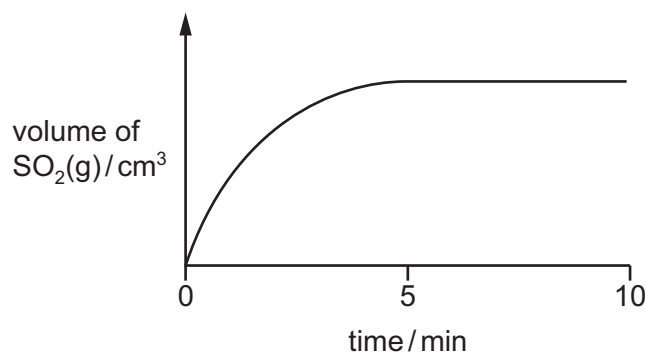
Which statement about photosynthesis is correct?

- A It has a negative enthalpy change.
- B It is catalysed by the presence of yeast.
- C The products of photosynthesis are oxygen and starch.
- D It occurs in green leaves.

19 Compound **X** reacts with an acid to produce sulfur dioxide gas.

A sample of **X** is placed in a flask and acid is added. The sulfur dioxide produced is collected and its volume is measured at various times.

A graph of the results is plotted.



Which statement about this experiment is correct?

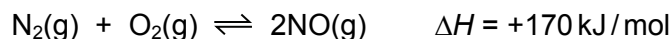
- A The gas can be collected by displacing water from a measuring cylinder.
- B The mass of the reaction flask and its contents decreases as the reaction proceeds.
- C The rate of the reaction increases as time increases.
- D The reaction is still proceeding after eight minutes.

20 Which reactions involve oxidation and reduction?

- 1 chlorine gas reacting with aqueous potassium iodide
- 2 dilute sulfuric acid reacting with magnesium
- 3 dilute hydrochloric acid reacting with aqueous sodium hydroxide

- A 1, 2 and 3
- B 1 and 2 only
- C 1 and 3 only
- D 2 and 3 only

21 Nitrogen reacts with oxygen in an equilibrium reaction.



When the reaction is at equilibrium, which statement is correct?

- A The concentration of nitrogen present will change with time.
 - B The forward and backward reactions are taking place at the same rate.
 - C The forward reaction releases heat energy.
 - D There are more molecules on the left hand side of the equation than on the right.
- 22 Lead(II) oxide, PbO, reacts with dilute nitric acid, neutralising the acid. Lead(II) oxide also reacts with aqueous sodium hydroxide, neutralising the alkali.

Which word best describes lead(II) oxide?

- A acidic
 - B alkaline
 - C amphoteric
 - D basic
- 23 Which pair of reagents are most suitable for the laboratory preparation of copper(II) chloride?
- A aqueous copper(II) nitrate and aqueous sodium chloride
 - B copper and chlorine
 - C copper and dilute hydrochloric acid
 - D copper(II) oxide and dilute hydrochloric acid
- 24 The compounds shown can be used as nitrogenous fertilisers.

Which compound has the lowest percentage by mass of nitrogen?

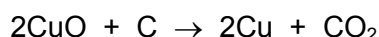
- A $(\text{NH}_2)_2\text{CO}$ [M_r : 60]
- B $(\text{NH}_4)_2\text{SO}_4$ [M_r : 132]
- C $(\text{NH}_4)_3\text{PO}_4$ [M_r : 149]
- D NH_4NO_3 [M_r : 80]

29 Brass is an alloy.

Which statement about brass is correct?

- A It contains a sea of electrons.
- B It contains positive and negative ions which are free to move.
- C It is a compound of a metal and a non-metal.
- D It is a compound of two or more metals.

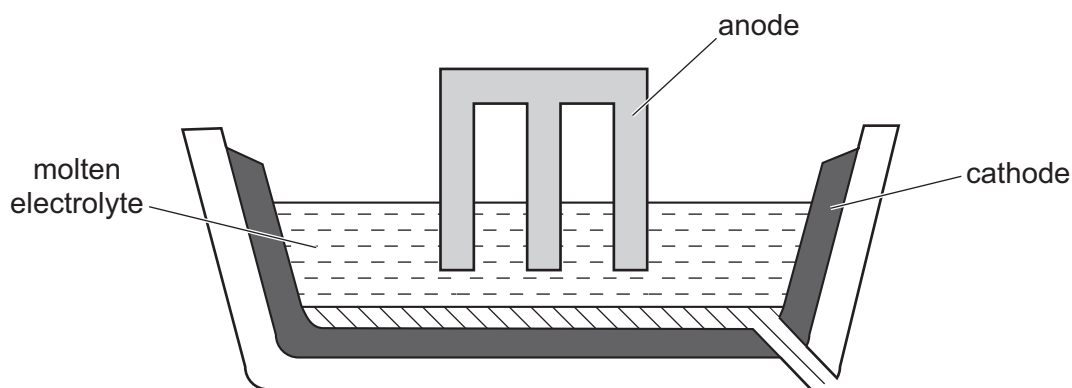
30 Copper(II) oxide reacts with carbon when heated.



Which statement about this reaction is correct?

- A Carbon is the oxidising agent.
- B Carbon is the reducing agent.
- C Copper(II) oxide is oxidised.
- D Copper(II) oxide is the reducing agent.

31 The diagram shows a cell that can be used to extract a metal from its oxide.



Molten aluminium oxide, copper(II) oxide, lead(II) oxide and magnesium oxide are each electrolysed in separate cells. Each cell receives the same number of electrons.

Which statement is correct?

- A All the metals can also be extracted from their oxides using coke.
- B The anode and cathode should be made of the metal being extracted.
- C The pure metal is always produced at the cathode.
- D The same mass of each metal is formed.

32 Iron is obtained in the blast furnace from the ore haematite.

Which process takes place in the blast furnace?

- A** Calcium carbonate is used to remove acidic impurities.
- B** Coke is reduced to carbon dioxide.
- C** Haematite is oxidised by carbon monoxide.
- D** Haematite undergoes thermal decomposition.

33 Aircraft manufacture requires a metal that:

- 1 has a relatively low density
- 2 is resistant to corrosion.

Which of these conditions does aluminium satisfy?

- A** 1 and 2
- B** 1 only
- C** 2 only
- D** neither 1 nor 2

34 Which pair of gases are both non-acidic?

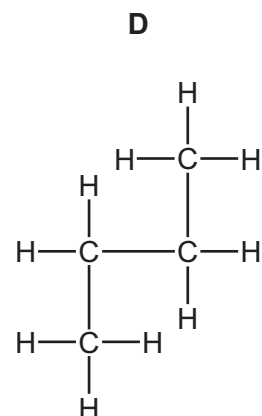
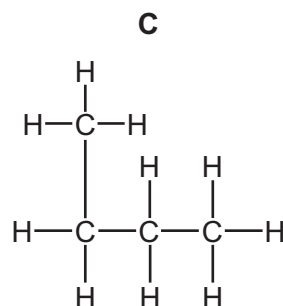
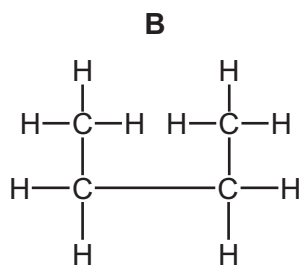
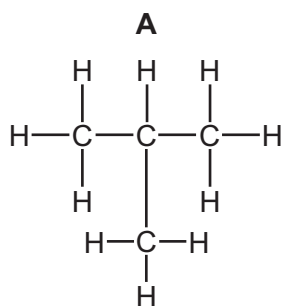
- A** ammonia and methane
- B** carbon dioxide and ammonia
- C** methane and nitrogen dioxide
- D** nitrogen dioxide and carbon dioxide

35 Seawater is desalinated to make it drinkable.

What is the main substance removed by desalination?

- A** detergent
- B** fertiliser
- C** sewage
- D** sodium chloride

36 Which diagram shows a branched-chain isomer of butane?

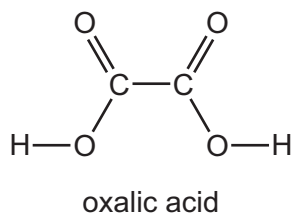


37 A straight-chain alkene, C_4H_8 , undergoes an addition reaction with bromine.

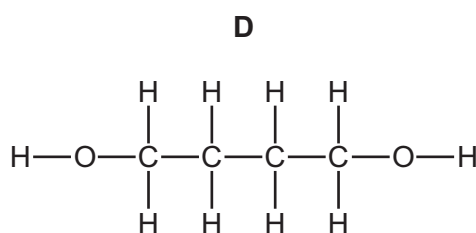
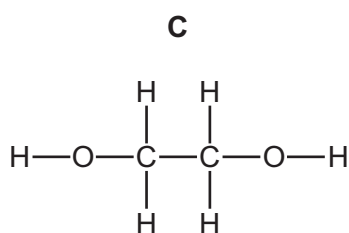
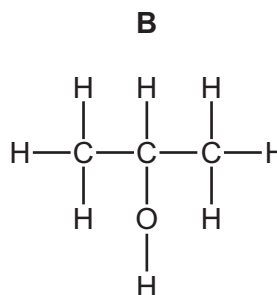
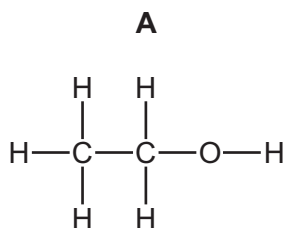
What is the possible structure of the product?

- A** $CH_3CHBrCH_2CH_2Br$
- B** $CH_3CHBrCHBrCH_3$
- C** $CH_2BrCH_2CH_2CH_2Br$
- D** $CH_3CH_2CH_2CH_2Br$

38 The diagram shows the structure of oxalic acid.



Which alcohol is oxidised to form oxalic acid?



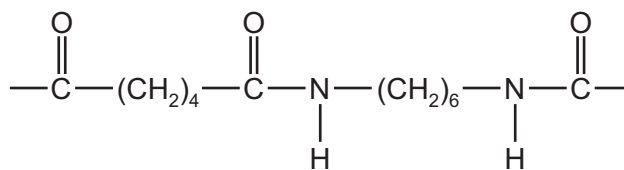
39 Some properties of compound **J** are listed.

- It reacts with potassium carbonate to produce carbon dioxide.
- It reacts with ethanol to produce a sweet-smelling liquid.
- It reacts with sodium hydroxide to produce a salt.

What is a possible identity of **J**?

- A** ethanoic acid
- B** ethanol
- C** ethyl ethanoate
- D** ethyl methanoate

40 The diagram shows the formula of nylon.



From which compounds could nylon be made?

- A $\text{HO}_2\text{C}-(\text{CH}_2)_6-\text{CO}_2\text{H}$ and $\text{H}_2\text{N}-(\text{CH}_2)_6-\text{NH}_2$
- B $\text{HO}_2\text{C}-(\text{CH}_2)_4-\text{CO}_2\text{H}$ and $\text{H}_2\text{N}-(\text{CH}_2)_4-\text{NH}_2$
- C $\text{HO}_2\text{C}-(\text{CH}_2)_4-\text{CO}_2\text{H}$ and $\text{H}_2\text{N}-(\text{CH}_2)_6-\text{NH}_2$
- D $\text{HO}_2\text{C}-(\text{CH}_2)_6-\text{CO}_2\text{H}$ and $\text{H}_2\text{N}-(\text{CH}_2)_4-\text{NH}_2$

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The Periodic Table of Elements

		Group														
I	II	III	IV	V	VI	VII	VIII									
3 Li lithium 7	4 Be beryllium 9	11 Na sodium 23	12 Mg magnesium 24	19 K potassium 39	20 Ca calcium 40	37 Rb rubidium 85	55 Cs caesium 133	87 Fr francium —	1 H hydrogen 1	2 He helium 4	5 B boron 11	6 C carbon 12	7 N nitrogen 14	8 O oxygen 16	9 F fluorine 19	10 Ne neon 20
13 Al aluminium 27	14 Si silicon 28	15 P phosphorus 31	16 S sulfur 32	13 Al aluminium 27	14 Si silicon 28	15 P phosphorus 31	16 S sulfur 32	17 Cl chlorine 35.5	18 Ar argon 40	30 Zn zinc 65	31 Ga gallium 70	32 Ge germanium 73	33 As arsenic 75	34 Se selenium 79	35 Br bromine 80	36 Kr krypton 84
21 Sc scandium 45	22 Ti titanium 48	23 V vanadium 51	24 Cr chromium 52	25 Mn manganese 55	26 Fe iron 56	27 Co cobalt 59	28 Ni nickel 59	29 Cu copper 64	30 Zn zinc 65	31 Ga gallium 70	32 Ge germanium 73	33 As arsenic 75	34 Se selenium 79	35 Br bromine 80	36 Kr krypton 84	54 Xe xenon 131
39 Y yttrium 89	40 Zr zirconium 91	41 Nb niobium 93	42 Mo molybdenum 96	43 Tc technetium —	44 Ru ruthenium 101	45 Rh rhodium 103	46 Pd palladium 106	47 Ag silver 108	48 Cd cadmium 112	49 In indium 115	50 Sn tin 119	51 Sb antimony 122	52 Te tellurium 128	53 I iodine 127	54 Xe xenon 131	86 Rn radon —
57–71 lanthanoids	72 Hf hafnium 178	73 Ta tantalum 181	74 W tungsten 184	75 Re rhenium 186	76 Os osmium 190	77 Ir iridium 192	78 Pt platinum 195	79 Au gold 197	80 Hg mercury 201	81 Tl thallium 204	82 Pb lead 207	83 Bi bismuth 209	84 Po polonium —	85 At astatine —	86 Rn radon —	—
89–103 actinoids	104 Rf rutherfordium —	105 Db dubnium —	106 Sg seaborgium —	107 Bh bohrium —	108 Hs hassium —	109 Mt meitnerium —	110 Ds darmstadtium —	111 Rg roentgenium —	112 Cn copernicium —	114 Fl flerovium —	116 Lv livermorium —	116 Lv livermorium —	116 Lv livermorium —	116 Lv livermorium —	116 Lv livermorium —	—

Key
atomic number
atomic symbol
name
relative atomic mass

57 La lanthanum 139	58 Ce cerium 140	59 Pr praseodymium 141	60 Nd neodymium 144	61 Pm promethium —	62 Sm samarium 150	63 Eu europium 152	64 Gd gadolinium 157	65 Tb terbium 159	66 Dy dysprosium 163	67 Ho holmium 165	68 Er erbium 167	69 Tm thulium 169	70 Yb ytterbium 173	71 Lu lutetium 175
89 Ac actinium —	90 Th thorium 232	91 Pa protactinium 231	92 U uranium 238	93 Np neptunium —	94 Pu plutonium —	95 Am americium —	96 Cm curium —	97 Bk berkelium —	98 Cf californium —	99 Es einsteinium —	100 Fm fermium —	101 Md mendelevium —	102 No nobelium —	103 Lr lawrencium —

lanthanoids

actinoids

The volume of one mole of any gas is 24 dm³ at room temperature and pressure (r.t.p.).

CHEMISTRY

5070/12

Paper 1 Multiple Choice

October/November 2018

1 hour

Additional Materials: Multiple Choice Answer Sheet
 Soft clean eraser
 Soft pencil (type B or HB recommended)

READ THESE INSTRUCTIONS FIRST

Write in soft pencil.

Do not use staples, paper clips, glue or correction fluid.

Write your name, Centre number and candidate number on the Answer Sheet in the spaces provided unless this has been done for you.

DO NOT WRITE IN ANY BARCODES.

There are **forty** questions on this paper. Answer **all** questions. For each question there are four possible answers **A, B, C** and **D**.

Choose the **one** you consider correct and record your choice in **soft pencil** on the separate Answer Sheet.

Read the instructions on the Answer Sheet very carefully.

Each correct answer will score one mark. A mark will not be deducted for a wrong answer.

Any rough working should be done in this booklet.

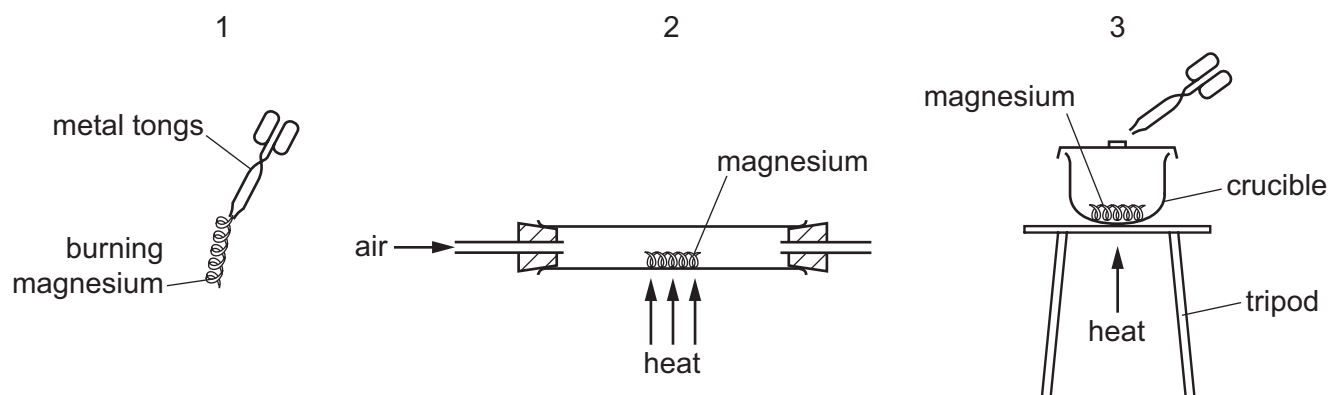
A copy of the Periodic Table is printed on page 16.

Electronic calculators may be used.

This document consists of **13** printed pages and **3** blank pages.

- 1 When heated, magnesium reacts with oxygen in the air to form magnesium oxide, a white powder.

A student investigates the change in mass that occurs during this reaction. He is given a balance and the three sets of apparatus shown.



Which sets of apparatus are suitable for this investigation?

- A** 1, 2 and 3 **B** 1 and 3 only **C** 2 and 3 only **D** 2 only
- 2 Four substances are heated gently. The temperatures at which they start and finish melting are recorded.

substance	temperature	
	start melting /°C	finish melting /°C
1	117	117
2	0	0
3	36	40
4	101	105

Which statement about the substances is correct?

- A** Substance 1 is the only pure substance.
- B** Substance 3 and substance 4 are impure.
- C** Substance 4 is water.
- D** They are all solids at room temperature.

- 3 A substance dissolves in water to form a colourless solution. This solution reacts with aqueous silver nitrate in the presence of dilute nitric acid to give a yellow precipitate.

What is the possible identity of the substance?

- A calcium iodide
- B copper(II) chloride
- C iron(II) iodide
- D sodium chloride

- 4 Which statements are correct?

- 1 The volume of a gas at constant pressure increases as the temperature increases.
- 2 The rate of diffusion of a gas increases as the temperature increases.
- 3 The pressure of a gas at constant volume decreases as the temperature increases.

- A 1, 2 and 3 B 1 and 2 only C 1 and 3 only D 2 and 3 only

- 5 Which particle contains the greatest number of electrons?

- A Mg^{2+} B N^{3-} C Ne D S^{2-}

- 6 Which substance has a giant covalent structure at room temperature?

- A methane
- B sand
- C sodium chloride
- D water

- 7 One atom of element X and two atoms of element Y react to form an ionic compound. Element X forms a positive ion.

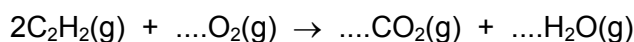
Which elements could X and Y be?

	X	Y
A	calcium	chlorine
B	calcium	oxygen
C	sodium	chlorine
D	sodium	oxygen

- 8 An element with a high melting point forms an oxide that is gaseous at room temperature.

Which type of structure or bonding is present in the element?

- A** giant covalent
B ionic
C metallic
D simple molecular
- 9 Which statement explains why aluminium is malleable?
- A** Aluminium has layers of cations that can slide over one another.
B Aluminium has layers of electrons that can slide over one another.
C Aluminium has weak bonds between protons and a 'sea of electrons'.
D Aluminium is covered with a layer of unreactive aluminium oxide.
- 10 The incomplete equation for the reaction between ethyne, C_2H_2 , and oxygen is shown.



When the equation is balanced, what is the correct value for $O_2(g)$?

- A** 2 **B** 3 **C** 4 **D** 5
- 11 A compound contains 40.0% carbon, 6.7% hydrogen and 53.3% oxygen by mass.

The relative molecular mass of the compound is between 55 and 65.

What is the molecular formula of the compound?

- A** CH_2O **B** C_2H_4O **C** $C_2H_4O_2$ **D** $C_2H_6O_2$
- 12 What is observed during the electrolysis of aqueous copper(II) sulfate using carbon electrodes?
- A** A pink solid is deposited on the anode.
B Bubbles form on the negative electrode.
C The colour of the solution fades.
D The negative electrode becomes smaller.

13 Four processes using electrolysis are listed.

- 1 the electrolysis of concentrated aqueous sodium chloride
- 2 the electrolysis of dilute sulfuric acid
- 3 the extraction of aluminium from pure aluminium oxide
- 4 the purification of copper using aqueous copper(II) sulfate

Which processes produce oxygen at one of the electrodes?

- A** 1 and 2 **B** 2 and 3 **C** 2 and 4 **D** 3 and 4

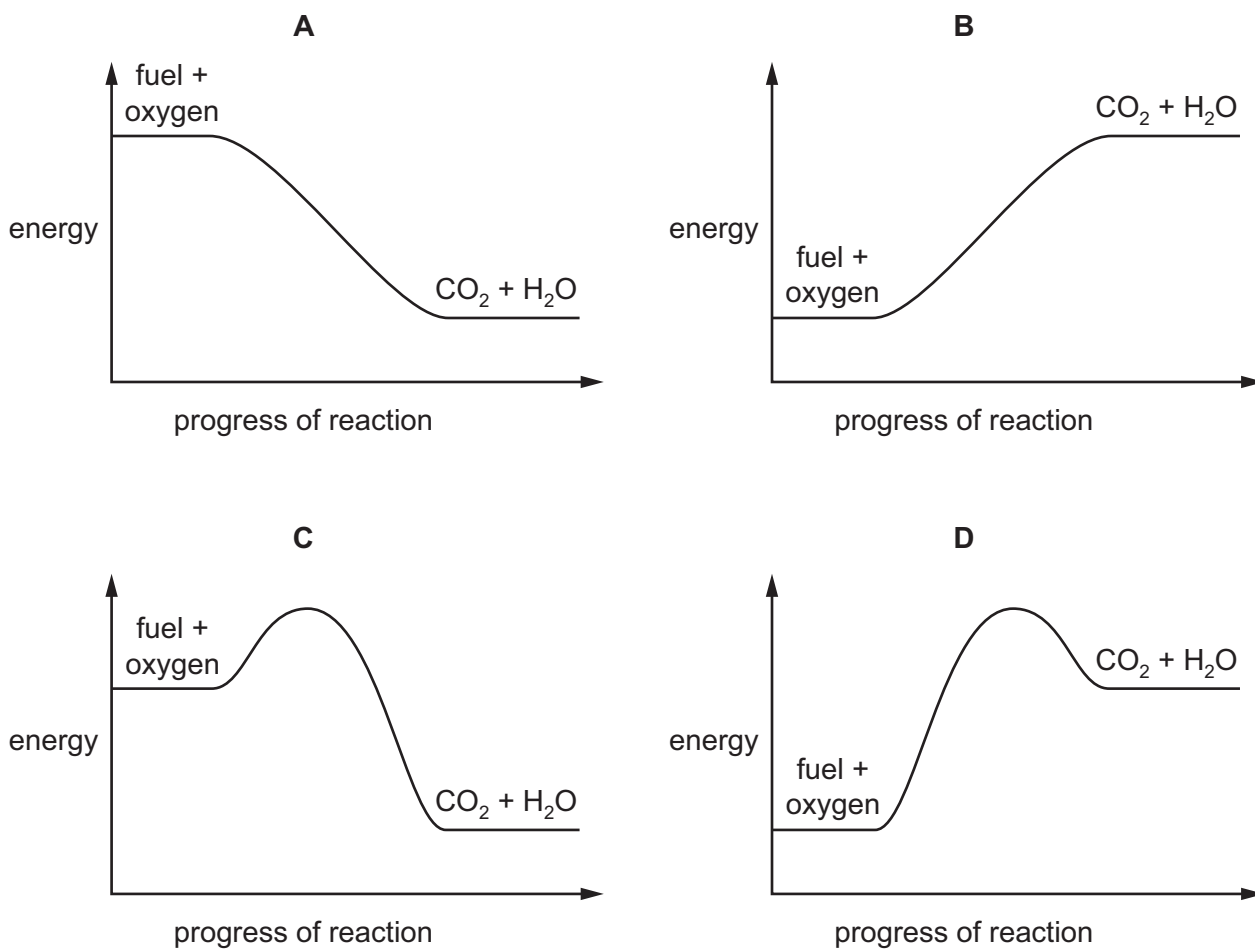
14 Which statements about endothermic reactions are correct?

