



COMPASSVALE SECONDARY SCHOOL
Secondary Four Express
Preliminary Examination 2025

NAME

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CENTRE
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CLASS

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INDEX
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CHEMISTRY

6092/01

Paper 1 Multiple Choice

25 August 2025

1 hour

Additional Materials: Multiple Choice Answer Sheet

READ THESE INSTRUCTIONS FIRST

Write your Centre number, class, index number and name on all the work you hand in.

Write in soft pencil.

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

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 17.

The use of an approved scientific calculator is expected, where appropriate.

This document consists of **17** printed pages and **1** blank page.

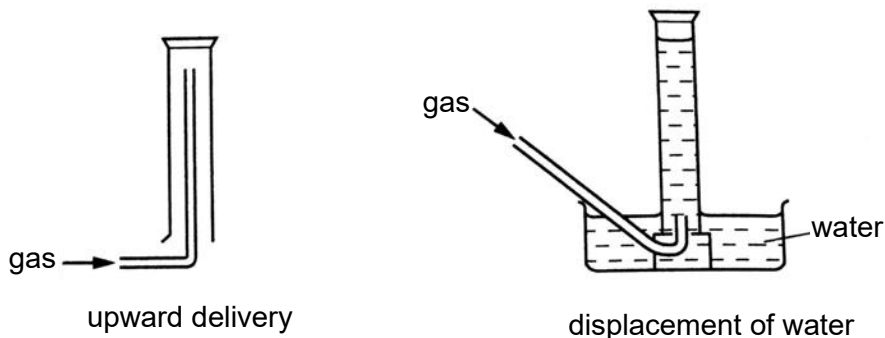
Set by: Mdm C Lim

[Turn over

- 1 The table gives the density and solubility of four gases in water.

gas	density	solubility in water
1	denser than air	soluble
2	less dense than air	soluble
3	denser than air	insoluble
4	less dense than air	insoluble

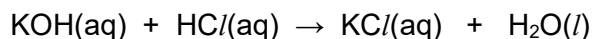
Two methods of gas collection are upward delivery and displacement of water.



Which row correctly shows whether each of these methods could be used to collect the gas?

	gas	method of collection	
		upward delivery	displacement of water
A	1	yes	yes
B	2	yes	no
C	3	yes	no
D	4	no	yes

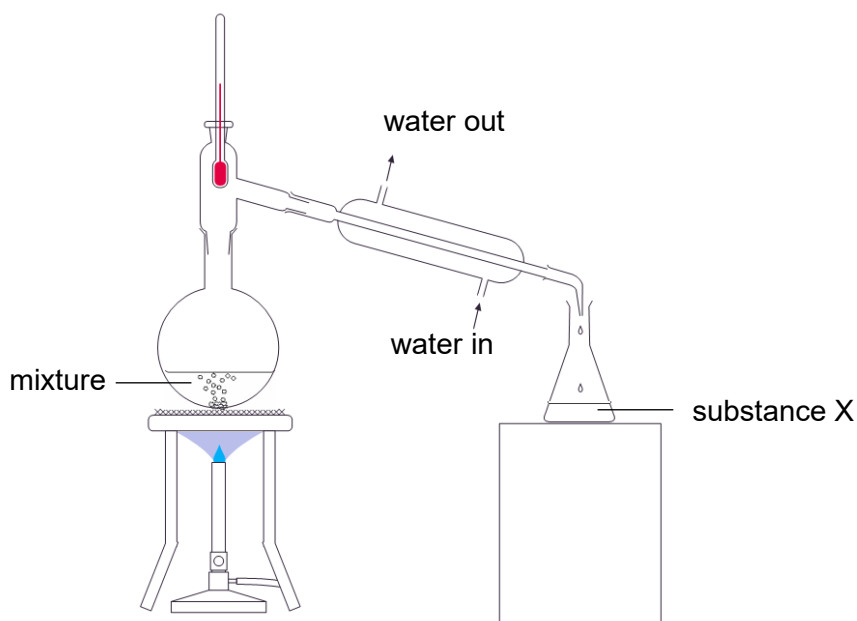
- 2 A student carried out an experiment to prepare a sample of aqueous potassium chloride. The equation for the reaction is shown.