- 1 Energy is absorbed from the surroundings.
- 2 Energy is released to the surroundings.
- 3 The temperature of the reaction mixture falls.
- 4 The temperature of the reaction mixture rises.

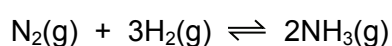
- A** 1 and 3 **B** 1 and 4 **C** 2 and 3 **D** 2 and 4

15 A fuel is completely burned in air. Carbon dioxide, water and heat are produced.

Which energy profile diagram is correct for burning a fuel?



16 The equation shows the reaction for the manufacture of ammonia.



Which change will decrease the activation energy of the reaction?

- A addition of a catalyst
- B decrease in temperature
- C increase in concentration
- D increase in pressure

- 17 Solid ammonium chloride is heated. The gases ammonia and hydrogen chloride are formed. This is reaction 1.

Ammonia gas is mixed with hydrogen chloride gas. Solid ammonium chloride is formed. This is reaction 2.

Which statement is correct?

- A Both reaction 1 and reaction 2 are exothermic.
 B Reaction 2 is reversible.
 C The equation for reaction 1 is $\text{NH}_5\text{Cl} \rightarrow \text{NH}_4 + \text{HCl}$.
 D The three substances involved in each reaction all have a simple molecular structure.
- 18 In a closed flask, gases Q and R reach a dynamic equilibrium.



Which change will move the equilibrium to the right?

- A adding a catalyst
 B decreasing the temperature
 C increasing the pressure
 D increasing the volume of the flask
- 19 Which reaction is a redox reaction?
- A $\text{Mg} + 2\text{HCl} \rightarrow \text{MgCl}_2 + \text{H}_2$
 B $\text{MgCO}_3 + 2\text{HCl} \rightarrow \text{MgCl}_2 + \text{H}_2\text{O} + \text{CO}_2$
 C $\text{MgO} + 2\text{HCl} \rightarrow \text{MgCl}_2 + \text{H}_2\text{O}$
 D $\text{Mg(OH)}_2 + 2\text{HCl} \rightarrow \text{MgCl}_2 + 2\text{H}_2\text{O}$

- 20 Three separate mixtures of a solution and a solid are made, as shown in the table.

The mixtures are warmed.

In which mixtures does gas form?

	NaOH(aq) and NH ₄ Cl(s)	H ₂ SO ₄ (aq) and NH ₄ Cl(s)	H ₂ SO ₄ (aq) and Mg(s)
A	✓	✓	x
B	✓	x	✓
C	x	✓	x
D	x	x	✓

key

✓ = gas forms

x = no gas forms

- 25 The Group I metals lithium, sodium and potassium show trends in their melting points and in their reactions with water.

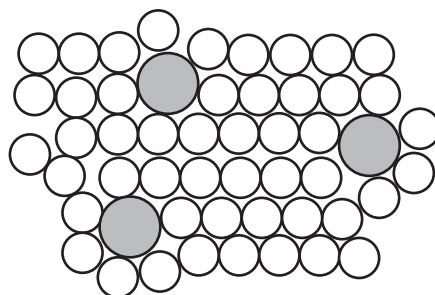
Which statement is correct going down the group from lithium to potassium?

- A Their melting points decrease and their reaction with water becomes less vigorous.
 - B Their melting points decrease and their reaction with water becomes more vigorous.
 - C Their melting points increase and their reaction with water becomes less vigorous.
 - D Their melting points increase and their reaction with water becomes more vigorous.
- 26 From their position in the Periodic Table, which properties would you expect the elements vanadium, chromium and cobalt to have?

- 1 variable oxidation states
- 2 coloured compounds
- 3 high melting points

- A 1, 2 and 3 B 1 and 2 only C 1 and 3 only D 2 and 3 only

- 27 The diagram shows the structure of an alloy.



Which statement about alloys is correct?

- A Alloys can only be formed by mixing copper or iron with other metals.
 - B High carbon steel alloys are soft and easily shaped.
 - C In an alloy there is attraction between positive ions and a 'sea of electrons'.
 - D The alloy brass has a chemical formula.
- 28 Which pair of reagents will undergo a displacement reaction?
- A Ag(s) and CuSO₄(aq)
 - B Cu(s) and MgSO₄(aq)
 - C Mg(s) and CaSO₄(aq)
 - D Zn(s) and CuSO₄(aq)

- 29 The reactivity series for some metals, with two gaps labelled **X** and **Y**, is shown.

most reactive	—————→										least reactive
K	Na	Ca	Mg	X	Zn	Y	Pb	(H)	Cu	Ag	

Which row correctly identifies metals **X** and **Y** and the method of extraction of **Y** from its ore?

	metal X	metal Y	method of extraction of Y
A	<i>Al</i>	Fe	electrolysis
B	<i>Al</i>	Fe	reduction with carbon
C	Fe	<i>Al</i>	electrolysis
D	Fe	<i>Al</i>	reduction with carbon

- 30 Iron can be extracted from the ore haematite, Fe_2O_3 .

What is the maximum mass of iron that could be produced from 500 kg of haematite?
[A_r : O, 16; Fe, 56]

- A** 160 kg **B** 240 kg **C** 350 kg **D** 420 kg

- 31 Aluminium is used to make saucepans because of its apparent lack of reactivity.

Which property of aluminium explains its unreactivity?

- A** It has a layer of oxide on its surface.
B It has a low density.
C It is a good conductor of electricity.
D It is in Group III of the Periodic Table.

- 32 Pollutant gases are released by the bacterial decay of vegetable matter.

The bacterial decay of vegetable matter is the main source of which gas?

- A** carbon monoxide
B methane
C nitrogen dioxide
D sulfur dioxide

33 Several different treatments are used to purify the water supply.

Which impurities can be removed by which treatment?

	filtration	use of carbon	chlorination
A	harmful microbes	solids	unpleasant odours and tastes
B	harmful microbes	unpleasant odours and tastes	solids
C	solids	harmful microbes	unpleasant odours and tastes
D	solids	unpleasant odours and tastes	harmful microbes

34 Which statement about the homologous series of alkanes is correct?

- A** Alkanes are unsaturated hydrocarbons.
- B** Alkanes all have the general formula C_nH_{2n} .
- C** The boiling points decrease as the number of carbon atoms per molecule increases.
- D** The liquid alkanes become more viscous as the mass of the molecules increases.

35 Which compound has the empirical formula with the greatest relative formula mass?

- A** C_2H_6 **B** C_4H_{10} **C** C_5H_{10} **D** C_6H_6

36 Which statement about vegetable oil and the margarine made from it is correct?

- A** Both are liquids at room temperature.
- B** Both occur naturally.
- C** Margarine has the higher melting point.
- D** Vegetable oil has fewer carbon-carbon double bonds than margarine.

37 When ethene reacts with steam to form ethanol, which type of reaction takes place?

- A** addition
- B** fermentation
- C** polymerisation
- D** reduction

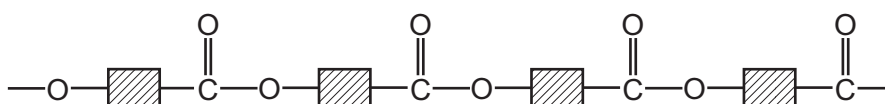
38 An ester is formed from a carboxylic acid and an alcohol.

How does the number of carbon, hydrogen and oxygen atoms in an ester differ from the total number of these atoms in the carboxylic acid and alcohol from which the ester is formed?

	carbon atoms	hydrogen atoms	oxygen atoms
A	fewer	fewer	fewer
B	fewer	same	fewer
C	same	fewer	fewer
D	same	same	same

39 Poly(lactic) acid is a polymer used to make biodegradable cups.

The partial structure of poly(lactic) acid is shown.



Which statements apply to poly(lactic) acid?

- 1 It is made by addition polymerisation.
- 2 It is made by condensation polymerisation.
- 3 It is a polyester.
- 4 The monomer used to make it is ethene.

A 1 and 3 **B** 1 and 4 **C** 2 and 3 **D** 2 and 4

40 Two large molecules, P and Q, both contain the same linkage.

P occurs naturally but Q does not.

Which row could be P and Q?

	P	Q
A	fat	nylon
B	fat	<i>Terylene</i>
C	nylon	protein
D	protein	<i>Terylene</i>

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The Periodic Table of Elements

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		Key proton (atomic) number atomic symbol name relative atomic mass		1 H hydrogen 1																																																																																			
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The volume of one mole of any gas is 24 dm³ at room temperature and pressure (r.t.p.).

CHEMISTRY

5070/12

Paper 1 Multiple Choice

May/June 2019

1 hour

Additional Materials: Multiple Choice Answer Sheet
Soft clean eraser
Soft pencil (type B or HB is recommended)

READ THESE INSTRUCTIONS FIRST

Write in soft pencil.

Do not use staples, paper clips, glue or correction fluid.

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There are **forty** questions on this paper. Answer **all** questions. For each question there are four possible answers **A, B, C** and **D**.

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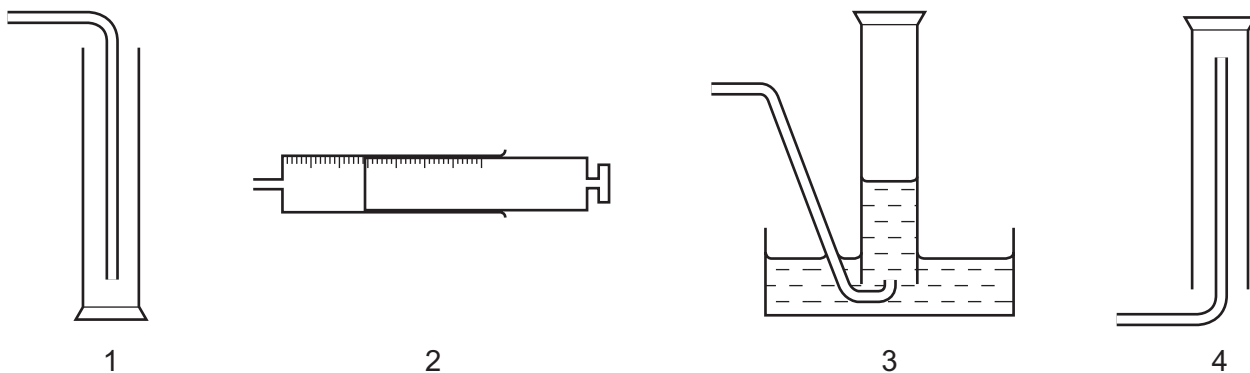
Any rough working should be done in this booklet.

A copy of the Periodic Table is printed on page 16.

Electronic calculators may be used.

This document consists of **14** printed pages and **2** blank pages.

1 The diagrams show four different methods of collecting gases.



Which method is suitable for collecting a gas which has the properties described?

	method for collecting gas	properties of gas
A	1	less dense than air and soluble in water
B	2	denser than air and soluble in water
C	3	less dense than air and soluble in water
D	4	denser than air and insoluble in water

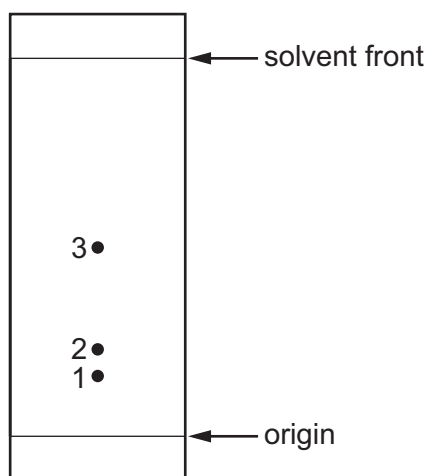
2 After acidification with dilute nitric acid, a colourless solution of **X** reacts with aqueous silver nitrate to give a white precipitate.

What could **X** be?

- A** calcium iodide
- B** copper(II) chloride
- C** lead(II) iodide
- D** sodium chloride

- 3 The diagram represents a chromatogram of the colourless acids present in a drink. The chromatogram has been treated with a locating agent.

A table of R_f values for the possible acids is given.



acid	R_f value
tartaric	0.14
citric	0.16
malic	0.23
lactic	0.45
succinic	0.50

Which acids are present in the drink?

- A** citric acid, malic acid and lactic acid
B citric acid, malic acid and succinic acid
C malic acid, lactic acid and succinic acid
D tartaric acid, citric acid and malic acid
- 4 Which gas will diffuse at the fastest rate at the same temperature and pressure?
- A** Ar **B** C₃H₈ **C** CO₂ **D** F₂
- 5 Two particles, K⁺ and Ar, can be written as ${}_{19}^{39}\text{K}^+$ and ${}_{18}^{40}\text{Ar}$.

Which statement about these particles is correct?

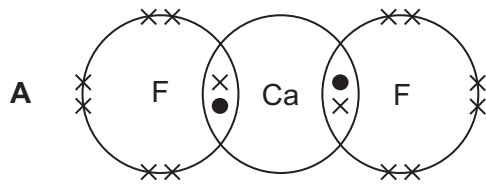
- A** Ar has more neutrons than K⁺.
B K has more nucleons than Ar.
C K⁺ has 20 electrons.
D K⁺ has a greater mass than Ar.

- 6 A mineral deposit is found to contain small grains made entirely of the element carbon.

Which property will **definitely** be true of the grains of carbon?

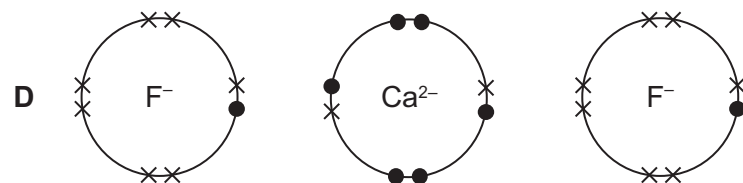
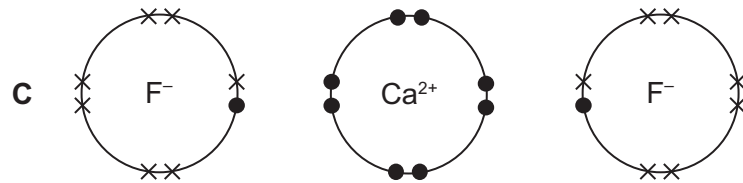
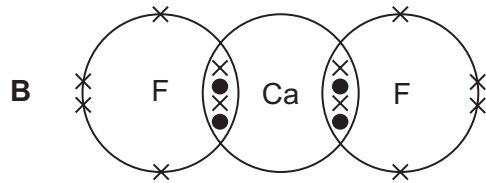
- A They will be made of atoms arranged in layers.
 B They will be soft.
 C They will burn to give carbon dioxide.
 D They will conduct electricity.

- 7 Which diagram shows the outer electron arrangement in calcium fluoride?



key

- an electron from calcium
 × an electron from fluorine



- 8 How many shared pairs of electrons are there in one carbon dioxide molecule?

- A 2 B 4 C 8 D 12

9 Two statements about metals are given.

- 1 Metals contain a lattice of negative ions in a 'sea of electrons'.
- 2 The electrical conductivity of metals is related to the mobility of the electrons in the structure.

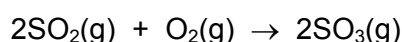
Which is correct?

- A** Both statements are correct and statement 1 explains statement 2.
B Both statements are correct but statement 1 does not explain statement 2.
C Statement 1 is correct and statement 2 is incorrect.
D Statement 2 is correct and statement 1 is incorrect.
- 10 Powdered calcium carbonate reacts with dilute hydrochloric acid to produce calcium chloride, water and carbon dioxide.

What is the correct ionic equation, including state symbols, for this reaction?

- A** $\text{CaCO}_3(\text{s}) + 2\text{HCl}(\text{aq}) \rightarrow \text{CaCl}_2(\text{aq}) + \text{H}_2\text{O}(\text{l}) + \text{CO}_2(\text{g})$
B $\text{Ca}^{2+}(\text{aq}) + \text{CO}_3^{2-}(\text{aq}) + 2\text{H}^+(\text{aq}) \rightarrow \text{Ca}^{2+}(\text{aq}) + \text{H}_2\text{O}(\text{l}) + \text{CO}_2(\text{g})$
C $\text{CO}_3^{2-}(\text{aq}) + 2\text{H}^+(\text{aq}) \rightarrow \text{H}_2\text{O}(\text{l}) + \text{CO}_2(\text{g})$
D $\text{CaCO}_3(\text{s}) + 2\text{H}^+(\text{aq}) \rightarrow \text{Ca}^{2+}(\text{aq}) + \text{H}_2\text{O}(\text{l}) + \text{CO}_2(\text{g})$
- 11 Which mass of carbon contains the same number of atoms as 16.0 g of sulfur?
A 0.5g **B** 6.0g **C** 8.0g **D** 12.0g

12 3.0 dm³ of sulfur dioxide is reacted with 2.0 dm³ of oxygen.



Assuming the reaction goes to completion and that all gases are at room temperature and pressure, which volume of sulfur trioxide is formed?

- A** 2.0 dm³ **B** 3.0 dm³ **C** 4.0 dm³ **D** 5.0 dm³
- 13 A sample of magnesium hydroxide, Mg(OH)₂, is made by adding an excess of aqueous sodium hydroxide to an aqueous solution containing 1.20 g magnesium sulfate, MgSO₄.

The mass of magnesium hydroxide formed is 0.26 g.

What is the percentage yield of magnesium hydroxide?

- A** 10.5% **B** 21.7% **C** 44.8% **D** 61.9%

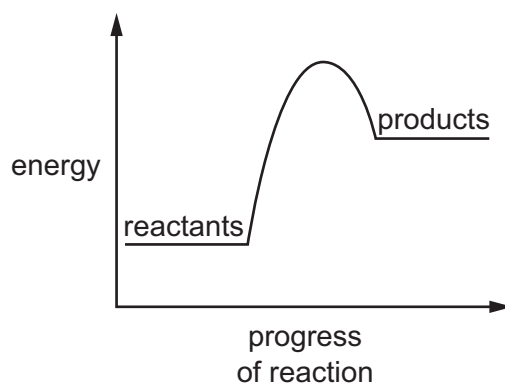
- 14 When concentrated aqueous sodium chloride is electrolysed using inert electrodes, which product is formed at the cathode and which product is formed at the anode?

	cathode product	anode product
A	hydrogen	chlorine
B	hydrogen	oxygen
C	sodium	chlorine
D	sodium	oxygen

- 15 Which negative ions are present in aqueous copper(II) sulfate?

- A** copper(II) ions and hydrogen ions
B copper(II) ions only
C sulfate ions and hydroxide ions
D sulfate ions only

- 16 The diagram shows the energy profile of a chemical reaction.



Which row is correct?

	the reaction that is endothermic	the reaction with greater activation energy
A	backward reaction	backward reaction
B	backward reaction	forward reaction
C	forward reaction	backward reaction
D	forward reaction	forward reaction

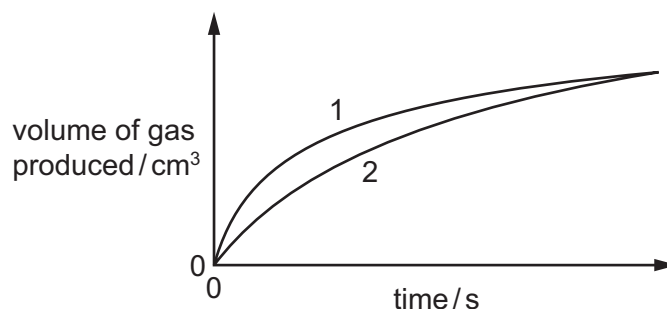
17 The table shows the energy released by the complete combustion of some compounds.

compound	formula	M_r	ΔH in kJ/mol
benzene	C_6H_6	78	-3270
heptane	C_7H_{16}	100	-4800
octane	C_8H_{18}	114	-5510
propane	C_3H_8	44	-2200

Which compound releases the least energy when 1 g is completely burned?

- A** benzene
B heptane
C octane
D propane
- 18 An experiment is carried out to measure the rate of reaction between magnesium and dilute hydrochloric acid under two different conditions. The mass of magnesium and the number of moles of hydrochloric acid are the same in both experiments.

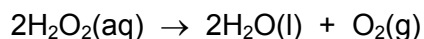
Graphs of the results are shown.



Which statements could explain the difference between graph 1 and graph 2?

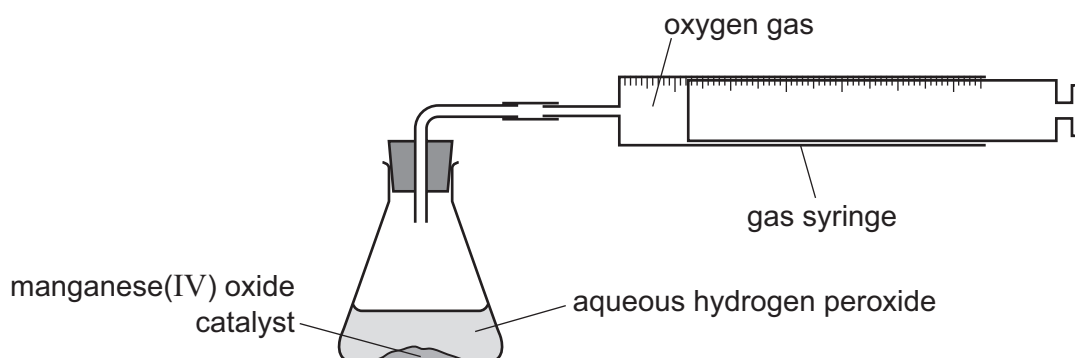
- 1 Graph 1 results are obtained at a higher temperature.
 - 2 Graph 1 results are obtained by using hydrochloric acid that is more concentrated.
 - 3 Graph 1 results are obtained using smaller pieces of magnesium.
- A** 1, 2 and 3 **B** 1 and 2 only **C** 1 and 3 only **D** 2 and 3 only

- 19 Hydrogen peroxide decomposes slowly at room temperature.



The reaction can be catalysed by adding manganese(IV) oxide.

The diagram shows the apparatus that can be used to monitor the rate of this reaction.



Which statement is correct when a catalyst is added to the aqueous hydrogen peroxide?

- A The catalyst increases the activation energy for the reaction.
 - B The catalyst is used up during the reaction.
 - C The gas syringe fills up more quickly when the catalyst is added.
 - D The total amount of oxygen produced increases when the catalyst is added.
- 20 Reduction can be defined in terms of the gain or loss of oxygen or of hydrogen or of electrons.