What pieces of apparatus are required for this experiment?

- A** beaker, electronic balance, evaporating dish
- B** burette, conical flask, pipette
- C** conical flask, gas syringe, stopwatch
- D** filter funnel, filter paper, measuring cylinder

- 3 Substance X can be separated from its mixture using the apparatus as shown in the diagram.



Which row gives the correct melting and boiling point of substance X?

	melting point / °C	boiling point / °C
A	-218	-183
B	-56	10
C	-7	59
D	45	179

- 4 An inflated balloon deflates because gas molecules can diffuse through the rubber.
Four balloons are filled with different gases at the same temperature and pressure.
Which balloon would deflate **most** quickly?

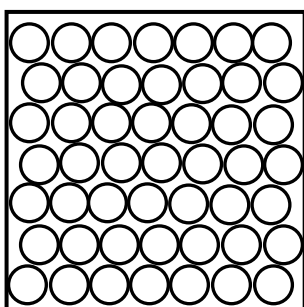
A	B	C	D
methane, CH ₄	carbon dioxide, CO ₂	nitrogen, N ₂	oxygen, O ₂

- 5 Which row correctly describes changes in the particles when a substance freezes?

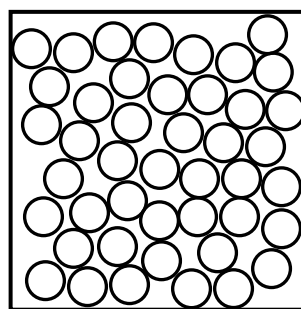
	arrangement of the particles	energy change in the particles
A	less orderly	gain energy
B	less orderly	lose energy
C	more orderly	gain energy
D	more orderly	lose energy

- 6 The diagrams show the spacing of particles in a substance at two different temperatures.

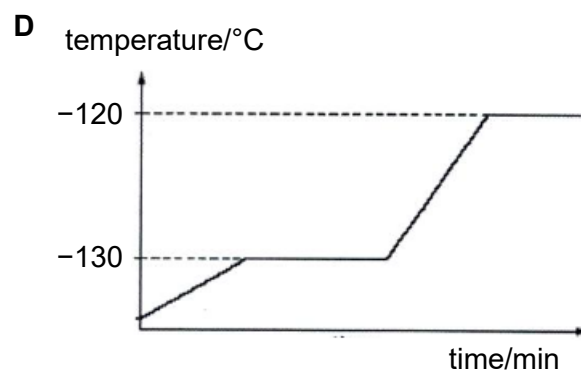
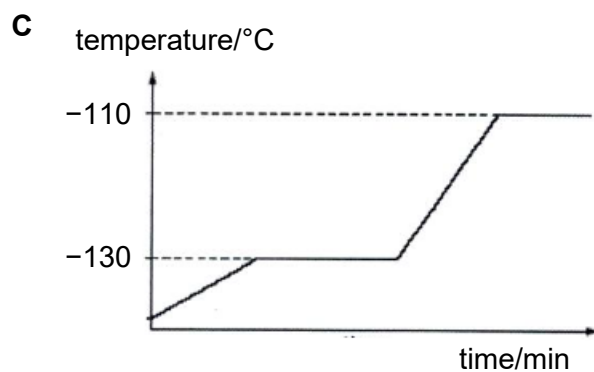
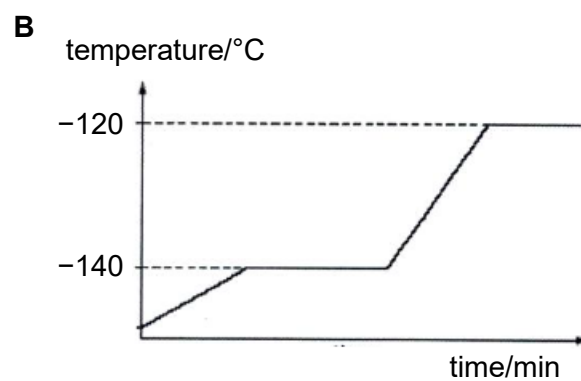
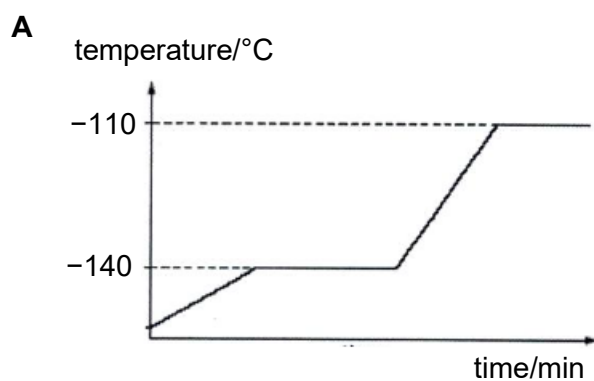
at -135°C



at -115°C



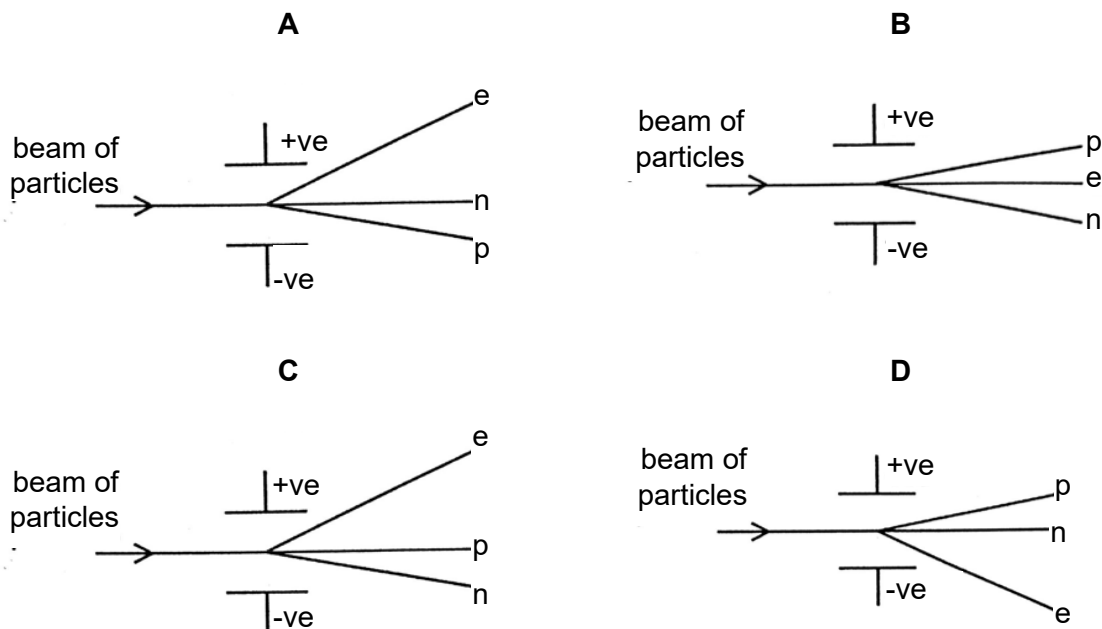
Which graph shows how the temperature of the substance changes with time when it is heated?



- 7 A beam of particles contains neutrons, n, protons, p and electrons, e.

The beam is passed between charged plates.

Which diagram shows how the particles are affected by the plates?



- 8 Iridium has two isotopes. One of the isotope is iridium-191 which has a percentage abundance of 37.3%. The relative atomic mass of iridium is 192.2.

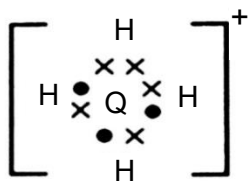
What is the other isotope of iridium?

- A iridium-190
 B iridium-192
 C iridium-193
 D iridium-194
- 9 Element Z which is in Group 16 of the Periodic Table has x neutrons and y protons.

Which symbol represents the ion of Z?

- A ${}^x_y\text{Z}^{2+}$ B ${}^{x+y}_y\text{Z}^{2+}$ C ${}^x_y\text{Z}^{2-}$ D ${}^{x+y}_y\text{Z}^{2-}$

- 10 The ion QH_4^+ can be represented by the 'dot-and-cross' diagram shown.



To which group in the Periodic Table does Q belong to?