Which row correctly describes all three definitions of reduction?

	oxygen	hydrogen	electrons
A	gain	loss	loss
B	gain	loss	gain
C	loss	loss	loss
D	loss	gain	gain

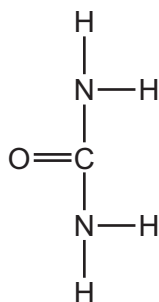
- 21 Why is ethanoic acid described as a weak acid?

- A It is an organic acid.
- B It is a poor conductor of electricity.
- C It is only slightly dissociated in water.
- D It reacts only with very reactive metals.

22 What is the best method to prepare a sample of silver chloride?

- A Add silver nitrate to chlorine.
- B Add silver to hydrochloric acid.
- C Burn silver in chlorine.
- D Mix aqueous solutions of silver nitrate and sodium chloride.

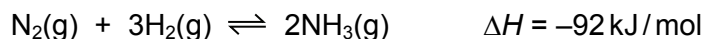
23 The nitrogenous fertiliser urea has the structure shown.



Which percentage, by mass, of nitrogen does it contain?

- A 23.3
- B 25.0
- C 43.8
- D 46.7

24 Ammonia is manufactured by the Haber process.



For this reaction, which rows give a true statement together with a correct reason?

	statement	reason
1	Nitrogen and hydrogen are mixed in the ratio 1 : 3 by volume.	The formula of ammonia is NH_3 .
2	The pressure used is approximately 200 atmospheres.	A high pressure is needed to produce a good yield of ammonia at equilibrium.
3	The temperature used is approximately 450°C .	A high temperature is needed to produce a good yield of ammonia at equilibrium.
4	Vanadium(V) oxide is used as a catalyst.	A catalyst speeds up the rate of the reaction.

- A 1 and 2 only
- B 2 and 3 only
- C 3 and 4 only
- D 1, 2 and 3 only

25 Which uses for sulfuric acid are correct?

- 1 as a bleach in the manufacture of wood pulp for paper
- 2 as a food preservative in tinned foods
- 3 as a raw material in the manufacture of detergents
- 4 as a fertiliser

A 1 and 3 B 2 and 4 C 2 only D 3 only

26 The atomic number of element X is 12.

What is the formula of the chloride of X?

A X_2Cl B XCl C XCl_2 D XCl_4

27 Which property is common to ^{40}Ca , ^{39}K and ^{23}Na ?

- A Their atoms all have more neutrons than protons.
- B Their ions all have eight electrons in their outer shell.
- C They all sink when added to water.
- D They are all deposited at the positive electrode when their molten chloride is electrolysed.

28 Which statement about transition elements is correct?

- A Their soluble salts usually form coloured aqueous solutions.
- B They are all in the same group of the Periodic Table.
- C They are non-metals with high melting points.
- D They can be mixed together to form compounds.

29 Three different elements react by losing electrons. The ions formed all have the electronic configuration 2,8.

Which statement about these elements is correct?

- A They are in the same group.
- B They are in the same period.
- C They are noble gases.
- D They are transition elements.

30 Metal M is displaced from aqueous M nitrate by copper.

Which statement about metal M and its compounds is correct?

- A M carbonate is stable when heated.
- B M oxide is reduced to M by heating with carbon.
- C M reacts with dilute hydrochloric acid to give hydrogen.
- D M reduces zinc oxide to zinc on heating.

31 Which statement about some of the gases present in air is correct?

- A Dry air contains about 78% of oxygen.
- B Methane is produced by the incomplete combustion of fossil fuels.
- C Sulfur dioxide is released by volcanoes.
- D The noble gases make up about 5% of dry air.

32 Which treatment process is used to disinfect water?

- A adding carbon
- B chlorination
- C desalination
- D filtration

33 A molecule of compound Q has three C–C single bonds and ten C–H bonds only. It has no other bonds.

Which statement about compound Q is correct?

- A It can be polymerised.
- B It decolourises bromine water.
- C It has three isomers.
- D It reacts with chlorine by substitution.

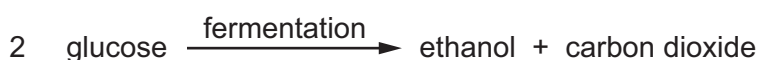
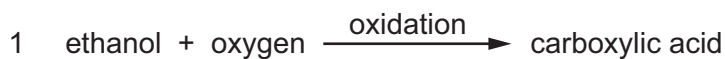
34 Which organic compound requires the least number of moles of oxygen for the complete combustion of one mole of the compound?

- A C_3H_7OH B C_3H_7COOH C C_3H_8 D C_4H_8

35 Which reaction is an addition reaction?

- A making ethane and ethene from butane
- B making ethene and hydrogen from butane
- C the manufacture of margarine from a vegetable oil
- D the reaction between ethene and oxygen, giving carbon dioxide and water

36 Two equations involving ethanol are shown.



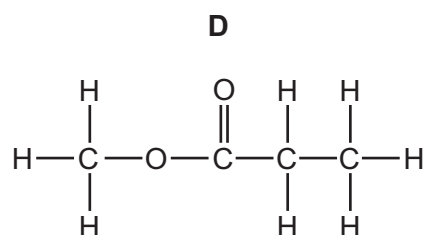
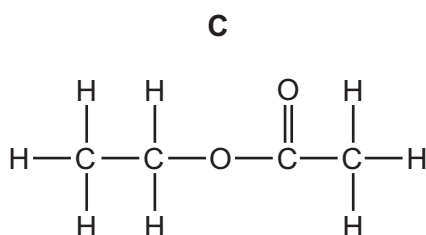
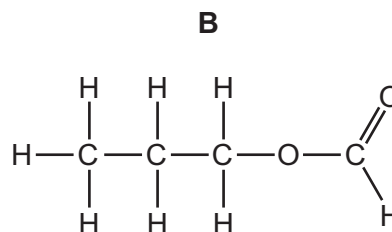
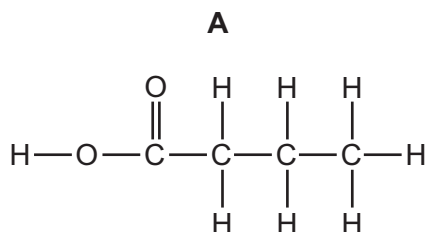
Which row is correct?

	molecular formula of carboxylic acid in 1	a catalyst is needed
A	CH ₃ CO ₂ H	1 only
B	C ₂ H ₅ CO ₂ H	1 only
C	CH ₃ CO ₂ H	2 only
D	C ₂ H ₅ CO ₂ H	2 only

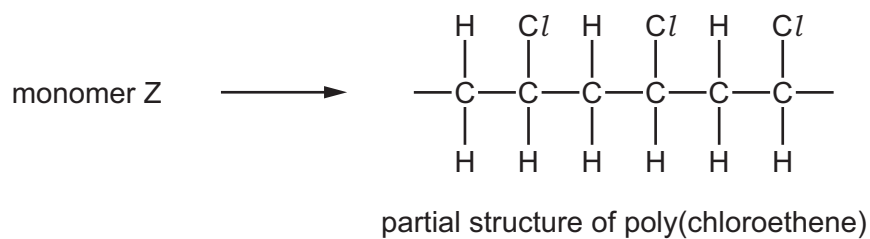
37 What is the empirical formula of ethanoic acid?

- A CH₂O
- B CH₄O
- C C₂H₃O
- D C₂H₄O₂

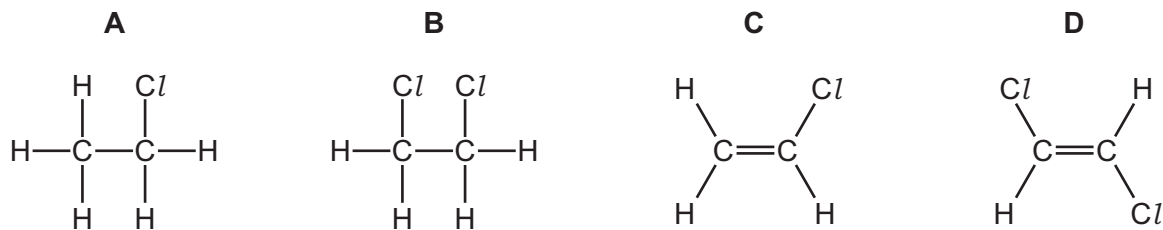
38 Which structure represents propyl methanoate?



39 Monomer Z is used to make poly(chloroethene).



What is monomer Z?



40 *Terylene*, a man-made fibre, is used to make clothing.

Which row correctly describes how *Terylene* is manufactured?

	starting materials	type of polymerisation
A	an acid and an alcohol	addition
B	an acid and an alcohol	condensation
C	an alkene	addition
D	an alkene	condensation

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The Periodic Table of Elements

		Group																				
I	II	III	IV	V	VI	VII	VIII															
3 Li lithium 7	4 Be beryllium 9	11 Na sodium 23	12 Mg magnesium 24	19 K potassium 39	20 Ca calcium 40	21 Sc scandium 45	22 Ti titanium 48	23 V vanadium 51	24 Cr chromium 52	25 Mn manganese 55	26 Fe iron 56	27 Co cobalt 59	28 Ni nickel 59	29 Cu copper 64	30 Zn zinc 65	31 Ga gallium 70	32 Ge germanium 73	33 As arsenic 75	34 Se selenium 79	35 Br bromine 80	36 Kr krypton 84	
37 Rb rubidium 85	38 Sr strontium 88	39 Y yttrium 89	57-71 lanthanoids	72 Hf hafnium 178	73 Ta tantalum 181	74 W tungsten 184	75 Re rhenium 186	76 Os osmium 190	77 Ir iridium 192	78 Pt platinum 195	79 Au gold 197	80 Hg mercury 201	81 Tl thallium 204	82 Pb lead 207	83 Bi bismuth 209	84 Po polonium —	85 At astatine —	86 Rn radon —				
87 Fr francium —	88 Ra radium —	89 Ac actinium —	89-103 actinoids	104 Rf rutherfordium —	105 Db dubnium —	106 Sg seaborgium —	107 Bh bohrium —	108 Hs hassium —	109 Mt meitnerium —	110 Ds darmstadtium —	111 Rg roentgenium —	112 Cn copernicium —	114 Fl flerovium —	116 Lv livermorium —								

Key
atomic number
atomic symbol
name
relative atomic mass

1
H
hydrogen
1

57 La lanthanum 139	58 Ce cerium 140	59 Pr praseodymium 141	60 Nd neodymium 144	61 Pm promethium —	62 Sm samarium 150	63 Eu europium 152	64 Gd gadolinium 157	65 Tb terbium 159	66 Dy dysprosium 163	67 Ho holmium 165	68 Er erbium 167	69 Tm thulium 169	70 Yb ytterbium 173	71 Lu lutetium 175
89 Ac actinium —	90 Th thorium 232	91 Pa protactinium 231	92 U uranium 238	93 Np neptunium —	94 Pu plutonium —	95 Am americium —	96 Cm curium —	97 Bk berkelium —	98 Cf californium —	99 Es einsteinium —	100 Fm fermium —	101 Md mendelevium —	102 No nobelium —	103 Lr lawrencium —

lanthanoids

actinoids

The volume of one mole of any gas is 24 dm³ at room temperature and pressure (r.t.p.).

CHEMISTRY

5070/12

Paper 1 Multiple Choice

October/November 2019

1 hour

Additional Materials: Multiple Choice Answer Sheet
 Soft clean eraser
 Soft pencil (type B or HB recommended)

READ THESE INSTRUCTIONS FIRST

Write in soft pencil.

Do not use staples, paper clips, glue or correction fluid.

Write your name, centre number and candidate number on the Answer Sheet in the spaces provided unless this has been done for you.

DO NOT WRITE IN ANY BARCODES.

There are **forty** questions on this paper. Answer **all** questions. For each question there are four possible answers **A, B, C** and **D**.

Choose the **one** you consider correct and record your choice in **soft pencil** on the separate Answer Sheet.

Read the instructions on the Answer Sheet very carefully.

Each correct answer will score one mark. A mark will not be deducted for a wrong answer.

Any rough working should be done in this booklet.

A copy of the Periodic Table is printed on page 16.

Electronic calculators may be used.

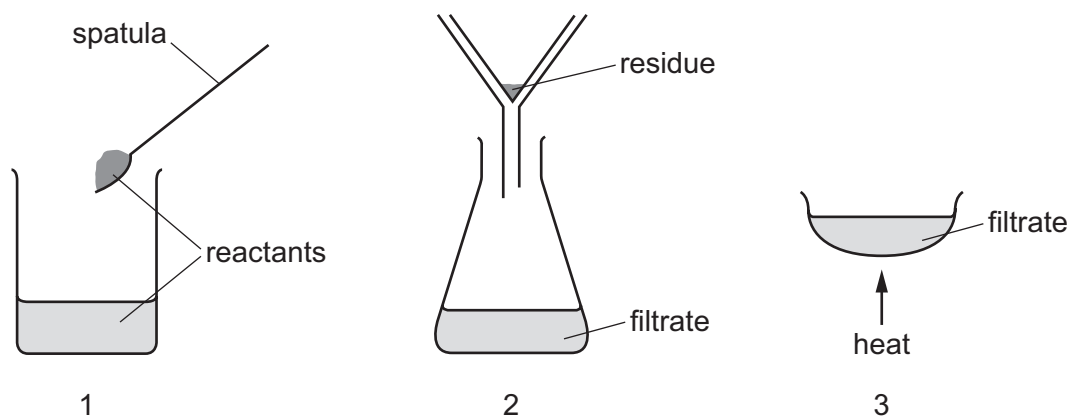
This document consists of **15** printed pages and **1** blank page.



- 1 The concentration of aqueous sodium carbonate can be found by reaction with hydrochloric acid of known concentration. The indicator methyl orange is used.

Which items of equipment are needed?

- A burette, measuring cylinder, gas syringe
 B burette, measuring cylinder, thermometer
 C burette, pipette, conical flask
 D burette, pipette, stopwatch
- 2 The diagrams show three stages, 1, 2 and 3, used in the preparation of a salt.



Which row correctly shows the solubilities both of the reactants and of the salt formed in this preparation?

	solubility of reactants	solubility of salt formed
A	both soluble	insoluble
B	both soluble	soluble
C	one soluble, one insoluble	insoluble
D	one soluble, one insoluble	soluble

- 3 The nucleon number of an atom is typically greater than its proton number. The difference between these two numbers indicates the number of1..... in the atom.

Atoms that have different nucleon numbers but the same proton number are called2..... .

Which words correctly complete gaps 1 and 2?

	1	2
A	electrons	isomers
B	electrons	isotopes
C	neutrons	isomers
D	neutrons	isotopes

- 4 Which three elements exist as diatomic molecules at room temperature?

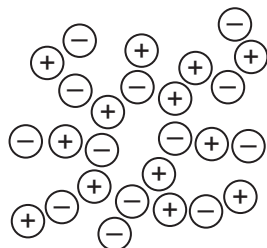
- A** hydrogen, oxygen, helium
- B** nitrogen, chlorine, neon
- C** nitrogen, oxygen, fluorine
- D** oxygen, chlorine, helium

- 5 Which is a pure compound?

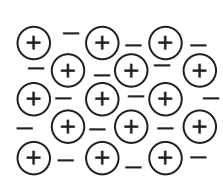
- A** dry air
- B** ethanol
- C** steel
- D** petrol (gasoline)

6 Which diagram best represents the structure of a solid metal?

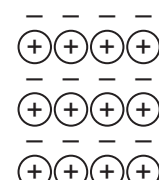
A



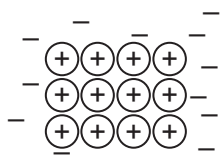
B



C

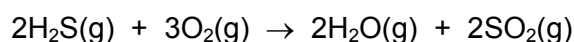


D



key
 ⊖ a negative ion
 ⊕ a positive ion
 - an electron

7 Hydrogen sulfide burns in an excess of oxygen according to the equation shown.



48 dm³ of hydrogen sulfide is burned.

Which volume of sulfur dioxide will be formed at room temperature and pressure?

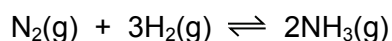
[All volumes are measured at the same temperature and pressure.]

- A** 24 dm³ **B** 36 dm³ **C** 48 dm³ **D** 96 dm³

8 Which statement about electrical conductivity is correct?

- A** Covalent compounds, such as glucose, conduct when molten or dissolved in water.
B Dilute acids, such as sulfuric acid, conduct because all the ions are free to move.
C Ionic compounds, such as sodium chloride, conduct due to movement of electrons.
D Metals, such as copper, conduct due to movement of positive ions.

9 Ammonia is manufactured from nitrogen and hydrogen by the Haber process.



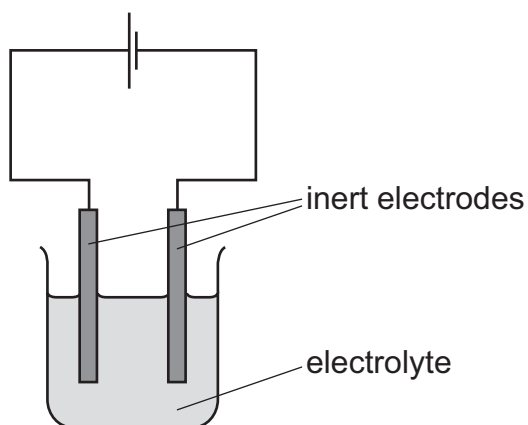
What is the percentage yield when 60 kg of ammonia is produced from 60 kg of hydrogen?

- A** 5.9% **B** 17.6% **C** 35.3% **D** 50.0%

10 What is the ratio of the number of molecules in 71 g of gaseous chlorine to the number of molecules in 2 g of gaseous hydrogen?

- A 1:1 B 1:2 C 2:1 D 71:2

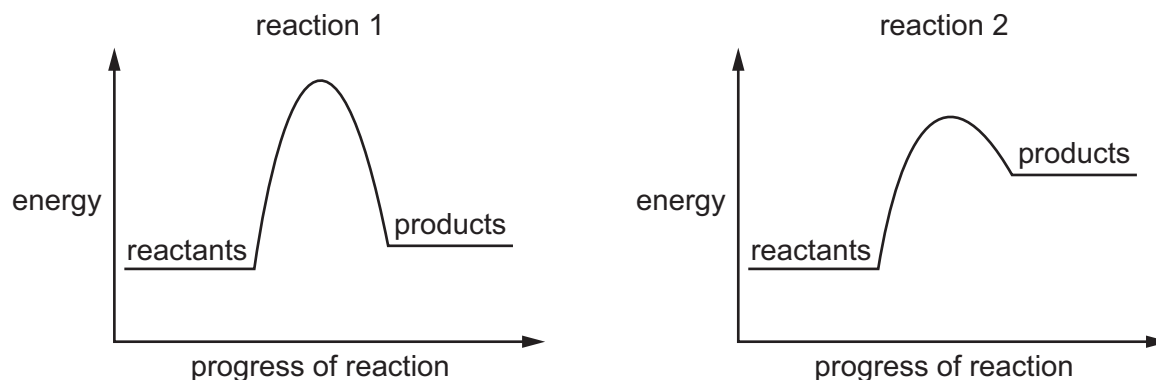
11 The diagram shows the apparatus for an electrolysis experiment.



Using the apparatus shown, which electrolyte would give colourless gases at both electrodes?

- A aqueous copper(II) sulfate
B concentrated aqueous sodium chloride
C dilute sulfuric acid
D molten lead bromide
- 12 Which metal is most likely to be extracted from its molten chloride by the use of electrolysis?
- A calcium
B copper
C iron
D silver

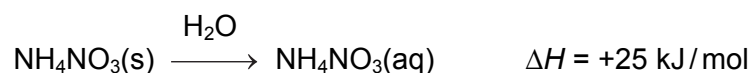
13 Two energy profile diagrams are shown. The scale on the y-axis is the same for both diagrams.



Which statement is correct?

- A Both reactions are exothermic.
- B Only one reaction is endothermic.
- C The activation energy of reaction 1 is smaller than the activation energy of reaction 2.
- D The enthalpy change of reaction 2 is larger than the enthalpy change of reaction 1.

14 Ammonium nitrate dissolves in water.



Which statements are correct?

- 1 The reaction is endothermic.
- 2 The water gets colder during the reaction.
- 3 Heat energy is absorbed by the ammonium nitrate from the water.

- A 1 and 2 only B 1 and 3 only C 2 and 3 only D 1, 2 and 3

15 Which statement about photosynthesis is correct?

- A Chlorophyll is a reactant.
- B Oxygen is a product.
- C Sunlight is a reactant.
- D Water is a product.

16 In which reaction is the underlined substance reduced?

- A C(s) + CO₂(g) → 2CO(g)
B Cl₂(g) + 2I⁻(aq) → I₂(aq) + 2Cl⁻(aq)
C Mg(s) + CuO(s) → MgO(s) + Cu(s)
D Zn(s) + 2H⁺(aq) → Zn²⁺(aq) + H₂(g)

17 Catalysts alter the rate of chemical reactions.

Which statements correctly describe the effect of adding a catalyst to a reaction?

- 1 All reactant particles have more energy and move faster.
- 2 The activation energy is lowered.
- 3 More reactant particles collide with enough energy to react.

A 1, 2 and 3 B 1 and 3 only C 2 and 3 only D 3 only

18 Solution T has the following properties.

- 1 It reacts with magnesium forming a gas.
- 2 It reacts with calcium carbonate forming a gas.

Which statement about solution T is correct?

- A It contains more OH⁻ ions than H⁺ ions.
B It has pH 9.
C Its reaction with calcium carbonate produces hydrogen.
D It reacts with aqueous ammonia.

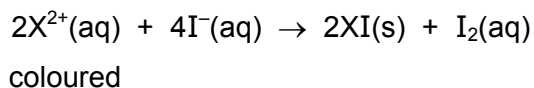
19 Which substance is soluble in water?

- A copper(II) carbonate
B copper(II) oxide
C copper(II) hydroxide
D copper(II) nitrate

20 Which statement about ammonia is correct?

- A It is a colourless, odourless gas.
B It is a gas that turns damp blue litmus paper red.
C It is formed when potassium nitrate is heated with aqueous sodium hydroxide and aluminium.
D It is manufactured using vanadium(V) oxide as a catalyst.

24 The ions of metal X react with aqueous potassium iodide.



From this information, it can be deduced that X is most likely a1..... metal and the $X^{2+}(aq)$ ions are2..... .

Which words correctly complete gaps 1 and 2?

	1	2
A	Group II	oxidised
B	Group II	reduced
C	transition	oxidised
D	transition	reduced

25 Which substance is a metal?

	melting point	conducts electricity when solid	conducts electricity when molten
A	high	x	✓
B	high	x	x
C	high	✓	✓
D	low	x	x

26 Which metal can be obtained from its oxide by using either carbon or hydrogen?

- A** Cu **B** Fe **C** Mg **D** Zn

27 Metal carbonates decompose when heated.

Which carbonate is most stable to heat?

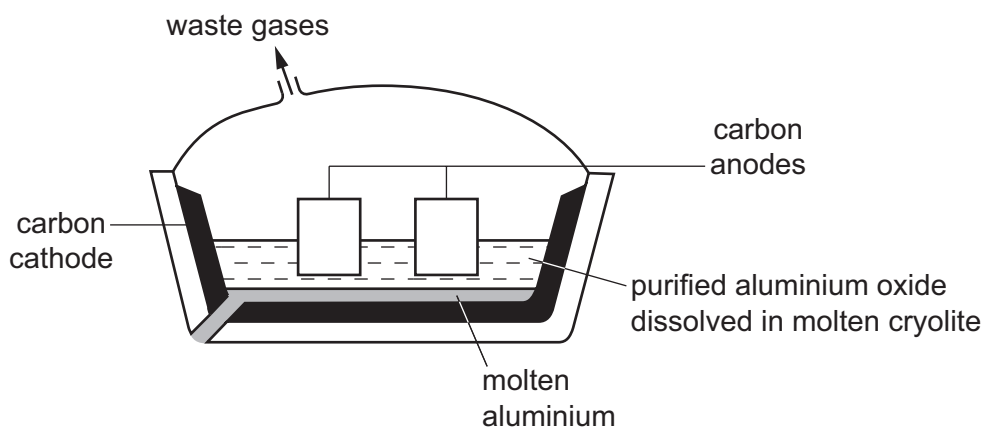
- A** calcium carbonate
B copper(II) carbonate
C lead(II) carbonate
D zinc carbonate

28 Iron is extracted from its ore in a blast furnace. Coke and limestone are also added to the blast furnace.

What is the purpose of the limestone?