- A** Group 1 **B** Group 13 **C** Group 14 **D** Group 15
- 11 Which row shows the correct number of electrons used in covalent bonding in each molecule?

	ammonia	carbon dioxide	fluorine	nitrogen
A	6	4	2	4
B	6	8	2	6
C	6	4	2	6
D	6	8	2	4

- 12 Which statement best explains why potassium chloride has a lower melting point than calcium oxide?
- A** Potassium chloride is a covalent compound but calcium oxide is an ionic compound.
B Potassium is more reactive than calcium.
C The forces of attraction between K^+ and Cl^- is weaker than that between Ca^{2+} and O^{2-} .
D The melting point of potassium is lower than that of calcium.

- 13 When green solid P is heated, black solid Q and colourless gas R is formed.

When gas R is bubbled into limewater, white precipitate is formed.

Which correctly describes P, Q and R?

	P	Q	R
A	compound	mixture	element
B	compound	compound	compound
C	element	element	compound
D	element	compound	element

- 14 Potash alum is a salt that is made up of three different ions. The formula of the salt is $KX(SO_4)_2$, where X is an unknown ion.

What is the formula for the nitrate of X ?

- A XNO_3
 B $X(NO_3)_2$
 C $X(NO_3)_3$
 D X_2NO_3

- 15 The relative formula masses of four compounds are given.

A student has 1.0 g samples of each compound.

Which sample contains the highest number of oxygen atoms?

	compound	relative formula mass
A	Al_2O_3	102
B	CuO	80
C	HNO_3	63
D	H_2SO_4	98

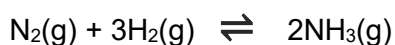
- 16 Oxides of nitrogen are pollutant gases which are emitted from car exhausts.

0.46 g of an oxide of nitrogen, N_xO_y , occupies 120 cm^3 at room temperature and pressure.

What are the values of x and y ?

	x	y
A	1	1
B	1	2
C	2	1
D	2	4

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

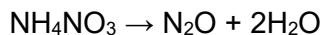


What is the percentage yield when 60 kg of ammonia is produced from 60 kg of hydrogen?

- A 17.6% B 30.0% C 35.3% D 50.0%

[Turn over

- 18 On heating, ammonium nitrate, NH_4NO_3 , decomposes to form dinitrogen oxide and water.



When 85 g of an impure sample of ammonium nitrate is heated, 27 g of water is formed.

What is the mass of ammonium nitrate in the impure sample?

- A $66 \times \frac{27}{36}$
- B $80 \times \frac{27}{18}$
- C $80 \times \frac{27}{36}$
- D $85 \times \frac{9}{36}$
- 19 In an experiment, 4.0 cm^3 of 1.0 mol/dm^3 copper(II) sulfate solution is mixed with 8.0 cm^3 of 1.0 mol/dm^3 sodium carbonate solution.

What does the reaction vessel now contain?

- A a colourless solution only
- B a green precipitate and a blue solution
- C a green precipitate and a colourless solution
- D a white precipitate and a colourless solution
- 20 The table shows the results of different experiments conducted on two different acids, E and F, both of equal concentrations.

experiment	E	F
electrical conductivity	high	low
temperature change when excess acid is reacted with sodium hydroxide / °C	6.9	6.7
reaction with magnesium	rapid effervescence	gradual effervescence

What deduction can be made about acids E and F?

- A Both are strong acids, but E is a dibasic acid while F is a monobasic acid.
- B Both are strong acids, but E is a monobasic acid while F is a dibasic acid.
- C E is a strong acid while F is a weak acid.
- D E is a weak acid while F is a strong acid.

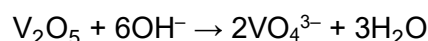
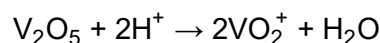
- 21** Solutions J and K were tested with a few drops of methyl orange indicator. Solution J turned the indicator red while solution K turned the indicator yellow.

Which statements about solutions J and K are correct?

- 1 Solution J has a higher pH than solution K.
- 2 Solution J has a lower pH than solution K.
- 3 Solution J has a higher concentration of hydrogen ions than solution K.
- 4 Solution J has a lower concentration of hydrogen ions than solution K.