- A to decompose to release oxygen to burn the coke
- B to decompose to release oxygen to oxidise the iron
- C to decompose to neutralise the acidic impurities
- D to react with coke to heat the blast furnace

29 Aluminium is extracted from aluminium oxide by electrolysis.



Which statement about this electrolysis is correct?

- A Aluminium ions gain electrons to form aluminium.
- B Cryolite increases the melting point of the electrolyte.
- C Cryolite reacts with impurities to form slag.
- D The carbon cathode has to be replaced regularly as it reacts with oxygen.

30 Steel is produced by blowing oxygen into impure molten iron.

A student suggests two reasons why this process is carried out.

- 1 The oxygen removes some of the carbon from the impure iron.
- 2 The oxygen oxidises iron(II) ions to iron(III) ions.

Which reasons are correct?

- A both 1 and 2
- B 1 only
- C 2 only
- D neither 1 nor 2

31 Z is a pollutant gas that is formed in internal combustion engines.

An aqueous solution of Z is acidic.

Z is removed from the exhaust gases in a catalytic converter by reduction.

What is Z?

- A** CO **B** N₂ **C** H₂O **D** NO₂

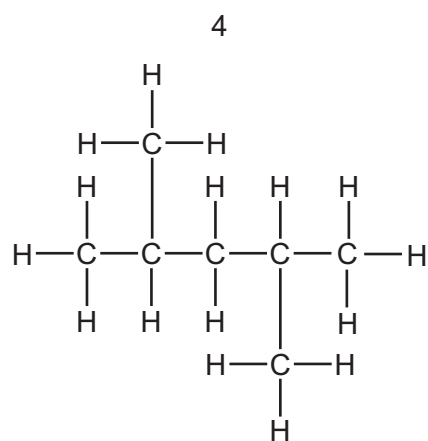
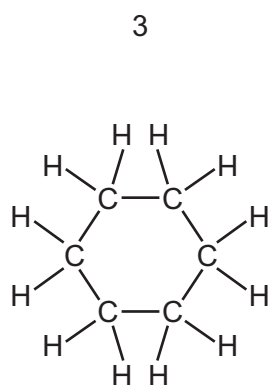
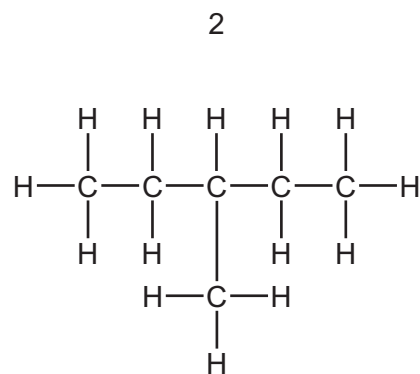
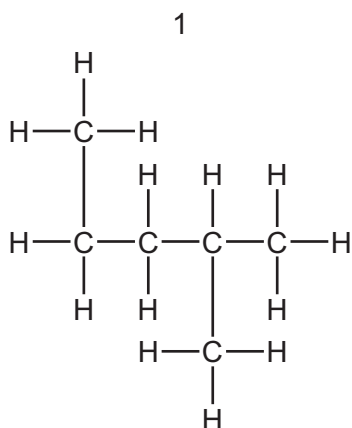
32 A student investigates the properties of a colourless organic liquid.

Which observation shows that the liquid is unsaturated?

- A** It decolourises aqueous bromine.
B It has a sweet smell.
C It is a good solvent for organic compounds.
D It produces carbon dioxide when burned.

33 Alkanes are saturated compounds containing carbon and hydrogen only.

Structures 1, 2, 3 and 4 are saturated hydrocarbons.



Which pair of structures are isomers?

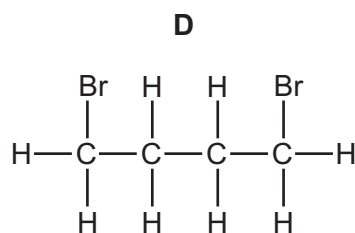
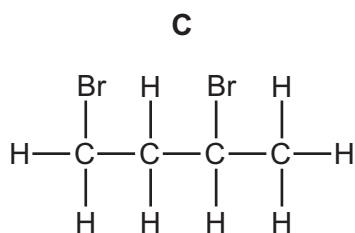
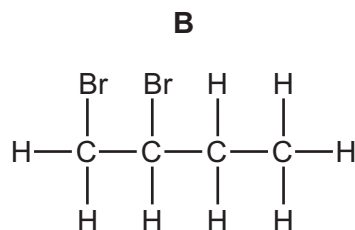
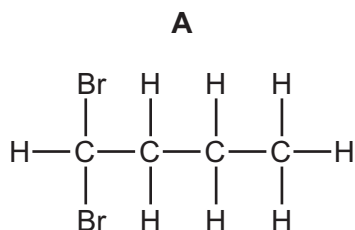
A 1 and 2

B 1 and 4

C 2 and 3

D 2 and 4

34 When butene reacts with bromine, which compound could be made?



35 Which statement about propene is correct?

- A** It can be formed by cracking butane.
- B** It has the formula C_3H_8 .
- C** It is a saturated hydrocarbon.
- D** It reacts with hydrogen to form ethane.

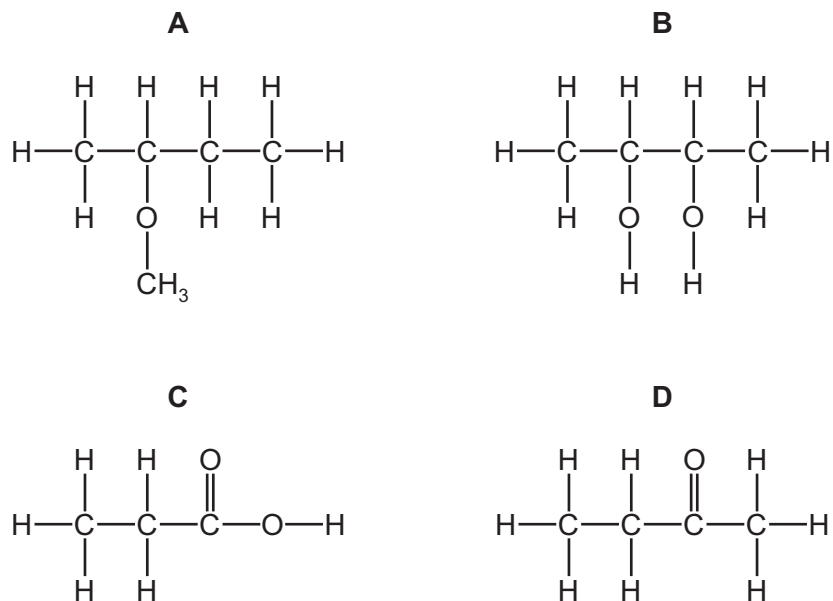
36 Which term describes the structure of *Terylene*?

- A** polyalkene
- B** polyamide
- C** polyester
- D** protein

37 Which process is involved in the formation of ethanol from ethene?

- A** addition
- B** combustion
- C** polymerisation
- D** substitution

38 Which compound is an alcohol?



39 Which two compounds react together to form $\text{CH}_3\text{CH}_2\text{COOCH}_3$?

- A ethanoic acid and ethanol
- B methanoic acid and ethanol
- C methanoic acid and propanol
- D propanoic acid and methanol

40 Which compound might be suitable to flavour a soft drink?

- A $\text{CH}_3\text{CH}_2\text{CH}_2\text{COOCH}_3$
- B $\text{CH}_3\text{CH}_2\text{CH}_2\text{CH}_2\text{CH}_2\text{OH}$
- C $\text{CH}_3\text{CH}_2\text{CH}_2\text{CH}_2\text{COOH}$
- D $\text{CH}_3\text{CHCHCH}_2\text{CH}_3$

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Cambridge O Level

CHEMISTRY

5070/12

Paper 1 Multiple Choice

May/June 2020

1 hour

You must answer on the multiple choice answer sheet.

You will need: Multiple choice answer sheet
Soft clean eraser
Soft pencil (type B or HB is recommended)

INSTRUCTIONS

- There are **forty** questions on this paper. Answer **all** questions.
- For each question there are four possible answers **A, B, C** and **D**. Choose the **one** you consider correct and record your choice in soft pencil on the multiple choice answer sheet.
- Follow the instructions on the multiple choice answer sheet.
- Write in soft pencil.
- Write your name, centre number and candidate number on the multiple choice answer sheet in the spaces provided unless this has been done for you.
- Do **not** use correction fluid.
- Do **not** write on any bar codes.
- You may use a calculator.

INFORMATION

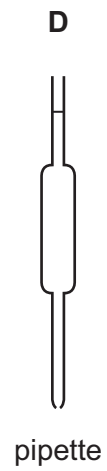
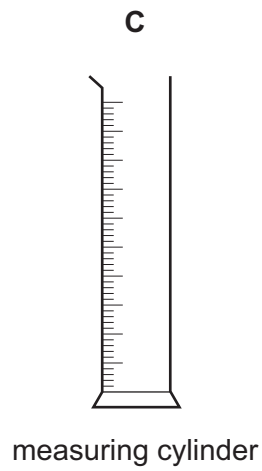
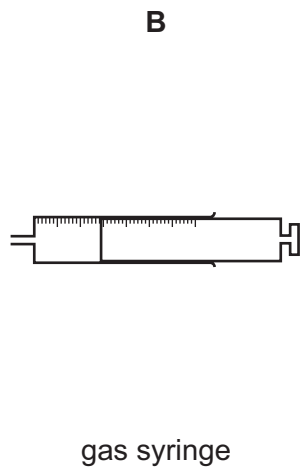
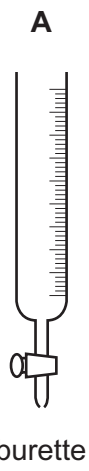
- The total mark for this paper is 40.
- Each correct answer will score one mark. A mark will not be deducted for a wrong answer.
- Any rough working should be done on this question paper.
- The Periodic Table is printed in the question paper.

This document has **20** pages. Blank pages are indicated.

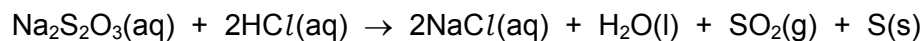


- 1 The diagram shows four pieces of apparatus that are used to measure the volume of a gas or liquid.

Which piece of apparatus should always be filled to the same level?



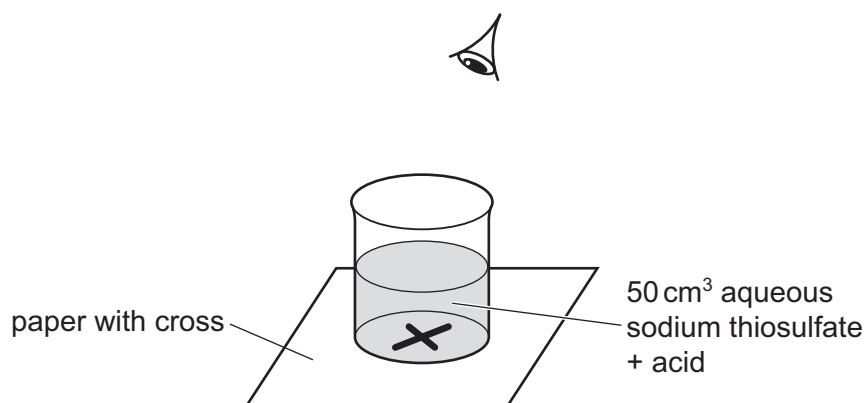
2 Aqueous sodium thiosulfate reacts with acid to make a precipitate of sulfur.



A student investigates the effect of temperature on the rate of this reaction.

The student:

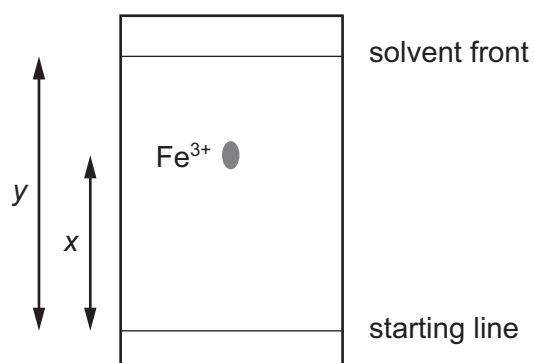
- places a piece of paper with a cross on it below the reaction mixture as shown in the diagram
- measures the time taken for the cross to no longer be seen
- repeats the reaction at different temperatures.



Which apparatus is needed for this investigation?

- A** balance, pipette, stop-clock
- B** balance, stop-clock, thermometer
- C** burette, gas syringe, thermometer
- D** measuring cylinder, stop-clock, thermometer

- 3 A paper chromatography experiment is carried out to find an R_f value for $\text{Fe}^{3+}(\text{aq})$. The result is shown.



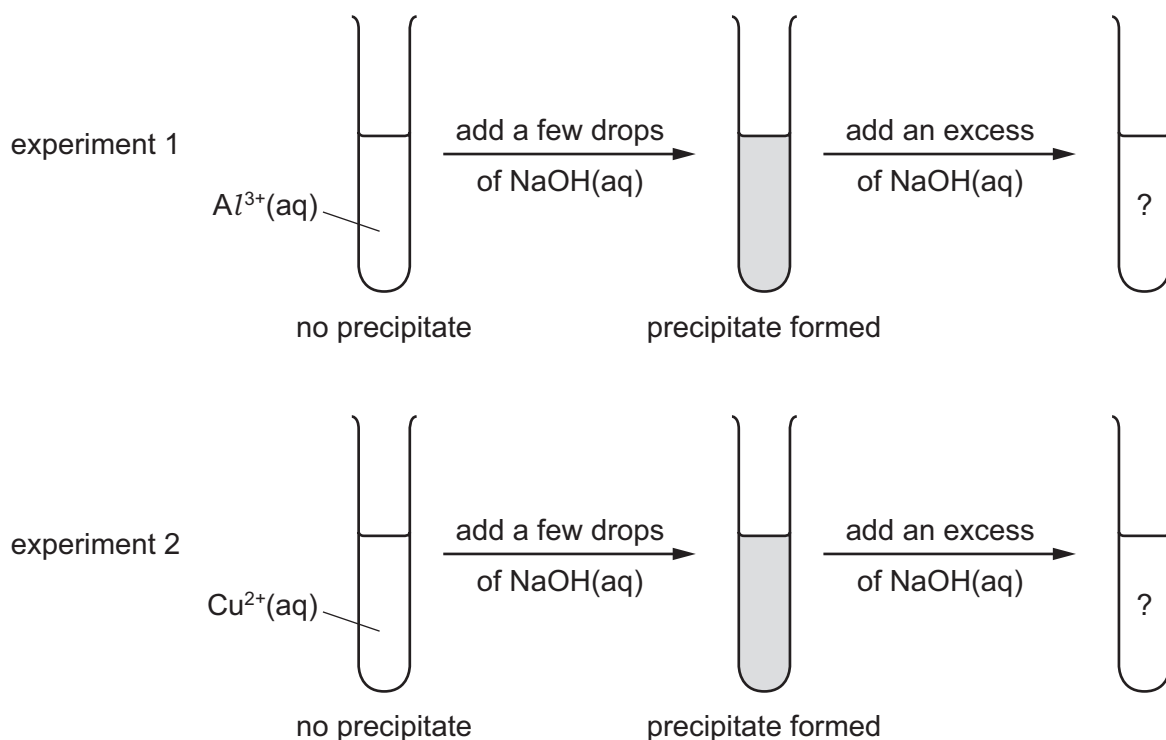
To make the spot containing $\text{Fe}^{3+}(\text{aq})$ more visible, the paper is sprayed with aqueous sodium hydroxide so that a precipitate of iron(III) hydroxide forms.

Under the conditions of the experiment, the R_f of $\text{Fe}^{3+}(\text{aq})$ is given by1..... and the colour of the precipitate is2..... .

Which row correctly completes gaps 1 and 2?

	gap 1	gap 2
A	$\frac{x}{y}$	red-brown
B	$\frac{x}{y}$	green
C	$\frac{y}{x}$	red-brown
D	$\frac{y}{x}$	green

4 The diagram shows two experiments.



What are the results of adding an excess of NaOH(aq) in each experiment?

	experiment 1	experiment 2
A	✓	✓
B	✓	✗
C	✗	✓
D	✗	✗

key

✓ = precipitate remains

✗ = precipitate dissolves

5 Which methods of separation require a change of state from liquid to gas?

- 1 paper chromatography
- 2 crystallisation
- 3 distillation
- 4 filtration

A 1 and 2

B 1 and 3

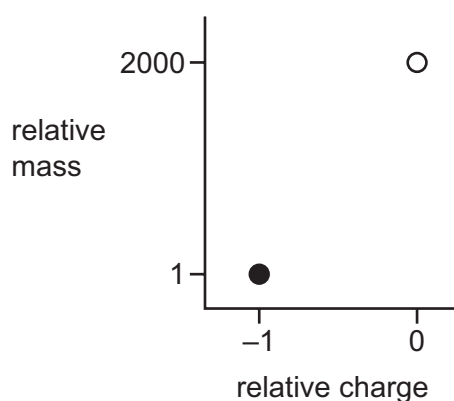
C 2 and 3

D 3 and 4

- 6 Hydrogen sulfide, H_2S , and hydrogen chloride, HCl , are both gases at temperatures above -50°C .

Which gas will diffuse most rapidly at the temperature given?

- A hydrogen chloride at -40°C
 B hydrogen chloride at -20°C
 C hydrogen sulfide at -40°C
 D hydrogen sulfide at -20°C
- 7 The diagram shows the relative mass and the relative charge of two particles, \circ and \bullet , present in atoms and ions.



Which of these particles are present in a hydrogen atom and in a hydrogen ion?

	H	H^+
A	both \circ and \bullet	both \circ and \bullet
B	both \circ and \bullet	\circ but not \bullet
C	\bullet but not \circ	neither \circ nor \bullet
D	\circ but not \bullet	\bullet but not \circ

- 8 Which ion has the most shells that contain electrons?
 A Al^{3+} B Be^{2+} C N^{3-} D S^{2-}
- 9 Which substance conducts electricity both when solid and when molten?
 A an alloy
 B a hydrocarbon
 C a metal oxide
 D a salt

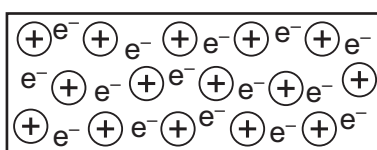
10 When they react together, which pair of elements form an ionic compound?

- A carbon and hydrogen
- B hydrogen and chlorine
- C lithium and oxygen
- D sulfur and oxygen

11 How many shared electrons are in one carbon dioxide molecule?

- A 2
- B 4
- C 8
- D 12

12 Element X has a lattice of positive ions and a 'sea of electrons'.



Which property will X have?

- A It conducts electricity by the movement of ions and electrons.
- B It has a high melting point.
- C It is decomposed by an electric current.
- D It is not malleable.

13 Which row shows the correct state symbols for the reaction between calcium carbonate and dilute hydrochloric acid? (The conditions are room temperature and pressure.)

	$\text{CaCO}_3 + 2\text{HCl} \rightarrow \text{CaCl}_2 + \text{H}_2\text{O} + \text{CO}_2$				
A	s	aq	aq	aq	g
B	s	l	aq	l	g
C	s	l	l	aq	g
D	s	aq	aq	l	g

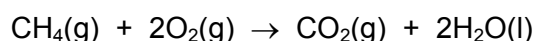
- 14 The expression shown for the value of A_r for fluorine is incomplete.

$$A_r(\text{fluorine}) = \frac{\text{average mass of one1..... of fluorine}}{\text{.....2..... of the mass of one atom of } {}^{12}_6\text{C}}$$

How should the gaps in the expression be correctly completed?

	gap 1	gap 2
A	atom	$\frac{1}{6}$
B	atom	$\frac{1}{12}$
C	molecule	$\frac{1}{6}$
D	molecule	$\frac{1}{12}$

- 15 A mixture of 5 cm³ of CH₄ and 100 cm³ of air is exploded. Assume air is 80% N₂ by volume and 20% O₂ by volume. The resulting mixture is cooled. All volumes are measured at room temperature and pressure.



What is the composition of the resulting gas?

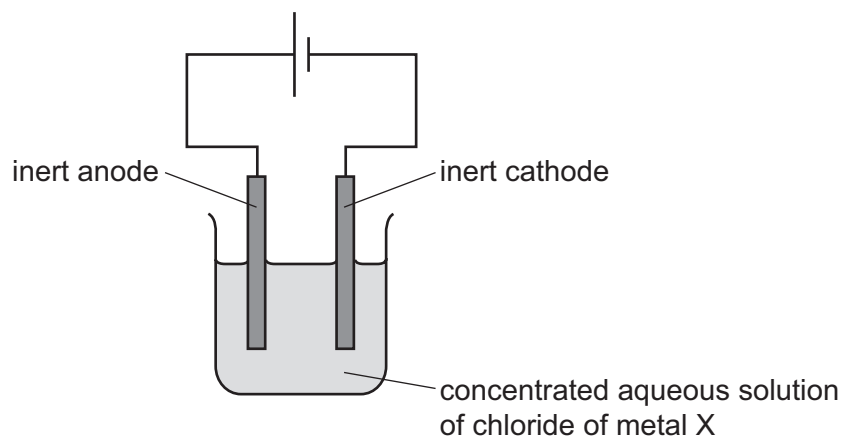
	5 cm ³ of CO ₂	10 cm ³ of O ₂	80 cm ³ of N ₂	10 cm ³ of steam
A	✓	✓	✓	✓
B	✓	✓	✓	x
C	✓	x	✓	✓
D	✓	x	✓	x

- 16 Which arrangement is used to electroplate copper onto a steel key?

	electrolyte	anode (positive electrode)	cathode (negative electrode)
A	aqueous copper(II) sulfate	piece of pure copper	steel key
B	aqueous copper(II) sulfate	steel key	piece of pure copper
C	dilute sulfuric acid	piece of pure copper	steel key
D	dilute sulfuric acid	steel key	piece of pure copper

17 The chloride of metal X is dissolved in water.

A concentrated solution of this chloride is electrolysed using inert electrodes.



X is above sodium in the reactivity series.

In addition to chlorine, which gas is liberated and at which electrode?

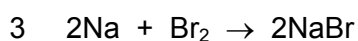
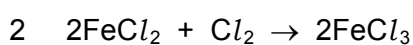
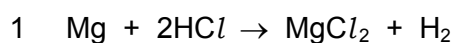
	gas	liberated at electrode
A	hydrogen	anode
B	hydrogen	cathode
C	oxygen	anode
D	oxygen	cathode

18 Which change in conditions, for the reaction between zinc and dilute sulfuric acid, increases the rate of reaction by lowering the activation energy?

- A** adding a catalyst
- B** increasing the concentration of the acid
- C** increasing the surface area of the zinc
- D** increasing the temperature

19 Many reactions can be classified as redox reactions.

Which equations show redox reactions?



- A** 1, 2 and 3 **B** 1 and 2 only **C** 2 and 3 only **D** 3 only

- 20 Which row correctly shows whether the hydrogen ion concentration and the pH of ethanoic acid are higher or lower than those of hydrochloric acid of the same concentration?

	hydrogen ion concentration	pH
A	higher	higher
B	higher	lower
C	lower	higher
D	lower	lower

- 21 Which aqueous reagent liberates ammonia from ammonium nitrate on warming?

- A** calcium nitrate
B potassium hydroxide
C sodium chloride
D sulfuric acid

- 22 Two fertilisers are made by mixing chemical compounds.

Fertiliser X contains 500 g of NH_4NO_3 and 500 g of $(\text{NH}_4)_2\text{SO}_4$ per kilogram.

Fertiliser Y contains 700 g of NH_4NO_3 and 300 g of CaSO_4 per kilogram.

Which fertiliser contains the higher percentage of nitrogen by mass and which contains the higher percentage of sulfur by mass?

[M_r : NH_4NO_3 , 80; $(\text{NH}_4)_2\text{SO}_4$, 132; CaSO_4 , 136]

	fertiliser with higher percentage N	fertiliser with higher percentage S
A	X	X
B	X	Y
C	Y	X
D	Y	Y

23 Which processes occur in the manufacture of sulfuric acid?

- 1 burning sulfur in air
- 2 dissolving sulfur dioxide in sulfuric acid
- 3 dissolving sulfur dioxide in water
- 4 reacting sulfur dioxide with air

A 1 and 2 **B** 1 and 3 **C** 1 and 4 **D** 2 and 4

24 A lump of element X can be cut by a knife.

During its reaction with water, X floats and melts.

What is X?

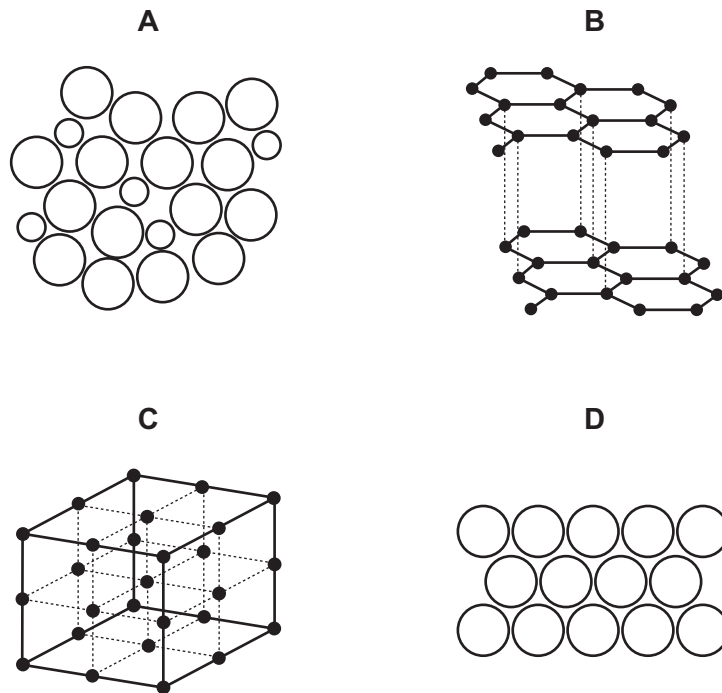
- A** calcium
- B** copper
- C** magnesium
- D** potassium

25 Chlorine is passed into separate samples of aqueous potassium iodide and aqueous potassium bromide.

In which solutions is there a colour change?

	KI(aq)	KBr(aq)	
A	✓	✓	key
B	✓	x	✓ = yes
C	x	✓	x = no
D	x	x	

26 Which diagram shows the structure of an alloy?



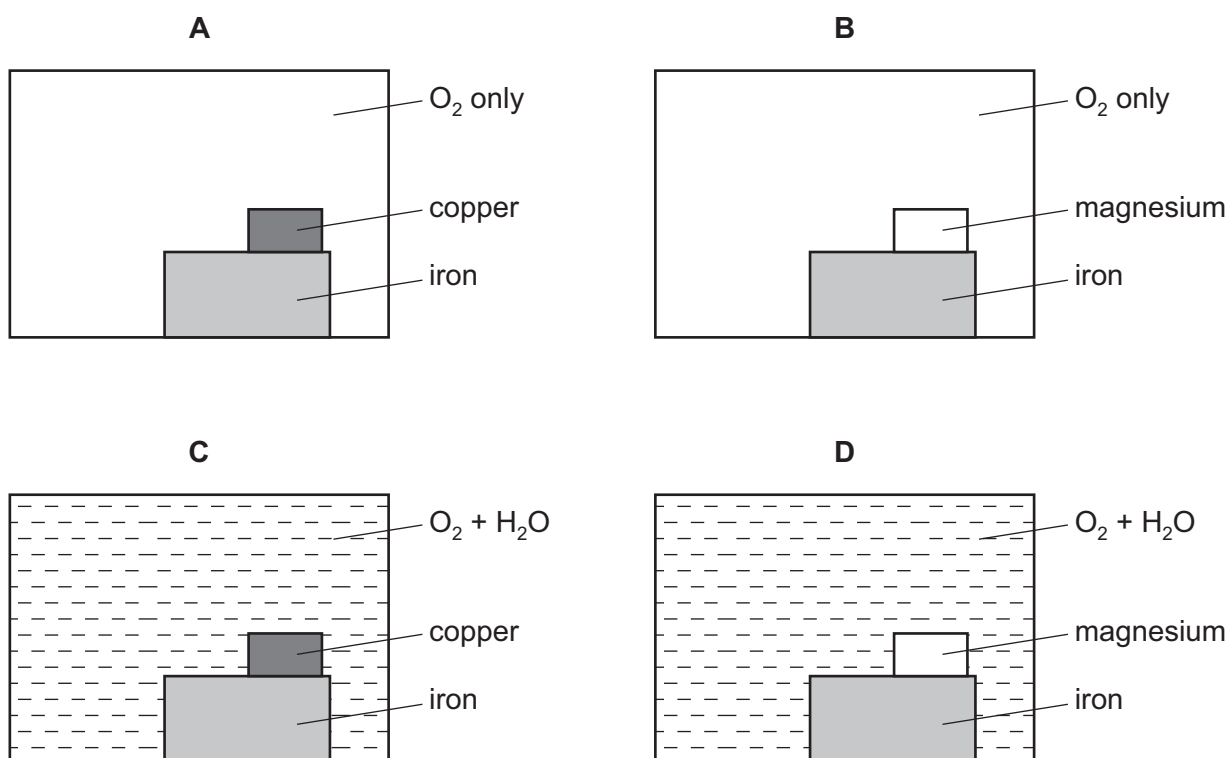
27 Which element can only be extracted from its ore using electrolysis?

- A** calcium
- B** copper
- C** lead
- D** silver

28 Which equation shows a thermal decomposition that occurs in the blast furnace?

- A** $C + O_2 \rightarrow CO_2$
- B** $CO_2 + C \rightarrow 2CO$
- C** $CaCO_3 \rightarrow CaO + CO_2$
- D** $CaO + SiO_2 \rightarrow CaSiO_3$

- 29 Which diagram correctly shows the conditions necessary for the rusting of iron and also the metal that can be used to prevent rusting by sacrificial protection?



- 30 Aluminium is produced by the electrolysis of pure aluminium oxide. One of the electrodes in the process has to be replaced often.

Which statement is correct?

- A The product at the anode reacts with the anode.
 - B The product at the anode reacts with the cathode.
 - C The product at the cathode reacts with the anode.
 - D The product at the cathode reacts with the cathode.
- 31 Which row correctly compares carbon dioxide and methane?

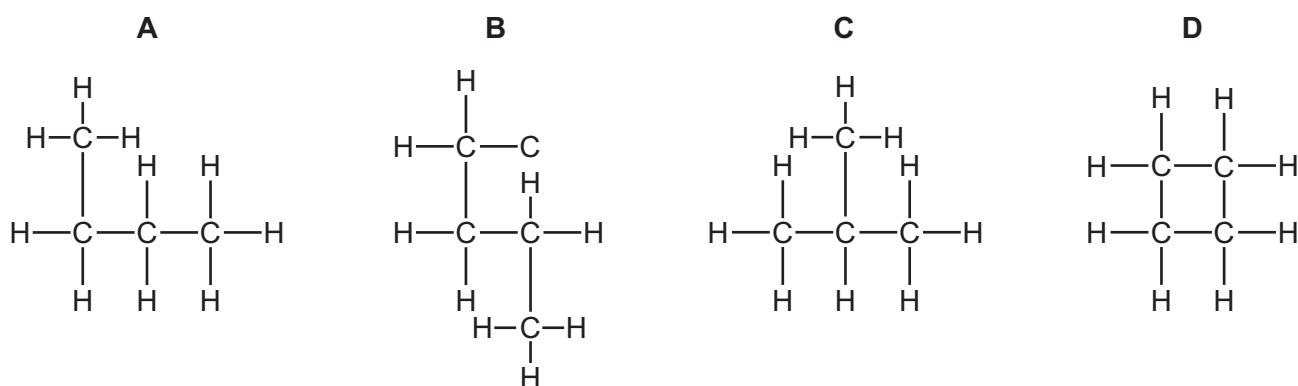
	both contain carbon	both are described as a greenhouse gas	both lower the pH of water when they dissolve in it
A	✓	x	✓
B	✓	✓	x
C	x	✓	✓
D	x	✓	x

32 Sea water has to be purified in order to obtain drinking water from it.

Which processes are used to purify the sea water?

	fractional distillation	desalination	
A	✓	✓	key ✓ = used x = not used
B	✓	x	
C	x	✓	
D	x	x	

33 Which structure represents an isomer of butane?



34 Which statement about the organic compounds CH_4 , C_2H_4 , C_2H_6 and C_3H_8 is correct?

- A** Only C_2H_4 and C_2H_6 decolourise bromine water.
- B** They are all saturated compounds.
- C** They are all unsaturated compounds.
- D** They are all hydrocarbons.

35 The alkenes are a homologous series.

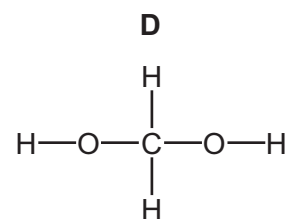
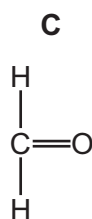
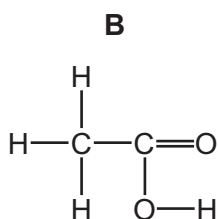
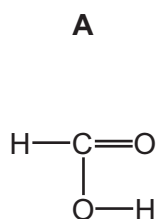
Which statement about alkenes is correct?

- A** An alkene molecule contains four fewer hydrogen atoms than an alkane molecule with the same number of carbon atoms.
- B** If a food is described as *polyunsaturated* it means that it contains polymers.
- C** Propene reacts with steam to form propanol.
- D** The general formula for the alkenes is $\text{C}_n\text{H}_{2n+2}$.

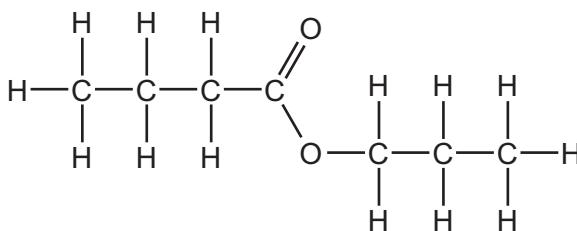
36 Which organic compound is used as a solvent, a renewable fuel and in the production of vinegar?

- A ethanoic acid
- B ethanol
- C propanoic acid
- D propanol

37 Which structure shows the carboxylic acid with the lowest relative molecular mass?

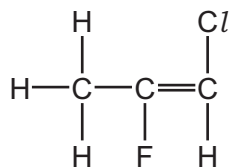


38 What is the name of the ester shown?



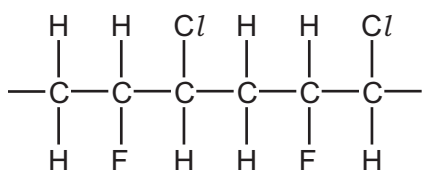
- A butyl propanoate
- B propyl butanoate
- C propyl ethanoate
- D propyl propanoate

39 The diagram shows the structure of a monomer.

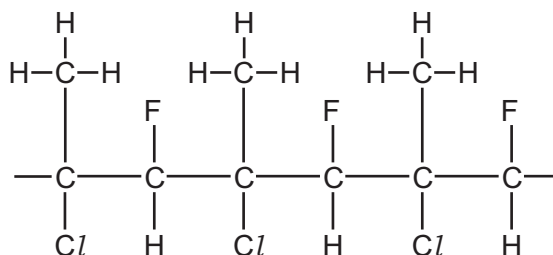


Which diagram shows the partial structure of its polymer?

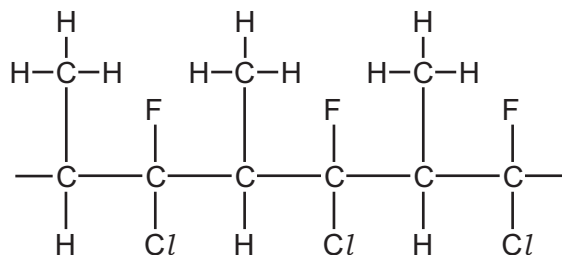
A



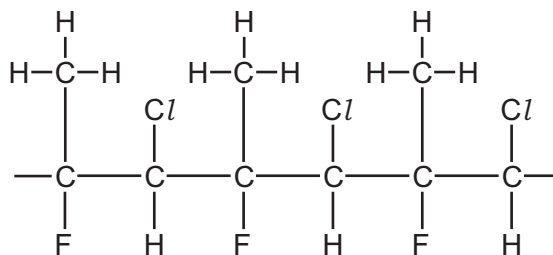
B



C



D



40 Which statement about polymers is correct?

- A** Nylon and *Terylene* are produced by addition polymerisation.
- B** Nylon and *Terylene* both contain amide linkages.
- C** Simple sugars are produced by hydrolysing proteins.
- D** Starch contains the elements carbon, hydrogen and oxygen.

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The Periodic Table of Elements

		Group															
I	II	III	IV	V	VI	VII	VIII										
3 Li lithium 7	4 Be beryllium 9	1 H hydrogen 1	5 B boron 11	6 C carbon 12	7 N nitrogen 14	8 O oxygen 16	9 F fluorine 19	10 Ne neon 20									
11 Na sodium 23	12 Mg magnesium 24	Key atomic number atomic symbol name relative atomic mass		13 Al aluminium 27	14 Si silicon 28	15 P phosphorus 31	16 S sulfur 32	17 Cl chlorine 35.5	18 Ar argon 40								
19 K potassium 39	20 Ca calcium 40	21 Sc scandium 45	22 Ti titanium 48	23 V vanadium 51	24 Cr chromium 52	25 Mn manganese 55	26 Fe iron 56	27 Co cobalt 59	28 Ni nickel 59	29 Cu copper 64	30 Zn zinc 65	31 Ga gallium 70	32 Ge germanium 73	33 As arsenic 75	34 Se selenium 79	35 Br bromine 80	36 Kr krypton 84
37 Rb rubidium 85	38 Sr strontium 88	39 Y yttrium 89	40 Zr zirconium 91	41 Nb niobium 93	42 Mo molybdenum 96	43 Tc technetium —	44 Ru ruthenium 101	45 Rh rhodium 103	46 Pd palladium 106	47 Ag silver 108	48 Cd cadmium 112	49 In indium 115	50 Sn tin 119	51 Sb antimony 122	52 Te tellurium 128	53 I iodine 127	54 Xe xenon 131
55 Cs caesium 133	56 Ba barium 137	57–71 lanthanoids	72 Hf hafnium 178	73 Ta tantalum 181	74 W tungsten 184	75 Re rhenium 186	76 Os osmium 190	77 Ir iridium 192	78 Pt platinum 195	79 Au gold 197	80 Hg mercury 201	81 Tl thallium 204	82 Pb lead 207	83 Bi bismuth 209	84 Po polonium —	85 At astatine —	86 Rn radon —
87 Fr francium —	88 Ra radium —	89–103 actinoids	104 Rf rutherfordium —	105 Db dubnium —	106 Sg seaborgium —	107 Bh bohrium —	108 Hs hassium —	109 Mt meitnerium —	110 Ds darmstadtium —	111 Rg roentgenium —	112 Cn copernicium —	114 Fl flerovium —	116 Lv livermorium —	118 Og oganeson —	119 Uue unbinetium —	120 Uuo unbinetium —	121 Uuq unbinetium —

lanthanoids

57 La lanthanum 139	58 Ce cerium 140	59 Pr praseodymium 141	60 Nd neodymium 144	61 Pm promethium —	62 Sm samarium 150	63 Eu europium 152	64 Gd gadolinium 157	65 Tb terbium 159	66 Dy dysprosium 163	67 Ho holmium 165	68 Er erbium 167	69 Tm thulium 169	70 Yb ytterbium 173	71 Lu lutetium 175
89 Ac actinium —	90 Th thorium 232	91 Pa protactinium 231	92 U uranium 238	93 Np neptunium —	94 Pu plutonium —	95 Am americium —	96 Cm curium —	97 Bk berkelium —	98 Cf californium —	99 Es einsteinium —	100 Fm fermium —	101 Md mendelevium —	102 No nobelium —	103 Lr lawrencium —

actinoids

The volume of one mole of any gas is 24 dm³ at room temperature and pressure (r.t.p.).



Cambridge O Level

CHEMISTRY

5070/12

Paper 1 Multiple Choice

October/November 2020

1 hour

You must answer on the multiple choice answer sheet.

You will need: Multiple choice answer sheet
Soft clean eraser
Soft pencil (type B or HB is recommended)

INSTRUCTIONS

- There are **forty** questions on this paper. Answer **all** questions.
- For each question there are four possible answers **A, B, C** and **D**. Choose the **one** you consider correct and record your choice in soft pencil on the multiple choice answer sheet.
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- Do **not** use correction fluid.
- Do **not** write on any bar codes.
- You may use a calculator.

INFORMATION

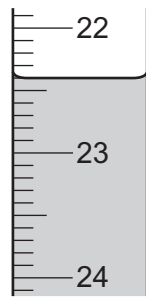
- The total mark for this paper is 40.
- Each correct answer will score one mark. A mark will not be deducted for a wrong answer.
- Any rough working should be done on this question paper.
- The Periodic Table is printed in the question paper.

This document has **16** pages. Blank pages are indicated.



- 1 During a titration experiment, an acid is transferred into a burette.

The diagrams show part of the burette at the start of the titration and at the end-point.



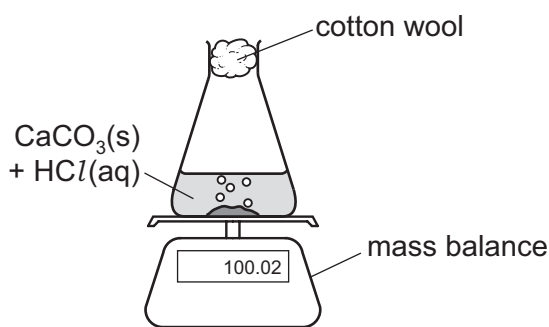
start of titration
/cm³



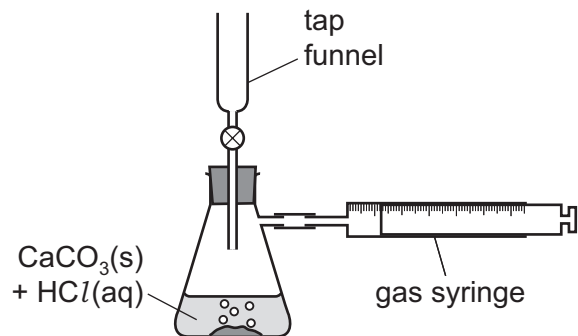
end-point of titration
/cm³

What is the volume of acid used during the titration?

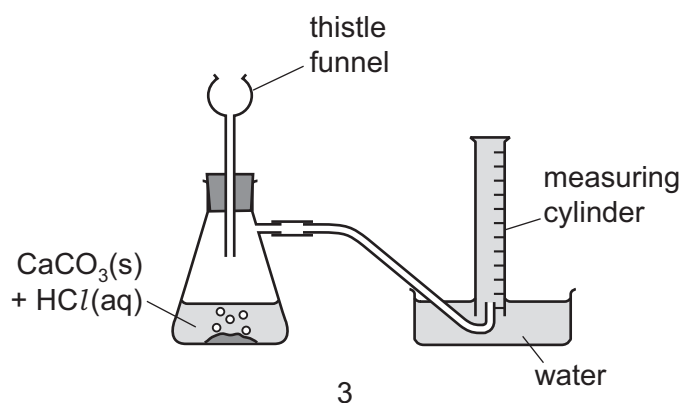
- A** 3.7 cm³ **B** 4.9 cm³ **C** 5.1 cm³ **D** 6.3 cm³
- 2 When calcium carbonate is added to dilute hydrochloric acid, carbon dioxide gas is released.
Three sets of apparatus are shown.



1



2



3

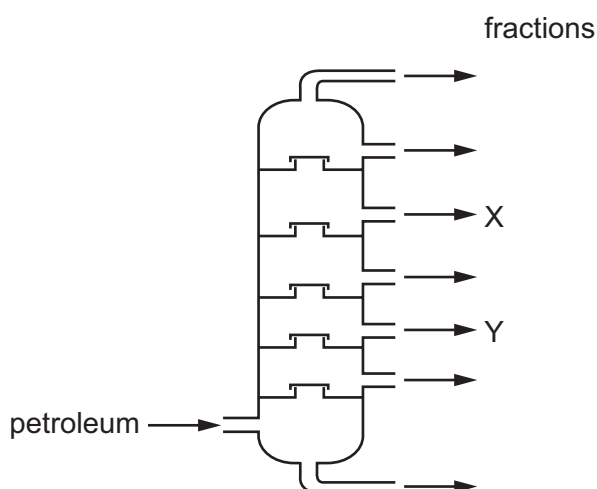
Which sets of apparatus are suitable, together with a stop-watch, for following the rate of this reaction?

- A** 1, 2 and 3 **B** 1 and 2 only **C** 2 only **D** 2 and 3 only

- 3 Chromatography can be used to separate and identify dyes present in a mixture.

Which statement is correct?

- A A dye with an R_f value of 1.2 can be present in a mixture.
- B A dye could have a different R_f value if a different solvent was used.
- C All blue dyes have the same R_f value.
- D Chromatography can only be used for coloured substances such as dyes.
- 4 Petroleum (crude oil) is separated into useful fractions by fractional distillation. The positions at which fractions X and Y are collected from the fractionating column are shown.



Which statement is correct?

- A The temperature increases up the column.
- B X condenses at a lower temperature than Y.
- C X has a higher boiling point than Y.
- D X has longer chain molecules than Y.
- 5 Aqueous zinc chloride is tested with various reagents.
- Which observation is correct?
- A Aqueous ammonia gives a white precipitate which is soluble in excess reagent.
- B Copper turnings give a precipitate of zinc.
- C Acidified aqueous silver nitrate gives a yellow precipitate.
- D Acidified aqueous barium nitrate gives a white precipitate.

- 6 When aqueous sodium hydroxide is added to a solution, a white precipitate forms which dissolves when excess sodium hydroxide is added.

Which ion could be present in the solution?

- A $Al^{3+}(aq)$ B $Ca^{2+}(aq)$ C $Cu^{2+}(aq)$ D $Na^{+}(aq)$

- 7 A sample of a gas occupies a volume of 2.0 dm^3 at room temperature and pressure.

Which changes in the conditions would both decrease the volume occupied by the gas?

	temperature	pressure
A	decreased	decreased
B	increased	decreased
C	decreased	increased
D	increased	increased

- 8 An ion contains 20 electrons and has a charge of +3.

From which element was the ion formed?

- A aluminium
B calcium
C iron
D vanadium

- 9 Which statement is correct?

- A Diamond conducts electricity while graphite does not.
B Graphite has delocalised ions between its layers.
C In diamond, each carbon atom is joined to three other carbon atoms only.
D The layered structure of graphite makes it slippery.