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

- 22** Vanadium(V) oxide, V_2O_5 , can undergo the reactions as shown in the following equations.



What can be inferred about vanadium(V) oxide from the above reactions?

- A** It is an acidic oxide.
- B** It is an amphoteric oxide.
- C** It is a basic oxide.
- D** It is a neutral oxide.

- 23** Aqueous ammonium sulfate is warmed with an excess of aqueous potassium hydroxide. The resulting mixture is neutralised with dilute hydrochloric acid.

This mixture is then mixed with aqueous barium chloride.

The precipitate is filtered off and dried to leave a white solid.

What is the identity of this white solid?

- A** ammonium chloride
- B** barium sulfate
- C** potassium chloride
- D** potassium sulfate

- 24 Ammonia gas is produced industrially by the Haber process.

Which statement about the Haber process is true?

- A Equal proportions of nitrogen and hydrogen are reacted in the process.
- B High pressure will increase the yield of ammonia.
- C Nickel catalyst is added to the process.
- D Nitrogen is the raw material obtained from the simple distillation of liquid air.

- 25 Gas Z is soluble in water. Its solution turns red litmus paper blue.

Which statement is **not** correct?

- A A green precipitate is obtained when an aqueous solution of Z is added one drop at a time to aqueous iron(II) nitrate.
- B A white precipitate is produced, which then dissolves, when an aqueous solution of Z is added one drop at a time to aqueous aluminium nitrate until no further change.
- C Gas Z could be made by warming aqueous ammonium nitrate with aqueous sodium hydroxide.
- D Gas Z could be made by warming aqueous zinc nitrate with aqueous sodium hydroxide and powdered aluminium.

- 26 Concentrated hydrochloric acid is oxidised by manganese(IV) oxide, MnO_2 .

What are two products formed in this reaction?

- A Mn^{2+} and Cl_2
- B Mn^{2+} and Cl^-
- C Mn^{6+} and Cl_2
- D Mn^{6+} and Cl^-

- 27 Hydrogen peroxide, H_2O_2 , can behave both as an oxidising agent or a reducing agent.

Which equation shows hydrogen peroxide behaving as a reducing agent?

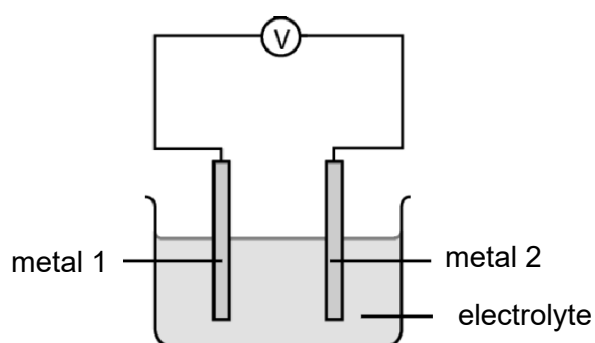
- A $\text{H}_2\text{O}_2 + 2\text{H}^+ + 2\text{e}^- \rightarrow 2\text{H}_2\text{O}$
- B $\text{H}_2\text{O}_2 + 2\text{H}^+ + 3\text{I}^- \rightarrow \text{I}_3^- + 2\text{H}_2\text{O}$
- C $\text{H}_2\text{O}_2 + 2\text{H}^+ + 2\text{Fe}^{2+} \rightarrow 2\text{Fe}^{3+} + 2\text{H}_2\text{O}$
- D $\text{H}_2\text{O}_2 + \text{NaOCl} \rightarrow \text{O}_2 + \text{NaCl} + \text{H}_2\text{O}$

- 28 A chromium bracelet is electroplated with silver.

Which row correctly describes the electrolysis cell used?

	positive electrode	negative electrode	electrolyte
A	bracelet	silver	silver nitrate
B	bracelet	silver	silver chloride
C	silver	bracelet	silver nitrate
D	silver	bracelet	silver chloride

- 29 Two metal electrodes and an electrolyte can be used to produce electrical energy.