- 10 Which material has the highest melting point?

- A ammonia
B methane
C sodium chloride
D water

11 Which statement describes ionic bonds?

- A a lattice of ions in a 'sea of electrons'
- B electrostatic attraction between oppositely charged ions
- C the sharing of electrons between atoms to gain a noble gas configuration
- D the transfer of electrons from atoms of a non-metal to the atoms of a metal

12 Which substances contain at least one double bond?

- 1 C₂H₄
- 2 O₂
- 3 C₂H₆
- 4 CO₂

- A 1, 2 and 3 B 2, 3 and 4 C 1, 2 and 4 D 1, 3 and 4

13 Magnesium will react with aqueous copper(II) sulfate to form copper and aqueous magnesium sulfate.

What is the correct equation for this reaction?

- A $\text{Mg} + \text{CuSO}_4 \rightarrow \text{Cu} + \text{MgSO}_4$
- B $\text{Mg} + \text{Cu}_2\text{SO}_4 \rightarrow 2\text{Cu} + \text{MgSO}_4$
- C $2\text{Mg} + \text{CuSO}_4 \rightarrow \text{Cu} + \text{Mg}_2\text{SO}_4$
- D $2\text{Mg} + \text{Cu}_2\text{SO}_4 \rightarrow 2\text{Cu} + \text{Mg}_2\text{SO}_4$

14 A sample of magnesium hydroxide has a mass of 4.63 g.

How many moles of magnesium hydroxide are present?

- A 0.0617 B 0.0798 C 0.113 D 0.154

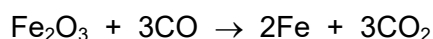
15 Which statement is correct?

- A The concentration of a solution is expressed in dm³/mol.
- B The empirical formula of a compound always gives the actual numbers of each type of atom in one molecule.
- C The molecular formula of a compound always contains more atoms than the empirical formula.
- D The relative atomic mass of an element is $\frac{\text{the average mass of one atom of the element}}{\frac{1}{12} \text{ the mass of one atom of carbon-12}}$.

16 Which sample contains the most atoms?

- A 0.5 mol of water
- B 1.0 mol of carbon dioxide
- C 1.0 mol of methane
- D 2.0 mol of hydrogen chloride

17 The equation shows the production of iron by the reduction of iron(III) oxide.



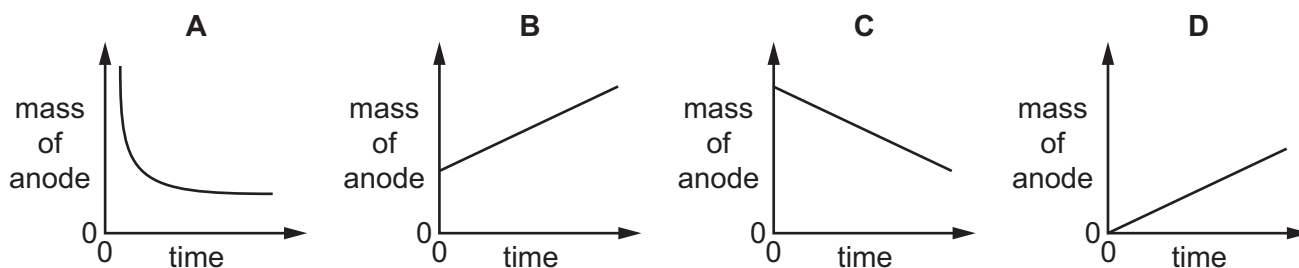
80 tonnes of iron(III) oxide produces 50 tonnes of iron.

What is the percentage yield?

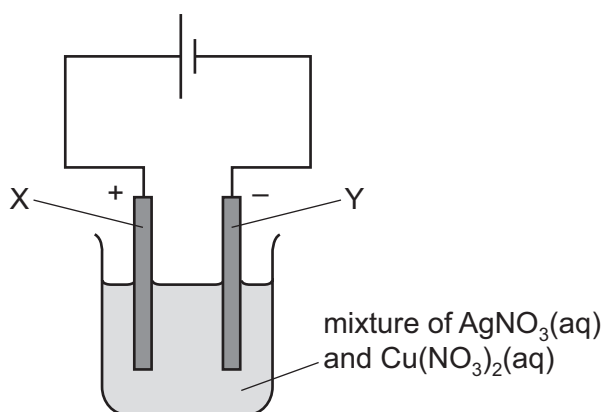
- A 45%
- B 63%
- C 68%
- D 89%

18 Aqueous copper(II) sulfate is electrolysed using copper electrodes. The current is constant and the anode is weighed at regular time intervals.

Which graph is obtained when the mass of the anode is plotted against time?



- 19 The diagram shows the electrolysis of a mixture of aqueous copper(II) nitrate, $\text{Cu}(\text{NO}_3)_2(\text{aq})$, and aqueous silver nitrate, $\text{AgNO}_3(\text{aq})$. Electrodes X and Y are inert.



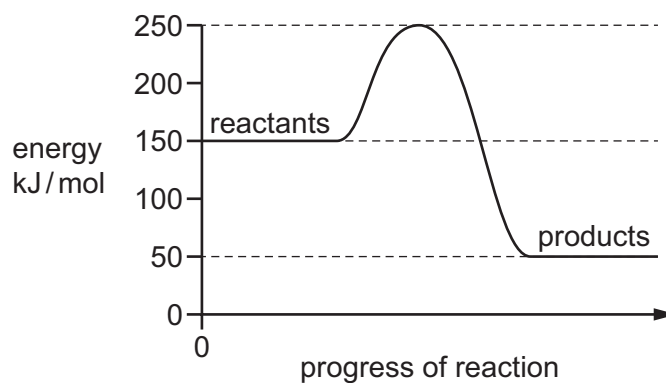
Copper is above silver in the reactivity series.

It can be deduced that1..... is initially deposited at electrode2..... .

Which words correctly complete gaps 1 and 2?

	1	2
A	copper	X
B	copper	Y
C	silver	X
D	silver	Y

- 20 The energy profile diagram of a chemical reaction is shown.



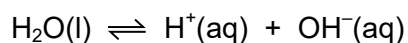
What is the value of the activation energy of the reaction?

- A** -200 kJ/mol **B** -100 kJ/mol **C** $+100 \text{ kJ/mol}$ **D** $+200 \text{ kJ/mol}$

21 Which statement describes the conversion of magnesium atoms to magnesium ions?

- A The change is reduction because there has been a gain of electrons.
- B The change is oxidation because there has been a loss of electrons.
- C The change is reduction because there has been a loss of electrons.
- D The change is oxidation because there has been a gain of electrons.

22 When water is liquid, it ionises slightly.



The forward reaction is endothermic.

When the temperature of water is increased, which changes take place?

- 1 The water becomes acidic.
- 2 The water becomes alkaline.
- 3 More water molecules form ions.

- A 1 and 3 B 1 only C 2 and 3 D 3 only

23 Which salts could be prepared by precipitation?

- 1 barium sulfate
- 2 lead chloride
- 3 copper(II) chloride
- 4 zinc sulfate

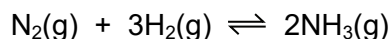
- A 1 and 2 B 3 and 4 C 1 and 3 D 2 and 4

24 Silver is below hydrogen in the reactivity series.

Which row describes the chemicals used and the method of separation used to prepare a pure sample of silver chloride?

	chemicals used	method of separation of product
A	silver and hydrochloric acid	crystallisation
B	silver and hydrochloric acid	filtration
C	silver nitrate and hydrochloric acid	crystallisation
D	silver nitrate and hydrochloric acid	filtration

25 Ammonia is manufactured by the Haber process.



The forward reaction is exothermic.

Which statement about the Haber process is correct?

- A A low pressure is used to shift the position of the equilibrium to the right.
- B A high temperature is used to shift the position of the equilibrium to the right.
- C An iron catalyst is used to shift the position of the equilibrium to the right.
- D The nitrogen used is obtained from the air.

26 The table contains some facts about sulfur dioxide and sulfuric acid and comments on these facts.

Which row is correct?

	fact	comment
A	In the manufacture of sulfuric acid, sulfur reacts with oxygen to make sulfur trioxide.	The equation for this reaction is $2\text{S}(\text{s}) + 3\text{O}_2(\text{g}) \rightleftharpoons 2\text{SO}_3(\text{g})$.
B	Nickel is used as the catalyst in the Contact process.	Catalysts speed up a reaction by lowering the activation energy, E_a .
C	Sulfuric acid is used in car batteries.	This increases the efficiency of the petrol engine.
D	The use of low sulfur petrol is beneficial because it minimises the formation of acid rain.	Sulfur dioxide is acidic because it is the oxide of a non-metal.

27 An atom of which element has the same electronic configuration as an atom of an ion of strontium?

- A calcium
- B krypton
- C rubidium
- D selenium

28 Metals have high melting points.

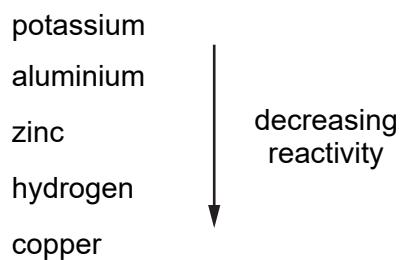
What is the reason for this?

- A Their atoms are joined by strong covalent bonds in a giant lattice.
- B They have strong forces of attraction between negative ions and delocalised electrons.
- C They have strong forces of attraction between negative ions and positive ions.
- D They have strong forces of attraction between positive ions and delocalised electrons.

29 What happens when a strip of silver is immersed in aqueous copper(II) sulfate?

- A Bubbles of gas will appear.
- B No reaction occurs.
- C Pink copper will be deposited on the silver strip.
- D The silver strip will start to dissolve.

30 Four metals and hydrogen are arranged in order of decreasing reactivity.



Which statement about these elements is correct?

- A Aluminium is formed when aluminium oxide is heated with hydrogen.
- B Copper displaces zinc from aqueous zinc sulfate.
- C Copper is formed when copper(II) oxide is heated with hydrogen.
- D When added to water, aluminium forms positive ions more readily than potassium forms positive ions.

31 Aluminium is extracted from its ore using electrolysis.

Which statement about the electrodes used is correct?

- A The anode is made of graphite.
- B The anode is made of steel.
- C The cathode is made of bauxite.
- D The cathode is made of cryolite.

32 Gas X is present in dry air and may contribute to global warming.

What is X?

- A carbon monoxide
- B methane
- C nitrogen oxide
- D sulfur dioxide

33 Four processes are used during the purification of water.

- use of carbon
- desalination
- chlorination
- filtration

The purposes, W, X, Y and Z, for these processes are listed.

W disinfection

X removal of solids

Y removal of dissolved salts

Z removal of tastes and odours

What is the purpose for each process?

	use of carbon	desalination	chlorination	filtration
A	Y	Z	W	X
B	Z	Y	W	X
C	Z	Y	X	W
D	Y	Z	X	W

34 Propane undergoes substitution reactions when mixed with chlorine gas in the presence of ultraviolet light.

Which compound could be formed when propane and chlorine are mixed in the presence of ultraviolet light?

- A** $\text{CH}_3\text{CCl}_2\text{CH}_3$
- B** $\text{CH}_2\text{ClCH}_2\text{Cl}$
- C** $\text{CH}_3\text{CH}_2\text{CH}_3\text{Cl}$
- D** $\text{CH}_3\text{CHClCH}_2\text{CH}_3$

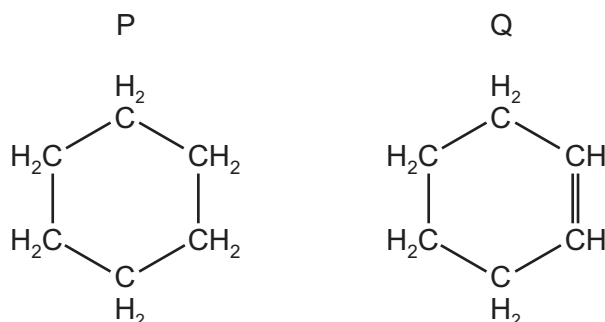
35 The hydrocarbon CH_3CHCH_2 will undergo a number of chemical reactions.

In which reaction will the carbon to carbon single bond be broken?

- A** combustion with oxygen
- B** hydrogenation
- C** polymerisation
- D** reaction with steam

36 Hydrocarbon compounds can form rings of carbon atoms as well as chains.

The structures of two hydrocarbon rings are shown.



Which of P and Q is unsaturated and which reacts with aqueous bromine?

	is unsaturated	reacts with aqueous bromine
A	P	P
B	P	Q
C	Q	P
D	Q	Q

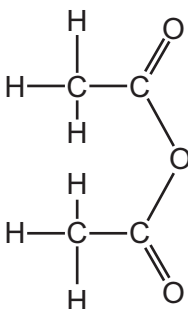
37 A sample of aqueous glucose is fermented with yeast at 37 °C in the absence of air.

The main organic product, X, is purified by fractional distillation. X is then oxidised, by heating under reflux with acidified potassium manganate(VII), to give a final product Y.

What is the identity of Y?

- A** ethanoic acid
- B** ethene
- C** propanoic acid
- D** propene

38 The diagram shows the structure of a compound called ethanoic anhydride.



1 mol of ethanoic anhydride reacts with water to form 2 mol of a carboxylic acid only. This carboxylic acid reacts with ethanol to form an ester.

How many moles of water react with 1 mol of the ethanoic anhydride and what is the structure of the ester?

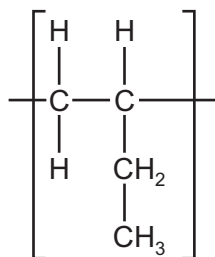
	number of moles of water	structure of the ester
A	1	
B	1	
C	2	
D	2	

39 Burning polymers can cause atmospheric pollution.

Which polymer, on burning, could produce nitrogen oxides?

- A nylon
- B poly(ethene)
- C starch
- D *Terylene*

40 The diagram shows the repeat unit of a polymer.



Which row correctly identifies the monomer and type of polymerisation involved in making this polymer?

	monomer	type of polymerisation
A	$\begin{array}{cc} \text{H} & \text{H} \\ & \\ \text{C} & =\text{C} \\ & \\ \text{H} & \text{C}_2\text{H}_5 \end{array}$	addition
B	$\begin{array}{cc} \text{H} & \text{H} \\ & \\ \text{C} & =\text{C} \\ & \\ \text{H} & \text{C}_2\text{H}_5 \end{array}$	condensation
C	$\begin{array}{cc} \text{H} & \text{H} \\ & \\ \text{H}-\text{C} & -\text{C} \\ & \\ \text{H} & \text{CH} \\ & \\ & \text{CH}_3 \end{array}$	addition
D	$\begin{array}{cc} \text{H} & \text{H} \\ & \\ \text{H}-\text{C} & -\text{C} \\ & \\ \text{H} & \text{CH} \\ & \\ & \text{CH}_3 \end{array}$	condensation

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The Periodic Table of Elements

		Group																				
I	II	III	IV	V	VI	VII	VIII															
3 Li lithium 7	4 Be beryllium 9	11 Na sodium 23	12 Mg magnesium 24	19 K potassium 39	20 Ca calcium 40	21 Sc scandium 45	22 Ti titanium 48	23 V vanadium 51	24 Cr chromium 52	25 Mn manganese 55	26 Fe iron 56	27 Co cobalt 59	28 Ni nickel 59	29 Cu copper 64	30 Zn zinc 65	31 Ga gallium 70	32 Ge germanium 73	33 As arsenic 75	34 Se selenium 79	35 Br bromine 80	36 Kr krypton 84	
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		1 H hydrogen 1																				
		Key atomic number atomic symbol name relative atomic mass																				

lanthanoids	57 La lanthanum 139	58 Ce cerium 140	59 Pr praseodymium 141	60 Nd neodymium 144	61 Pm promethium —	62 Sm samarium 150	63 Eu europium 152	64 Gd gadolinium 157	65 Tb terbium 159	66 Dy dysprosium 163	67 Ho holmium 165	68 Er erbium 167	69 Tm thulium 169	70 Yb ytterbium 173	71 Lu lutetium 175
actinoids	89 Ac actinium —	90 Th thorium 232	91 Pa protactinium 231	92 U uranium 238	93 Np neptunium —	94 Pu plutonium —	95 Am americium —	96 Cm curium —	97 Bk berkelium —	98 Cf californium —	99 Es einsteinium —	100 Fm fermium —	101 Md mendelevium —	102 No nobelium —	103 Lr lawrencium —

The volume of one mole of any gas is 24 dm³ at room temperature and pressure (r.t.p.).



Cambridge O Level

CHEMISTRY

5070/12

Paper 1 Multiple Choice

May/June 2021

1 hour

You must answer on the multiple choice answer sheet.

You will need: Multiple choice answer sheet
Soft clean eraser
Soft pencil (type B or HB is recommended)

INSTRUCTIONS

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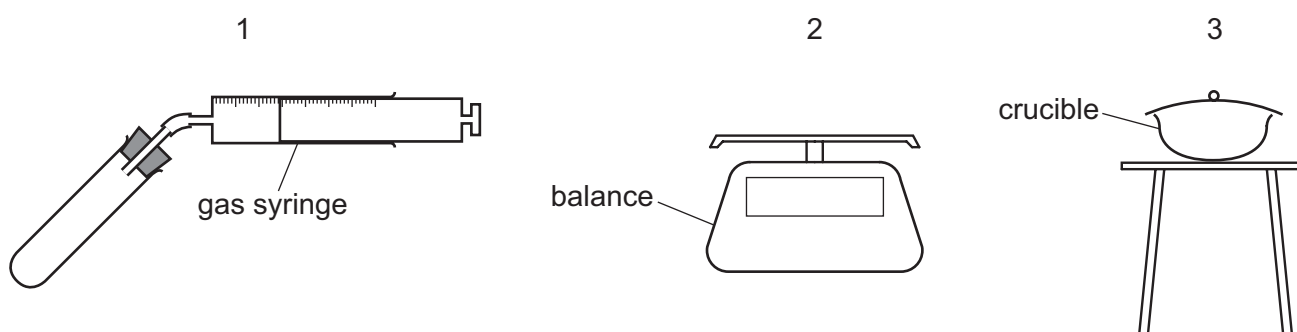
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This document has **16** pages.



- 1 The formula of magnesium oxide can be investigated by using the fact that when magnesium is heated it reacts with oxygen to form magnesium oxide.

Which apparatus is used for this investigation?



- A** 1, 2 and 3 **B** 1 and 2 only **C** 1 and 3 only **D** 2 and 3 only
- 2 Which property of a liquid ester can be used to check its purity before use as a food flavouring?
- A** boiling point
B colour
C smell
D solubility in water
- 3 Which separation method would give pure samples of **both** substances from the mixture?

	mixture	separation method
A	copper sulfate crystals and water	crystallisation
B	ethanol and water	evaporation
C	salt and sand	filtration
D	nitrogen and oxygen	fractional distillation

- 4 An aqueous solution of J is a colourless solution that contains cations and chloride ions.

Separate samples of the solution give a white precipitate with a few drops of aqueous sodium hydroxide and with a few drops of aqueous ammonia.

Which statement about J is correct?

- A** The cation in J must be Al^{3+} .
B The cation in J must be Fe^{2+} .
C When dilute nitric acid and aqueous barium nitrate are added to an aqueous solution of J, a white precipitate is formed.
D When dilute nitric acid and aqueous silver nitrate are added to an aqueous solution of J, a white precipitate is formed.

- 5 Gas X has the following properties.
- 1 colourless
 - 2 no effect on either damp red or blue litmus papers
 - 3 no effect on limewater
 - 4 flammable

What is gas X?

- A** ammonia
- B** chlorine
- C** hydrogen
- D** oxygen
- 6 Which statement about states of matter is correct?
- A** When a liquid freezes it becomes a solid and energy is released to the surroundings.
- B** When a liquid reaches its boiling point it becomes a gas. This process is called evaporation.
- C** When a solid changes directly to a gas the process is called condensation.
- D** When a solid melts the particles get further apart and have less energy.
- 7 Use the Periodic Table to answer this question.

Which two particles have the same number of electrons?

- A** Ar and Ca
- B** Na⁺ and K⁺
- C** Fe²⁺ and Fe³⁺
- D** Ca²⁺ and Sc³⁺

- 10 The names and formulae of three nitrogen compounds are shown.

ammonia	hydrazine	hydroxylamine
NH_3	N_2H_4	NH_2OH

Which compound has the highest relative molecular mass, M_r , and in which compound is the percentage by mass of hydrogen the greatest?

	highest M_r	greatest percentage by mass of hydrogen
A	N_2H_4	NH_3
B	N_2H_4	N_2H_4
C	NH_2OH	NH_3
D	NH_2OH	N_2H_4

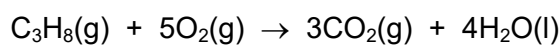
- 11 The relative formula masses of four compounds are given.

A student has a 1.0 g sample of each compound.

Which sample contains the highest number of moles of oxygen atoms?

	compound	relative formula mass
A	Al_2O_3	102
B	CuO	80
C	H_2SO_4	98
D	HNO_3	63

- 12 10 cm^3 of propane is burned in 70 cm^3 of oxygen in a closed container.

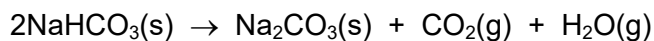


What is the total volume of gas present after the reaction?

(Assume all volumes of gases are measured at room temperature and pressure.)

- A** 30 cm^3 **B** 50 cm^3 **C** 70 cm^3 **D** 90 cm^3

- 13 When a mixture of sodium chloride and sodium hydrogencarbonate is heated, the reaction shown takes place.



Sodium chloride is unchanged on heating.

When 6.0 g of the mixture is heated, the loss in mass is 1.5 g.

What is the percentage by mass of sodium hydrogencarbonate in the mixture?

[relative molecular mass, M_r : NaHCO_3 , 84; Na_2CO_3 , 106; CO_2 , 44; H_2O , 18]

- A** 34% **B** 48% **C** 68% **D** 95%
- 14 Molten sodium chloride is electrolysed.
- Which change occurs at the cathode?
- A** Sodium ions are oxidised.
B Sodium ions are reduced.
C Chloride ions are oxidised.
D Chloride ions are reduced.
- 15 Which positive ions are present in aqueous copper(II) sulfate?
- A** copper(II) ions only
B copper(II) ions and hydrogen ions
C sulfate ions only
D sulfate ions and hydroxide ions
- 16 Natural gas is used as a source of energy.

What is the main compound in natural gas?

- A** ethane
B ethene
C methane
D methanol

- 17 Ethanol is produced by the fermentation of glucose from sugar cane. In some countries ethanol is used as a fuel.

Which statements are correct?

- 1 Sugar cane is a non-renewable (finite) resource.
- 2 When sugar cane is growing it removes carbon dioxide from the atmosphere.

- A** 1 only
B 2 only
C both 1 and 2
D neither 1 nor 2

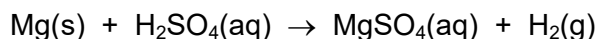
- 18 Aqueous sodium thiosulfate reacts with hydrochloric acid. The rate of the reaction increases if the concentration of both reactants is increased.

Nitrogen gas reacts with hydrogen gas. The rate of the reaction increases if the pressure in the reaction vessel is increased.

Which row correctly explains why the given change increases the rate of the reaction?

	aqueous sodium thiosulfate + hydrochloric acid	nitrogen + hydrogen
A	higher frequency of collisions between particles	higher frequency of collisions between particles
B	higher frequency of collisions between particles	the activation energy is decreased
C	the activation energy is decreased	higher frequency of collisions between particles
D	the activation energy is decreased	the activation energy is decreased

19 Magnesium reacts with dilute sulfuric acid.



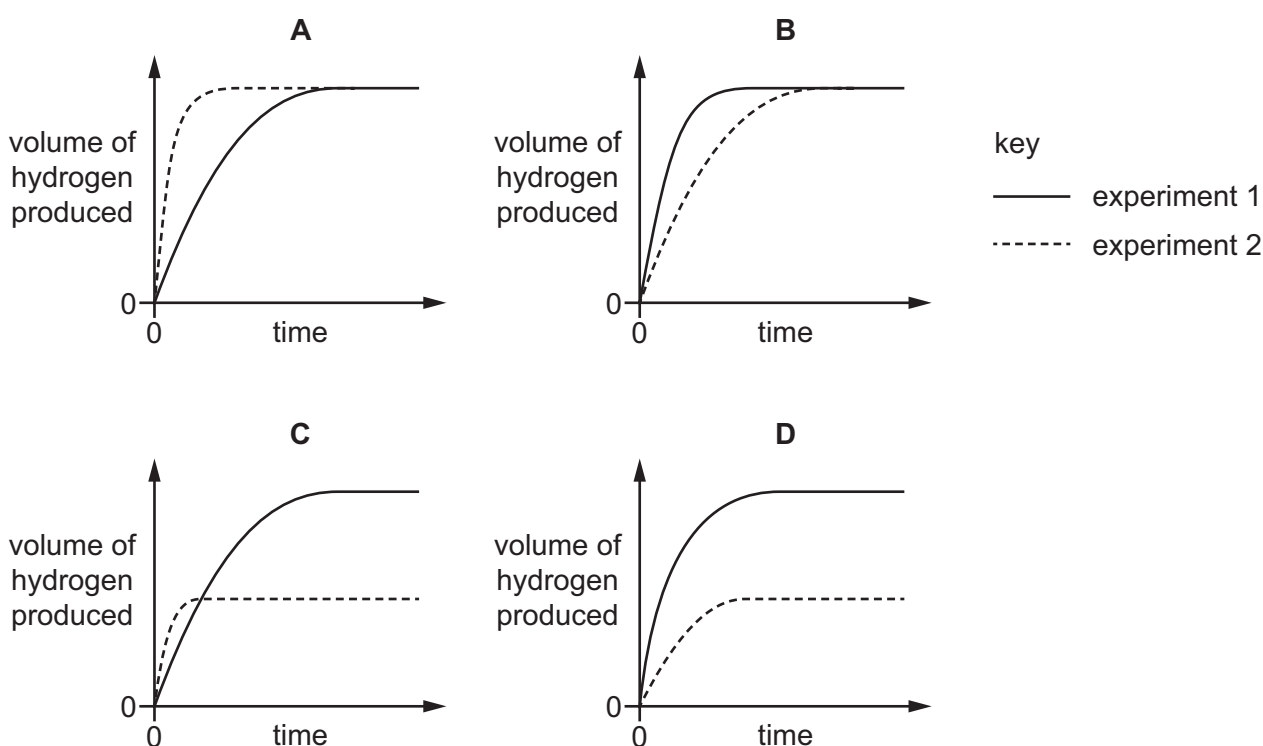
Two experiments are carried out at 25 °C.

experiment 1 24.0 g of powdered magnesium is reacted with 100 cm³ of 1.0 mol/dm³ sulfuric acid.

experiment 2 24.0 g of powdered magnesium is reacted with 50 cm³ of 2.0 mol/dm³ sulfuric acid.

During each experiment the volume of hydrogen produced is measured. The results are plotted on a graph.

Which graph is correct?



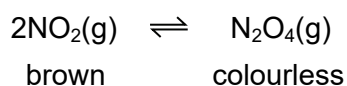
20 Solution X is colourless. A few drops of aqueous potassium iodide solution are added to a sample of X. No change is seen.

Solution Y is colourless. A few drops of aqueous acidified potassium manganate(VII) solution are added to a sample of Y. The colour of the potassium manganate(VII) disappears.

What can be deduced about X and Y from these two observations?

- A X and Y are both reducing agents.
- B X is an oxidising agent and Y is **not** a reducing agent.
- C X is **not** a reducing agent and Y is an oxidising agent.
- D X is **not** an oxidising agent and Y is a reducing agent.

- 21 Brown nitrogen dioxide reacts to form colourless dinitrogen tetroxide in a reversible reaction. The forward reaction is exothermic.



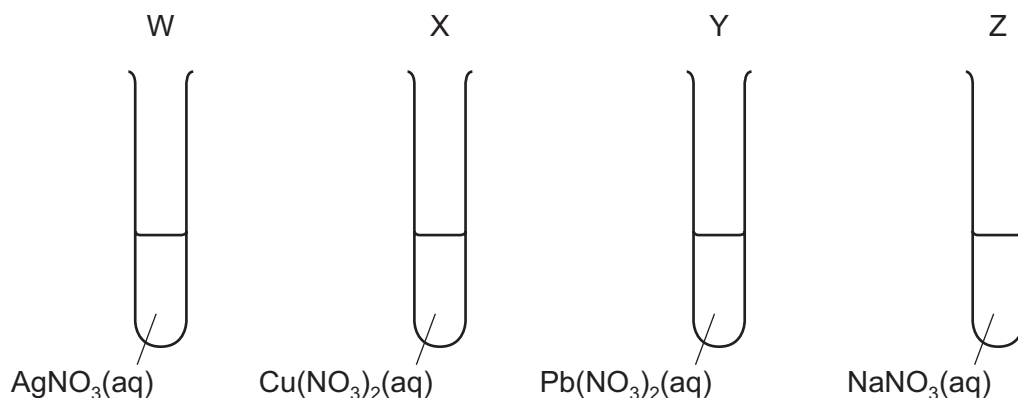
Which changes would make the equilibrium mixture darker in colour?

	temperature	pressure
A	decrease	decrease
B	decrease	increase
C	increase	decrease
D	increase	increase

- 22 Which row shows the pH values for 0.1 mol/dm³ solutions of ammonia, hydrochloric acid, sodium chloride and sodium hydroxide?

	pH values			
	NH ₃	HCl	NaCl	NaOH
A	1	7	13	11
B	7	1	11	13
C	11	1	7	13
D	13	11	7	1

23 Four test-tubes are set up as shown.



What is the effect of adding dilute hydrochloric acid to each test-tube?

	W	X	Y	Z	
A	x	✓	x	✓	key
B	✓	x	✓	x	x = clear solution
C	✓	x	✓	✓	✓ = precipitate formed
D	✓	x	x	x	

24 Aqueous ammonia reacts with a compound to form a salt, ammonium phosphate.

What type of reaction will ammonia undergo to form ammonium phosphate?

- A** combustion
- B** neutralisation
- C** oxidation
- D** precipitation

25 Sulfuric acid is manufactured in the contact process. Several substances are involved in this process, including vanadium(V) oxide and water.

Which roles are played by vanadium(V) oxide and water in the contact process?

	vanadium(V) oxide	water
A	catalyst	reactant
B	catalyst	solvent
C	reactant	reactant
D	reactant	solvent

26 Some properties which indicate the differences in elements are listed.

- 1 metallic character
- 2 number of electron shells in an atom
- 3 number of protons in an atom
- 4 total number of electrons in an atom

Which two properties increase across a period of the Periodic Table?

- A** 1 and 2 **B** 1 and 3 **C** 2 and 4 **D** 3 and 4

27 Germanium is in Group IV of the Periodic Table. It has a proton number of 32.

Selenium is in Group VI of the Periodic Table. It has a proton number of 34.

Which prediction can be made, based on the positions of germanium and selenium in the Periodic Table?

- A** A germanium atom has two more valence electrons than a selenium atom.
B Germanium forms a Ge^{3+} ion and selenium forms an Se^{3-} ion.
C Germanium has more metallic character than selenium.
D Germanium has similar properties to tellurium, and selenium has similar properties to tin.

28 The proton number of caesium is 55.

Compared with lithium, the melting point of caesium is1..... and the reaction of caesium with water is2..... vigorous. The number of valence electrons in caesium is3..... compared to lithium.

Which words correctly complete gaps 1, 2 and 3?

	1	2	3
A	higher	more	the same
B	higher	less	the same
C	lower	more	greater
D	lower	more	the same

29 Nickel is a transition element.

Which properties does it have?

- 1 It can act as a catalyst.
- 2 It conducts electricity when molten.
- 3 It forms coloured compounds.
- 4 It has only one oxidation state in its compounds.

A 1, 2 and 3 **B** 1, 3 and 4 **C** 1 and 2 only **D** 1 and 3 only

30 Which metal reacts with steam and can be extracted from its ore by reduction with carbon?

- A** magnesium
- B** calcium
- C** copper
- D** zinc

31 Three correct statements about aluminium are listed.

- 1 Aluminium is the most common metal in the Earth's crust.
- 2 It is costly to extract aluminium from its ore, bauxite.
- 3 The world's supply of bauxite is limited.

Which statements explain why aluminium should be recycled?

A 1 and 2 only **B** 2 and 3 only **C** 3 only **D** 1, 2 and 3

32 Attaching pieces of magnesium to underground iron pipes can protect the iron from corrosion.

Which reaction protects the iron from corrosion?

- A** $\text{Fe}^{2+}(\text{aq}) + 2\text{e}^{-} \rightarrow \text{Fe}(\text{s})$
- B** $\text{Fe}(\text{s}) \rightarrow \text{Fe}^{2+}(\text{aq}) + 2\text{e}^{-}$
- C** $\text{Mg}^{2+}(\text{aq}) + 2\text{e}^{-} \rightarrow \text{Mg}(\text{s})$
- D** $\text{Mg}(\text{s}) \rightarrow \text{Mg}^{2+}(\text{aq}) + 2\text{e}^{-}$

33 Iron is extracted from its ore, haematite, in a blast furnace.

Which statement about this extraction process is correct?

- A Air is blown into the blast furnace to react with carbon.
- B At the bottom of a blast furnace a layer of molten iron floats on top of a layer of molten slag.
- C Limestone is decomposed in the blast furnace to produce carbon monoxide.
- D Silicon dioxide, an impurity in the ore, is a basic oxide.

34 Which statement about the preparation and properties of aluminium is correct?

- A Aluminium is obtained by heating aluminium oxide with carbon.
- B Aluminium is produced at the anode by electrolysis of aluminium oxide dissolved in molten cryolite.
- C Aluminium is unreactive as it forms an oxide coating.
- D Aluminium is used in overhead electricity cables as it is a good conductor of electricity and has a high density.

35 How many moles of hydrogen chloride are formed when one mole of methane reacts with a large excess of chlorine in sunlight?

- A 1 B 2 C 3 D 4

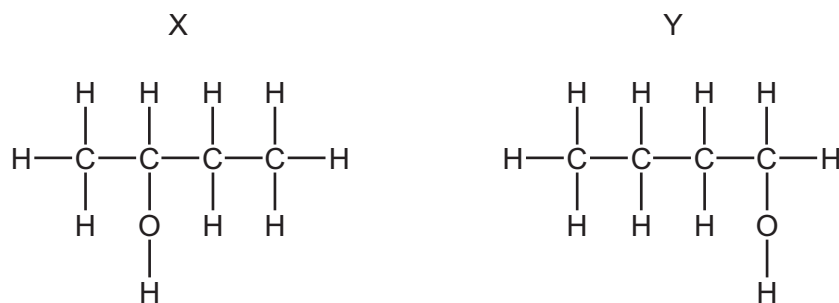
36 Vegetable oils can be made into margarine.

Which row describes the changes which take place?

	hydrogen	viscosity
A	is added	increases
B	is removed	decreases
C	is added	decreases
D	is removed	increases

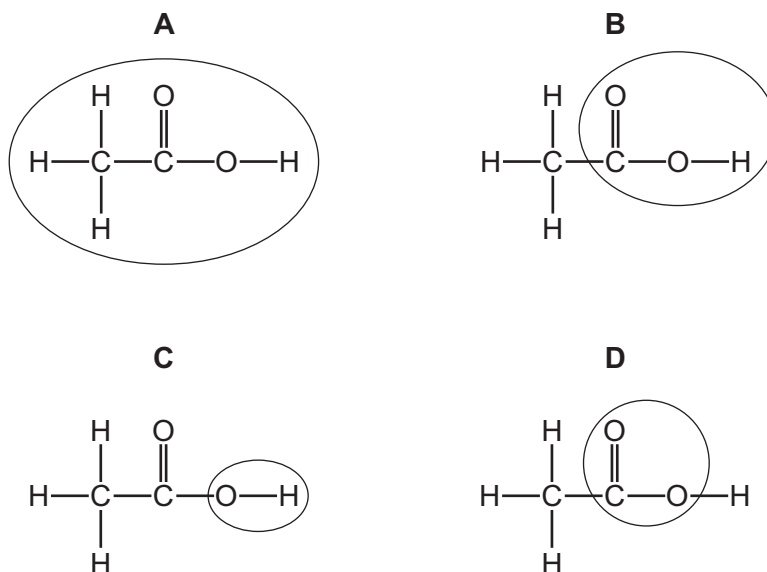
37 Which statements about alcohols are correct?

- 1 All alcohols contain the hydroxide ion, OH^- .
- 2 Ethanol can be formed from ethene using a reaction catalysed by yeast.
- 3 Methanol can be oxidised to methanoic acid.
- 4 The alcohols X and Y shown are isomers.



- A** 1 and 2 **B** 1 and 3 **C** 2 and 4 **D** 3 and 4

38 Which circled structure shows only the functional group of a carboxylic acid?



39 Which statement about polymers is correct?

- A** Nylon and *Terylene* are both polyesters.
- B** Proteins and nylon have the same monomer units.
- C** Proteins have the same amide linkages as nylon.
- D** *Terylene* and fats are esters but with different linkages.

40 Some information about compound X is given.

X contains the elements carbon, hydrogen and oxygen only.

The product of the hydrolysis of X is the simple sugar, glucose.

What is X?

- A a polyester
- B a protein
- C nylon
- D starch

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The Periodic Table of Elements

		Group															
I	II	III	IV	V	VI	VII	VIII										
3 Li lithium 7	4 Be beryllium 9	11 Na sodium 23	12 Mg magnesium 24	<div style="border: 1px solid black; padding: 5px; margin-bottom: 5px;"> Key atomic number atomic symbol name relative atomic mass </div>													
19 K potassium 39	20 Ca calcium 40	21 Sc scandium 45	22 Ti titanium 48	23 V vanadium 51	24 Cr chromium 52	25 Mn manganese 55	26 Fe iron 56	27 Co cobalt 59	28 Ni nickel 59	29 Cu copper 64	30 Zn zinc 65	31 Ga gallium 70	32 Ge germanium 73	33 As arsenic 75	34 Se selenium 79	35 Br bromine 80	36 Kr krypton 84
37 Rb rubidium 85	38 Sr strontium 88	39 Y yttrium 89	40 Zr zirconium 91	41 Nb niobium 93	42 Mo molybdenum 96	43 Tc technetium —	44 Ru ruthenium 101	45 Rh rhodium 103	46 Pd palladium 106	47 Ag silver 108	48 Cd cadmium 112	49 In indium 115	50 Sn tin 119	51 Sb antimony 122	52 Te tellurium 128	53 I iodine 127	54 Xe xenon 131
55 Cs caesium 133	56 Ba barium 137	57–71 lanthanoids	72 Hf hafnium 178	73 Ta tantalum 181	74 W tungsten 184	75 Re rhenium 186	76 Os osmium 190	77 Ir iridium 192	78 Pt platinum 195	79 Au gold 197	80 Hg mercury 201	81 Tl thallium 204	82 Pb lead 207	83 Bi bismuth 209	84 Po polonium —	85 At astatine —	86 Rn radon —
87 Fr francium —	88 Ra radium —	89–103 actinoids	104 Rf rutherfordium —	105 Db dubnium —	106 Sg seaborgium —	107 Bh bohrium —	108 Hs hassium —	109 Mt meitnerium —	110 Ds darmstadtium —	111 Rg roentgenium —	112 Cn copernicium —	114 Fl flerovium —	116 Lv livermorium —	118 Og oganesson —	119 Uue unbinilium —	120 Uub unbinilium —	121 Uut ununilium —

1
H
hydrogen
1

atomic number
atomic symbol
name
relative atomic mass

57 La lanthanum 139	58 Ce cerium 140	59 Pr praseodymium 141	60 Nd neodymium 144	61 Pm promethium —	62 Sm samarium 150	63 Eu europium 152	64 Gd gadolinium 157	65 Tb terbium 159	66 Dy dysprosium 163	67 Ho holmium 165	68 Er erbium 167	69 Tm thulium 169	70 Yb ytterbium 173	71 Lu lutetium 175
89 Ac actinium —	90 Th thorium 232	91 Pa protactinium 231	92 U uranium 238	93 Np neptunium —	94 Pu plutonium —	95 Am americium —	96 Cm curium —	97 Bk berkelium —	98 Cf californium —	99 Es einsteinium —	100 Fm fermium —	101 Md mendelevium —	102 No nobelium —	103 Lr lawrencium —

lanthanoids

actinoids

The volume of one mole of any gas is 24 dm³ at room temperature and pressure (r.t.p.).



Cambridge O Level

CHEMISTRY

5070/12

Paper 1 Multiple Choice

October/November 2021

1 hour

You must answer on the multiple choice answer sheet.

You will need: Multiple choice answer sheet
Soft clean eraser
Soft pencil (type B or HB is recommended)

INSTRUCTIONS

- There are **forty** questions on this paper. Answer **all** questions.
- For each question there are four possible answers **A, B, C** and **D**. Choose the **one** you consider correct and record your choice in soft pencil on the multiple choice answer sheet.
- Follow the instructions on the multiple choice answer sheet.
- Write in soft pencil.
- Write your name, centre number and candidate number on the multiple choice answer sheet in the spaces provided unless this has been done for you.
- Do **not** use correction fluid.
- Do **not** write on any bar codes.
- You may use a calculator.

INFORMATION

- The total mark for this paper is 40.
- Each correct answer will score one mark.
- Any rough working should be done on this question paper.
- The Periodic Table is printed in the question paper.

This document has **20** pages. Any blank pages are indicated.



- 1 In a titration, 25.0 cm^3 of aqueous sodium hydroxide is transferred into a conical flask. A few drops of indicator are added. Dilute hydrochloric acid is then added to the flask until the end-point is reached.

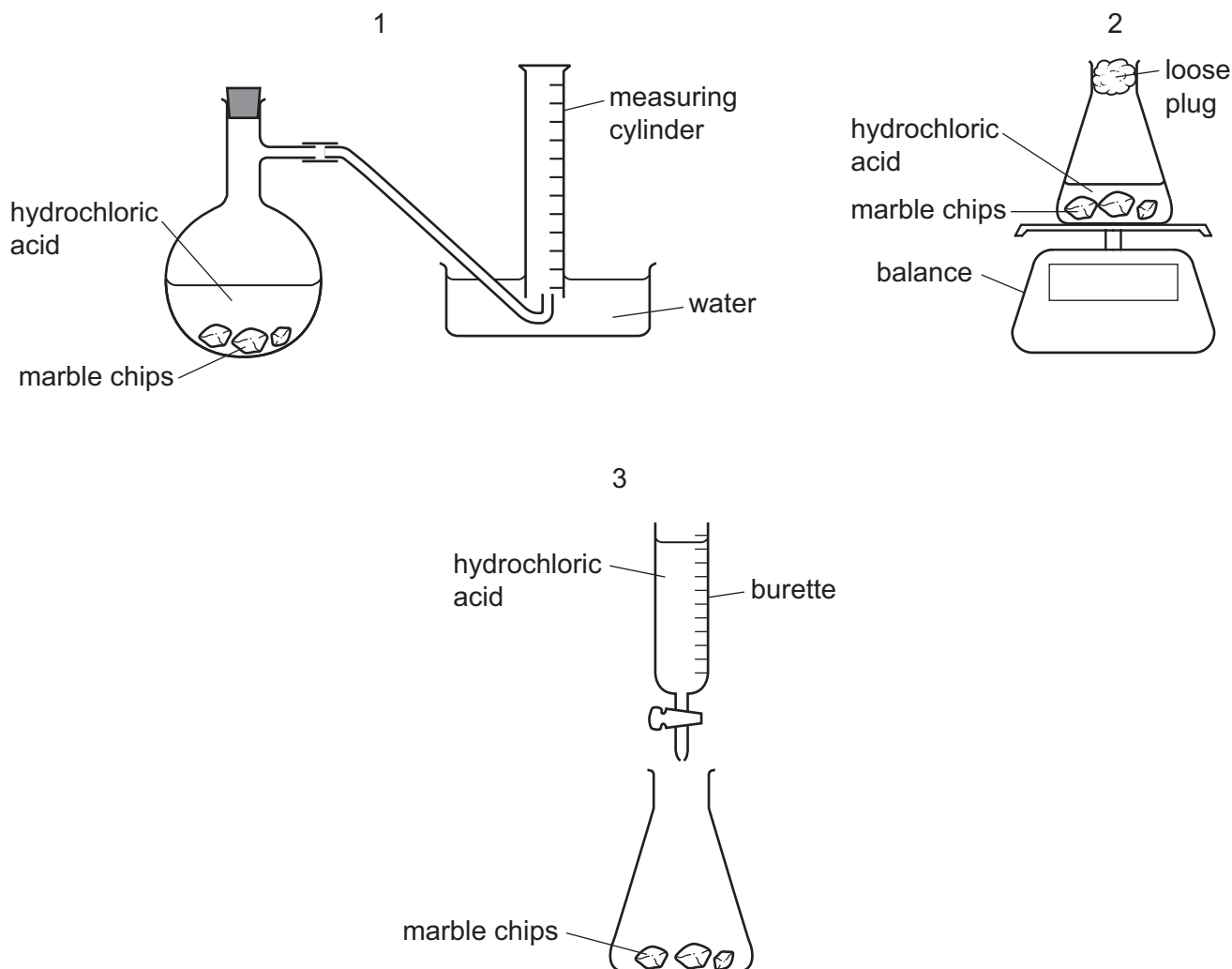
Which pieces of apparatus are used to measure volume in this experiment?

	to measure dilute hydrochloric acid	to measure aqueous sodium hydroxide
A	burette	beaker
B	burette	pipette
C	pipette	pipette
D	pipette	beaker

- 2 A student follows the rate of the reaction between marble chips, CaCO_3 , and dilute hydrochloric acid.



Which diagrams show apparatus that, with a stopwatch, is suitable for this experiment?



- A** 1 only **B** 1 and 2 only **C** 2 and 3 only **D** 1, 2 and 3

- 3 Pure oxygen is needed by many industries.

How is pure oxygen obtained in large amounts for such uses?

- A** by decomposition of calcium carbonate
B by decomposition of hydrogen peroxide
C by filtration of liquid air
D by fractional distillation of liquid air

- 4 An impure sample of compound X has a melting point of 120 °C.

X is purified and its melting point is measured again.

Which row is correct?

	method of purifying X	melting point of pure X/°C
A	crystallisation	115
B	distillation	115
C	crystallisation	125
D	distillation	125

- 5 When aqueous sodium hydroxide is added to aqueous compound X, a red-brown precipitate is formed. When dilute nitric acid followed by aqueous barium nitrate is added to aqueous compound X, a white precipitate is formed.

What is X?

- A** chromium(III) sulfate
B chromium(III) chloride
C iron(III) chloride
D iron(III) sulfate
- 6 An aqueous solution of zinc chloride is tested by adding reagents.

Which observation is correct?

	reagent added to zinc chloride (aq)	observations
A	acidified aqueous barium nitrate	forms a white precipitate
B	aqueous ammonia	forms a white precipitate, soluble in excess of the reagent
C	aqueous sodium hydroxide	forms a white precipitate, insoluble in excess of the reagent
D	powdered copper	forms a grey precipitate

- 7 A sample of gas is released at a particular point in a laboratory.