The table shows the voltage produced by some cells when different metals are used.

metal 1	metal 2	voltage / V
copper	zinc	1.10
copper	nickel	0.60
silver	nickel	1.06
silver	iron	1.25

Which set of metal electrodes will give the largest voltage?

	metal 1	metal 2
A	copper	zinc
B	copper	iron
C	nickel	iron
D	nickel	zinc

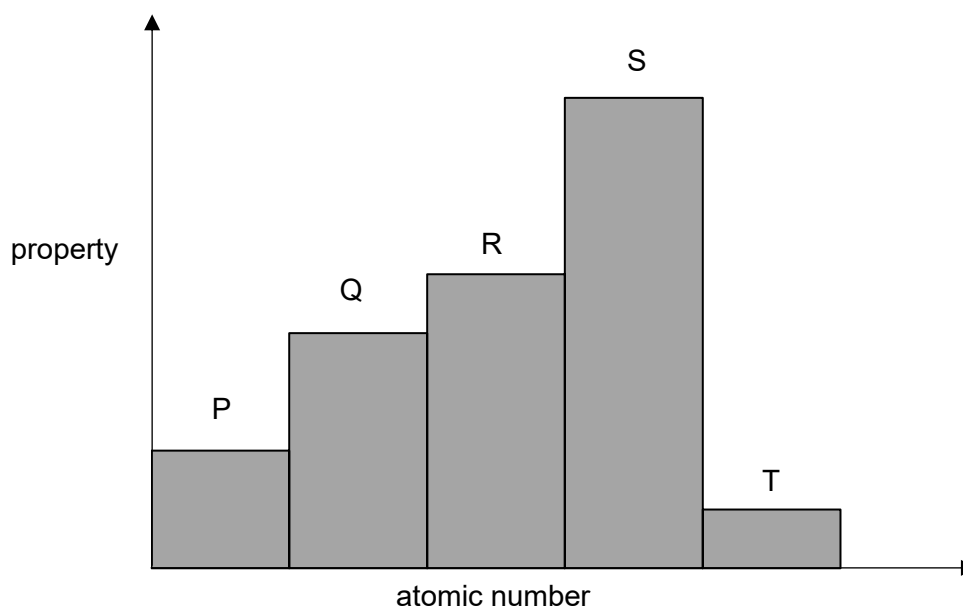
30 Three statements about hydrogen fuel cells are given.

- 1 Hydrogen is burned in oxygen to produce water as the only by-product.
- 2 A disadvantage of using hydrogen fuel cells is that hydrogen can only be produced from the electrolysis of water.
- 3 The ratio of hydrogen to oxygen consumed in the cell is 1 : 2.

Which statements are correct?

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

31 The graph shows the relationship between a physical property and the atomic number of five consecutive elements, P, Q, R, S and T in period 2 of the Periodic Table.



Which row correctly shows the physical property and the identity of element S?

	physical property	identity of element S
A	colour intensity	carbon
B	melting point	carbon
C	metallic character	silicon
D	solubility in water	silicon

32 Rubidium is found in Group 1 of the Periodic Table.

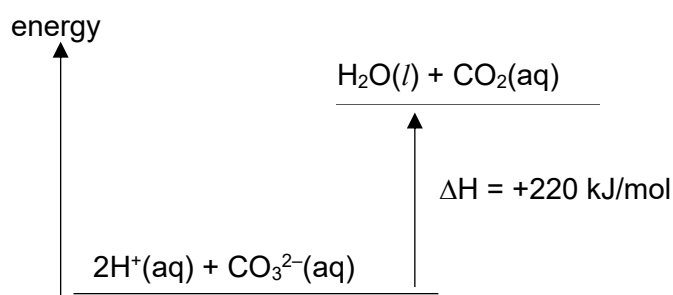
Which statement about rubidium is **not** correct?

- A It forms an ionic compound with halogens.
- B It has a higher density than sodium.
- C It has a higher melting point than potassium.
- D It reacts with water to form an alkali, RbOH.