A detecting device is placed ten metres from the point where the gas is released. This device detects and records the time when the concentration of the gas is ten molecules in every million molecules of air.

The experiment is carried out with two gases at different temperatures.

In which experiment was the time recorded by the detector **greatest**?

	gas	temperature of laboratory/°C
A	SF ₆	20
B	SF ₆	40
C	CO ₂	20
D	CO ₂	40

- 8 The table shows data for some particles.

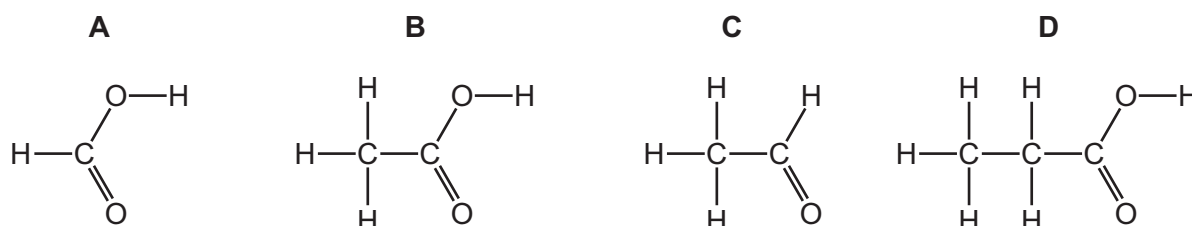
particle	proton number	nucleon number	number of protons	number of neutrons	number of electrons
sodium ion	11	23	11	W	10
fluoride ion	9	19	9	10	X
magnesium ion	12	24	Y	12	10

What are the values of W, X and Y?

	W	X	Y
A	10	10	12
B	11	12	10
C	12	10	12
D	12	10	10

- 9 A covalent compound P has the empirical formula CH₂O.

Which structure represents P?



10 Which statement about the structure or bonding of metals is correct?

- A A metal lattice consists of negative ions in a 'sea of electrons'.
- B Electrons in a metal move randomly through the lattice.
- C Metals are malleable because the ions present are mobile.
- D The ions in a metal move when positive and negative electrodes are attached.

11 The relative atomic mass of chlorine is 35.5.

What is the mass of 2.0 mol of chlorine gas?

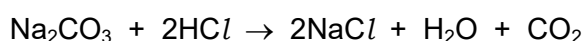
- A 17.75 g B 35.5 g C 71 g D 142 g

12 When gases react, the volume of gaseous reactants may be different from the volume of gaseous products.

For which reaction is the percentage change in the volume of gas largest? (Assume each reaction goes to completion.)

- A $2\text{SO}_2(\text{g}) + \text{O}_2(\text{g}) \rightarrow 2\text{SO}_3(\text{g})$
- B $\text{CH}_4(\text{g}) + 2\text{O}_2(\text{g}) \rightarrow \text{CO}_2(\text{g}) + 2\text{H}_2\text{O}(\text{g})$
- C $\text{N}_2(\text{g}) + 3\text{H}_2(\text{g}) \rightarrow 2\text{NH}_3(\text{g})$
- D $2\text{C}_2\text{H}_6(\text{g}) + 7\text{O}_2(\text{g}) \rightarrow 6\text{H}_2\text{O}(\text{g}) + 4\text{CO}_2(\text{g})$

13 Sodium carbonate reacts with dilute hydrochloric acid.



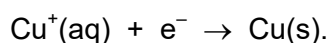
A sample containing 0.0800 mol of sodium carbonate is added to a solution containing 0.100 mol of hydrochloric acid.

Which volume of carbon dioxide is produced, measured at room temperature and pressure?

- A 0.96 dm³ B 1.20 dm³ C 1.92 dm³ D 2.40 dm³

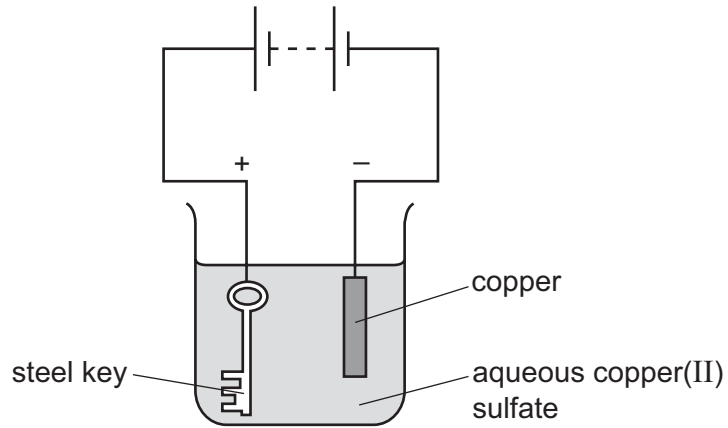
14 Which statement about the electrolysis of solutions is correct?

- A During the electrolysis of concentrated aqueous sodium chloride solution, hydrogen is produced at the cathode.
- B During the electrolysis of dilute sulfuric acid, oxygen is produced at the cathode.
- C When aqueous copper(II) sulfate is electrolysed, the reaction taking place at the cathode is



- D When aqueous copper(II) sulfate is electrolysed using copper electrodes, the mass of the anode at the end of the reaction will be greater than at the beginning.

15 The apparatus shown is set up to plate a steel key with copper.

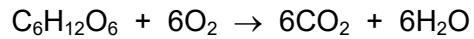


The key does not get coated with copper.

Which change needs to be made to plate the key?

- A Increase the concentration of the aqueous copper(II) sulfate.
- B Increase the voltage.
- C Replace the solution with dilute sulfuric acid.
- D Reverse the electrical connections.

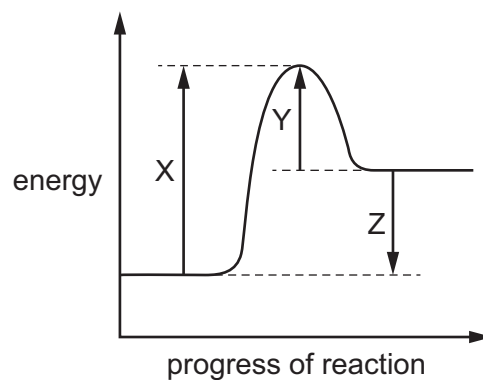
16 The equation shows the reaction of glucose with oxygen.



Which statement about this reaction is correct?

- A It can occur in the dark.
- B It is endothermic.
- C It needs chlorophyll as a catalyst.
- D It occurs in plants but not in animals.

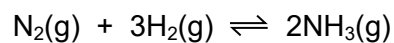
17 The energy profile diagram of a chemical reaction is shown.



Which statement is correct?

- A The reaction is exothermic.
- B X represents the activation energy for the reaction.
- C Y represents ΔH for the reaction.
- D Z represents the energy given out as the reaction proceeds.

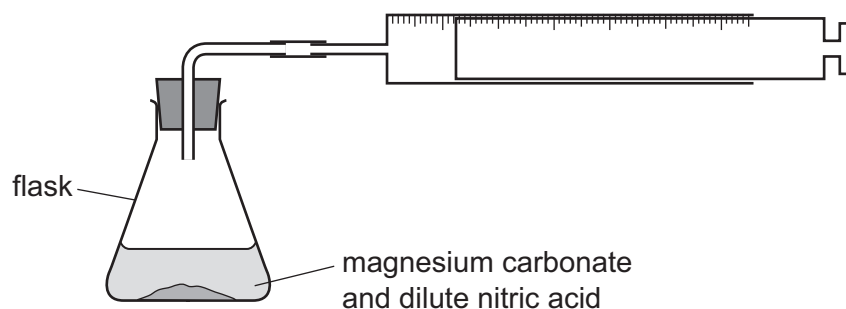
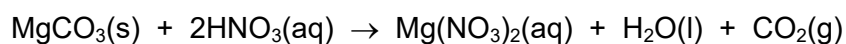
18 The equation shows the reaction for the manufacture of ammonia.



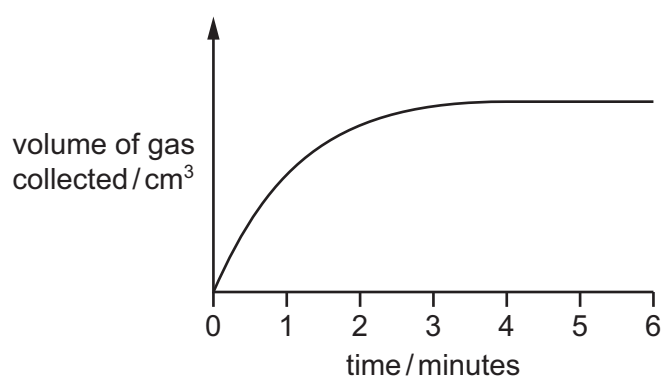
Which change will decrease the activation energy of the reaction?

- A addition of a catalyst
- B decrease in temperature
- C increase in concentration
- D increase in pressure

- 19 The apparatus shows a method of following the rate of the reaction between magnesium carbonate, MgCO_3 , and dilute nitric acid, HNO_3 .



The graph shows the volume of gas collected against time.



Three statements are made about the experiment.

- 1 The mass of the flask and its contents decreases as time increases.
- 2 The rate of the reaction decreases as time increases.
- 3 The reaction has finished after four minutes.

Which statements are correct?

- A** 1, 2 and 3 **B** 1 and 2 only **C** 1 and 3 only **D** 2 and 3 only

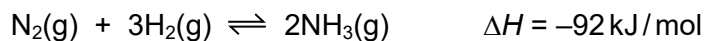
- 20 Aqueous bromine is added to aqueous sodium chloride.

Which statement is correct?

- A** Bromine is oxidised and chloride ions are reduced.
B Bromine is reduced and chloride ions are oxidised.
C Neither oxidation nor reduction takes place.
D Sodium ions are oxidised.

- 21 Which statement is correct for all reversible reactions that have reached dynamic equilibrium?
- A Introduction of a catalyst changes the position of the equilibrium.
 - B The number of moles of products equals the number of moles of reactants.
 - C The rate of the forward reaction equals the rate of the reverse reaction.
 - D When the reaction reaches the position of equilibrium the reaction stops.
- 22 Which statement about acids and bases is correct?
- A A 0.1 mol/dm^3 solution of ethanoic acid has a higher pH than a 0.1 mol/dm^3 solution of hydrochloric acid.
 - B All bases dissolve in water to produce OH^- ions.
 - C Bases react with nitrates to produce ammonia.
 - D Oxides of metals are always acidic in character.
- 23 Which compound can be formed by precipitation?
- A NaCl B K_2SO_4 C $\text{Ca}(\text{NO}_3)_2$ D PbSO_4
- 24 Which methods could be used to make a pure sample of copper(II) sulfate?
- 1 acid + metal carbonate
 - 2 acid + metal oxide
 - 3 acid + metal
 - 4 precipitation
- A 1 and 2 only B 1 and 3 only C 1, 2 and 3 D 1, 2 and 4

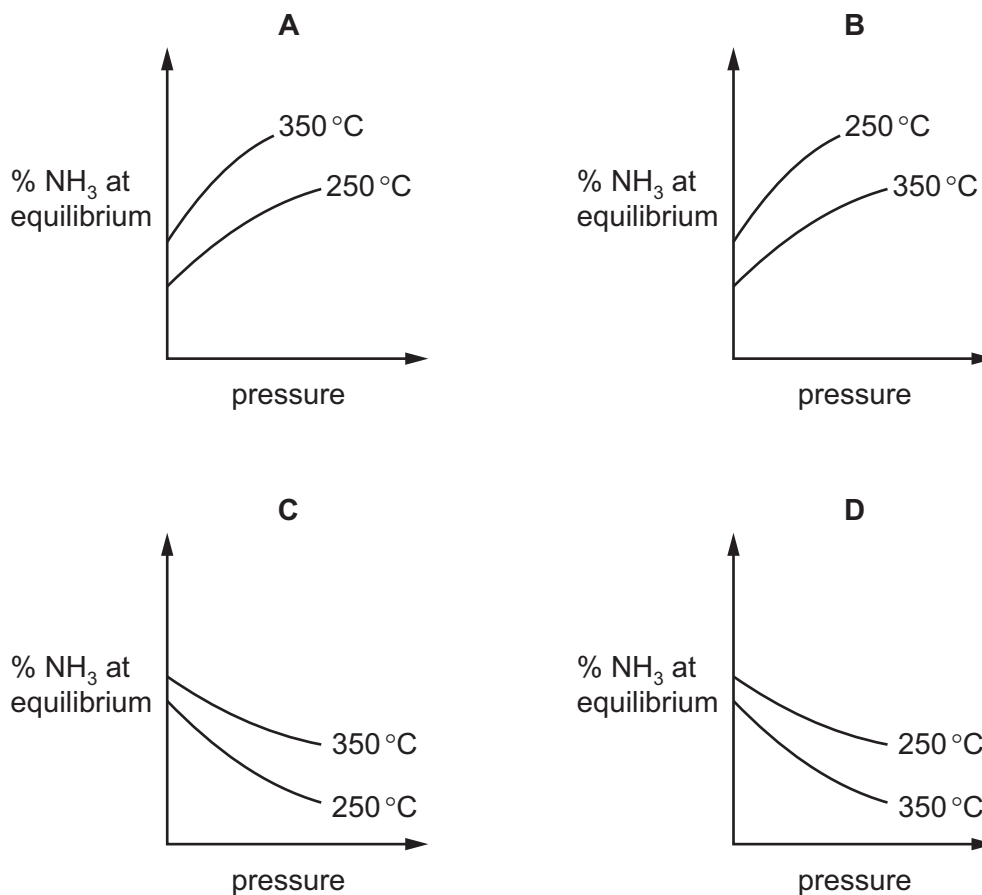
25 Ammonia is made by a reversible reaction.



A chemist investigates how the percentage of ammonia at equilibrium changes with pressure.

The experiment is carried out both at 250 °C and at 350 °C.

Which graph shows the chemist's results?



26 Which statement about sulfur dioxide, SO_2 , is correct?

- A It is dissolved in water to make sulfuric acid for car batteries.
- B It is the final product of the Contact process.
- C It is used as a food preservative.
- D It turns aqueous potassium iodide brown.

31 The table gives properties of four metals, P, Q, R and S.

	method of extraction	reaction with water	reaction with acid
P	electrolysis only	no reaction	reacts slowly
Q	heating oxide with carbon	reacts slowly with steam	reacts slowly
R	electrolysis only	reacts rapidly with steam	reacts rapidly
S	heating oxide with carbon	no reaction	no reaction

Which statement is correct?

- A P is the least reactive.
- B Q would displace R from a solution of its salt.
- C R could be zinc.
- D S could be copper.

32 Which statements about extracting metals from their ores are correct?

- 1 Aluminium is extracted by the electrolysis of aluminium oxide dissolved in cryolite.
- 2 Silver is difficult to extract from its ores because of its low reactivity.
- 3 Iron is extracted from haematite by reduction in the blast furnace.

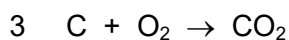
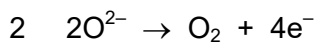
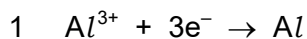
- A 1 and 2 only B 1 and 3 only C 2 and 3 only D 1, 2 and 3

33 Which statements about the corrosion of iron are correct?

- 1 Corrosion can be prevented by coating the iron with zinc.
- 2 Corrosion only occurs in the presence of both air and water.
- 3 Rust is an alloy of iron and oxygen.
- 4 Sacrificial protection occurs when iron is connected to a less reactive metal.

- A 1 and 2 B 1 and 3 C 2 and 4 D 3 and 4

34 In the extraction of aluminium from aluminium oxide, the following three reactions take place.



Which reactions take place at the positive electrode?

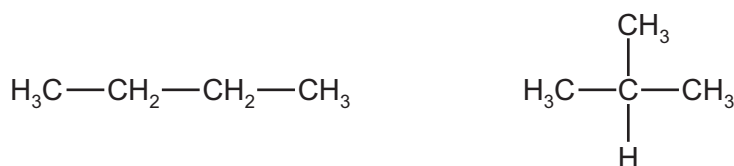
- A** 1 only **B** 2 only **C** 1 and 3 **D** 2 and 3

35 Which statements are correct?

- 1 Chlorination is used to remove unpleasant tastes from drinking water.
- 2 Desalination can be achieved using distillation.
- 3 The presence of phosphates in water and soil encourages plant growth.

- A** 1, 2 and 3 **B** 1 and 2 only **C** 2 and 3 only **D** 3 only

36 Two isomers are shown.



Which statements about these isomers are correct?

- 1 They have the same empirical formula.
- 2 They have different molecular formulae.
- 3 They are members of the same homologous series.

- A** 1, 2 and 3 **B** 1 and 3 only **C** 1 only **D** 2 and 3 only

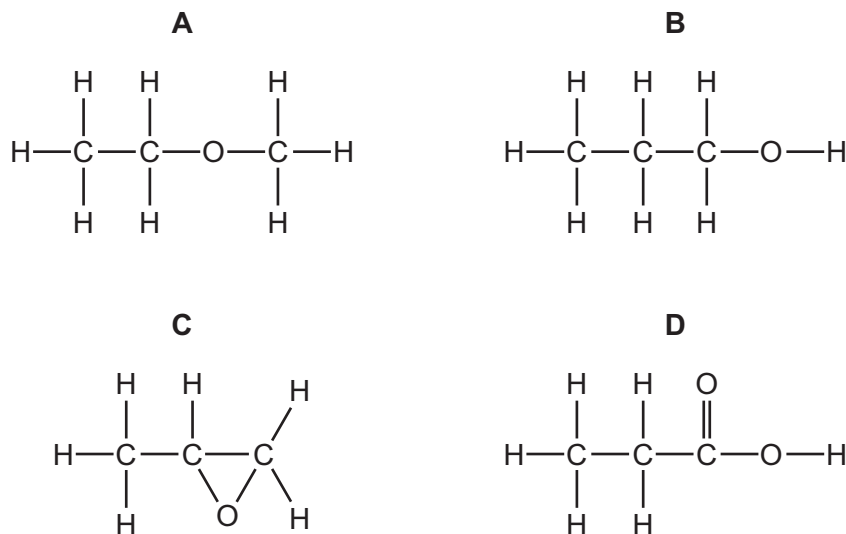
37 A hydrocarbon compound Q has molecular formula C_xH_y .

Q reacts with hydrogen to form a single product with molecular formula C_xH_{y+2} .

Which statement about Q is correct?

- A** Q does not burn in air.
- B** Q is a saturated hydrocarbon.
- C** Q reacts with bromine to form a single product with molecular formula $\text{C}_x\text{H}_{y-1}\text{Br}$.
- D** Q reacts with steam to form a single product with molecular formula $\text{C}_x\text{H}_{y+2}\text{O}$.

38 Which structural formula represents an alcohol?



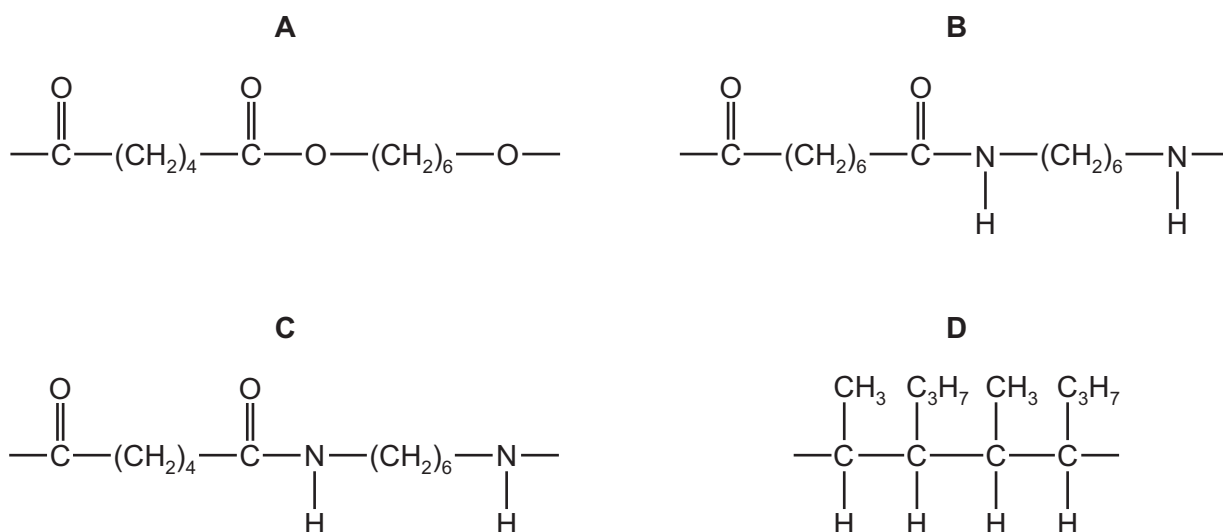
39 Which statement about carboxylic acids is correct?

- A** They are prepared by the oxidation of alkanes.
- B** They decolourise bromine water.
- C** They react with alcohols to form esters.
- D** They react with carbonates to form a salt, hydrogen and water.

40 P is a polymer that:

- has six carbon atoms in each of the monomers from which it is formed
- is **not** a polyester
- is formed using condensation polymerisation.

What is the partial structure of P?



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The Periodic Table of Elements

		Group																				
I	II	III	IV	V	VI	VII	VIII															
3 Li lithium 7	4 Be beryllium 9	11 Na sodium 23	12 Mg magnesium 24	19 K potassium 39	20 Ca calcium 40	21 Sc scandium 45	22 Ti titanium 48	23 V vanadium 51	24 Cr chromium 52	25 Mn manganese 55	26 Fe iron 56	27 Co cobalt 59	28 Ni nickel 59	29 Cu copper 64	30 Zn zinc 65	31 Ga gallium 70	32 Ge germanium 73	33 As arsenic 75	34 Se selenium 79	35 Br bromine 80	36 Kr krypton 84	
37 Rb rubidium 85	38 Sr strontium 88	39 Y yttrium 89	57-71 lanthanoids	72 Hf hafnium 178	73 Ta tantalum 181	74 W tungsten 184	75 Re rhenium 186	76 Os osmium 190	77 Ir iridium 192	78 Pt platinum 195	79 Au gold 197	80 Hg mercury 201	81 Tl thallium 204	82 Pb lead 207	83 Bi bismuth 209	84 Po polonium —	85 At astatine —	86 Rn radon —				
87 Fr francium —	88 Ra radium —	89 Ac actinium —	89-103 actinoids	104 Rf rutherfordium —	105 Db dubnium —	106 Sg seaborgium —	107 Bh bohrium —	108 Hs hassium —	109 Mt meitnerium —	110 Ds darmstadtium —	111 Rg roentgenium —	112 Cn copernicium —	114 Fl flerovium —	116 Lv livermorium —								
		1 H hydrogen 1												2 He helium 4								
		Key atomic number atomic symbol name relative atomic mass																				

lanthanoids	57 La lanthanum 139	58 Ce cerium 140	59 Pr praseodymium 141	60 Nd neodymium 144	61 Pm promethium —	62 Sm samarium 150	63 Eu europium 152	64 Gd gadolinium 157	65 Tb terbium 159	66 Dy dysprosium 163	67 Ho holmium 165	68 Er erbium 167	69 Tm thulium 169	70 Yb ytterbium 173	71 Lu lutetium 175
actinoids	89 Ac actinium —	90 Th thorium 232	91 Pa protactinium 231	92 U uranium 238	93 Np neptunium —	94 Pu plutonium —	95 Am americium —	96 Cm curium —	97 Bk berkelium —	98 Cf californium —	99 Es einsteinium —	100 Fm fermium —	101 Md mendelevium —	102 No nobelium —	103 Lr lawrencium —

The volume of one mole of any gas is 24 dm³ at room temperature and pressure (r.t.p.).

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Question Papers

Paper #1



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