33 Which element is **most** likely a transition metal?

	melting point / °C	density in g/cm ³	number of chlorides the element can form
A	-7	3.10	3
B	113	2.07	1
C	1083	8.92	2
D	1521	6.98	1

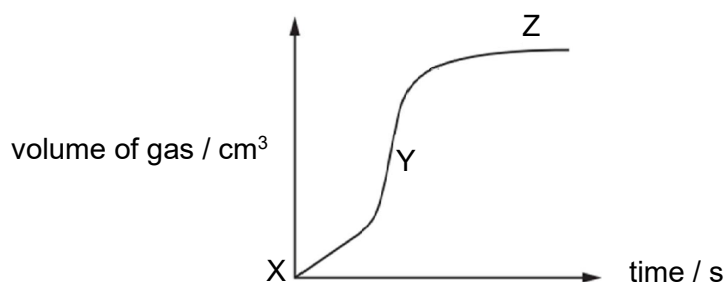
34 The energy level diagram for the reaction between an acid and a carbonate salt is given.



From the diagram, it can be deduced that

- A 220 kJ of energy is absorbed for every mole of acid that react with carbonate.
- B the amount of energy absorbed for bond breaking is more than the amount of energy released during bond formation.
- C the activation energy needed for the reaction will be less than 220 kJ.
- D the reaction is exothermic.

- 35** The graph shows the volume of gas produced when excess aluminium reacts with dilute hydrochloric acid.



The rate of reaction changes during the reaction.

Which row explains the changes in reaction rate between points X and Y, and points Y and Z?

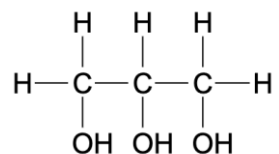
	between points X and Y	between points Y and Z
A	heat is given out	concentration of hydrochloric acid decreases
B	oxide layer has reacted, exposing aluminium	aluminium is used up
C	surface area of aluminium decreases	concentration of hydrochloric acid decreases
D	a catalyst is added after a few minutes into the reaction	aluminium is used up

- 36** In the presence of ultraviolet light, ethane and chlorine react to give a mixture of products.

Which compound is a possible product of the reaction?

- A** CH_3Cl
- B** $\text{CH}_2\text{ClCHCl}_2$
- C** $\text{CH}_2=\text{CHCl}$
- D** $\text{CH}_3\text{CH}_2\text{CH}_2\text{Cl}$

- 37 Propane-1,2,3-triol is a raw material for many important industrial chemical processes. The structure of propane-1,2,3-triol is shown.

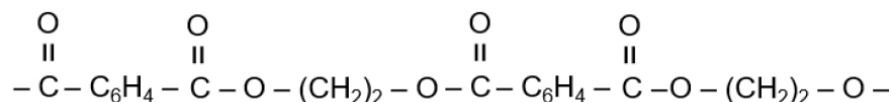


- 1 It can be used as a solvent and a fuel.
- 2 It reacts with acidified KMnO_4 to form carboxylic acids.
- 3 It reacts with carboxylic acids to form compounds containing up to three ester linkages.

Which statements about propane-1,2,3-triol are correct?

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

- 38 The polymer below is broken down into its monomers by hydrolysis using acid as a catalyst.



Which monomers are obtained from the hydrolysis reaction?

- 1 $\text{HOC}_6\text{H}_4\text{OH}$
- 2 $\text{HOOC}(\text{CH}_2)_2\text{COOH}$
- 3 $\text{HO}(\text{CH}_2)_2\text{OH}$
- 4 $\text{HOCC}_6\text{H}_4\text{COOH}$

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

- 39 Which change takes place as propene is converted to poly(propene)?

- A** a change in empirical formula
B a condensation polymerisation reaction
C the loss of electrons as new bonds form
D increase in boiling point

- 40** To reduce atmospheric pollution, the waste gases from a coal-burning power station are passed through powdered calcium carbonate.

Which waste gas will **not** be removed by the calcium carbonate?

- A** carbon dioxide
- B** nitrogen monoxide
- C** phosphorus(V) oxide
- D** sulfur dioxide

The Periodic Table of Elements

Group																										
1	2	1 H hydrogen 1															13	14	15	16	17	18				
		Key																					2 He helium 4			
		proton (atomic) number atomic symbol name relative atomic mass																								
3 Li lithium 7	4 Be beryllium 9																		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																		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	3	4	5	6	7	8	9	10	11	12					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 —								
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.).
The Avogadro constant, $L = 6.02 \times 10^{23} \text{ mol}^{-1}$.

