NAME:	NO:	CLASS:

ADMIRALTY SECONDARY SCHOOL

PRELIMINARY EXAMINATION 2024

SUBJECT	:	Chemistry
CODE/PAPER	:	6092/1
LEVEL/STREAM	:	Secondary 4 Express
DATE	:	26 August 2024
TIME	:	0800h – 0900h
DURATION	:	1 hour

READ THESE INSTRUCTIONS FIRST

Write in soft pencil.
Do not use staples, paper clips, glue or correction fluid.
Write your name, class and register number on the Optical Answer Sheet 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 Optical Answer Sheet.

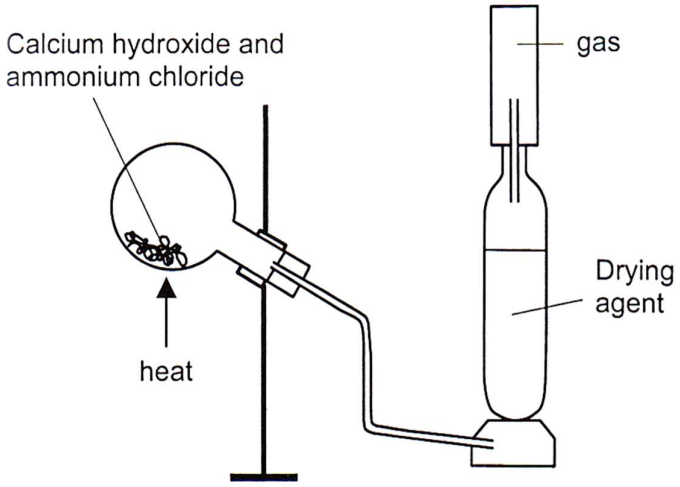
Fill in the Optical Answer Sheet very carefully.

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 question paper.
A copy of the Periodic Table is printed on page 19.
The use of an approved scientific calculator is expected, where appropriate.

40

DO NOT TURN OVER THIS PAPER UNTIL YOU ARE TOLD TO DO SO.

1 A student sets up the apparatus as shown below.



What gas will be collected from the set-up shown and what would be a suitable dehydrating agent?

	name of gas	dehydrating agent
A	ammonia gas	concentrated sulfuric acid
B	ammonia gas	calcium oxide
C	hydrogen chloride	concentrated sulfuric acid
D	hydrogen chloride	calcium oxide

2 A bottle of magnesium carbonate has been contaminated with sodium chloride. How can pure magnesium carbonate be obtained from this mixture?

A Add acid to the mixture, filter then evaporate the filtrate.
B Add acid to the mixture, filter then collect the residue.
C Add water to the mixture, filter then evaporate the filtrate.
D Add water to the mixture, filter then collect the residue.

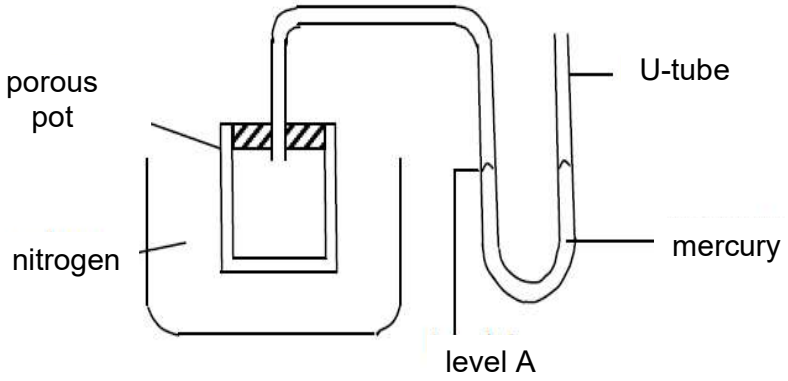
3 Which piece of apparatus could be used to determine the end-point of the reaction between hydrochloric acid and potassium hydroxide?

A electronic balance
B gas syringe
C stopwatch
D thermometer

4 Which of the following best describes the particles present in a diluted solution of potassium chloride?

	potassium chloride ions	water molecules
A	far apart	close together
B	close together	close together
C	close together	far apart
D	far apart	far apart

5 In a porous pot experiment, the porous pot was placed in a beaker of nitrogen. The porous pot was joined to a U tube filled with mercury as shown.

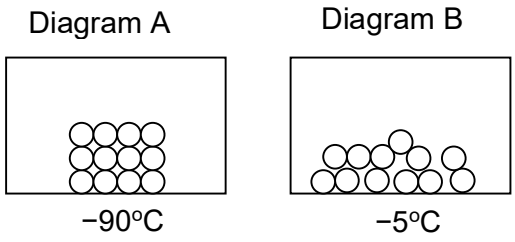


Which of the gases, 1 to 4, when used to fill the porous pot would cause level A to move down?

1 ammonia
2 carbon dioxide
3 chlorine
4 hydrogen

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

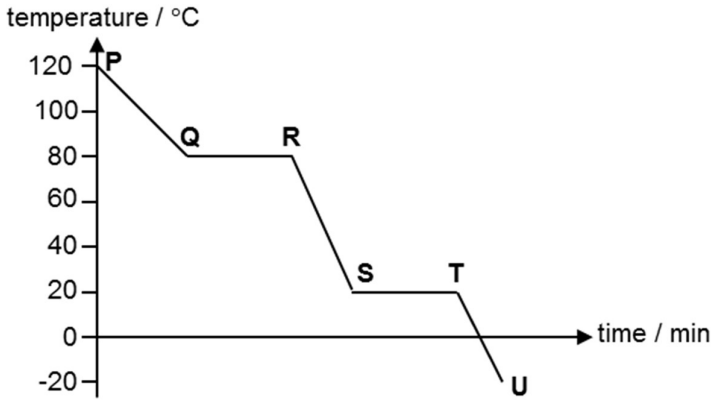
6 The diagrams show the particles in a substance at two different temperatures but at the same pressure.



Which of the following most likely indicates the melting point and boiling point of the substance?

	melting point / °C	boiling point / °C
A	−70	30
B	−70	−10
C	−100	−70
D	−120	−10

7 The graph shows the change in temperature with time when a substance at 120 °C is cooled to −20 °C.



Which statement correctly describes the change taking place between the points?

A The volume of vapour is decreasing from **R** to **S**.
B The particles release energy as they become closer together from **Q** to **R**.
C The particles absorb energy as they become more orderly from **S** to**T**.
D The energy of the particles remains constant from **S** to **T**.

8 Which ion has the least number of occupied shells?

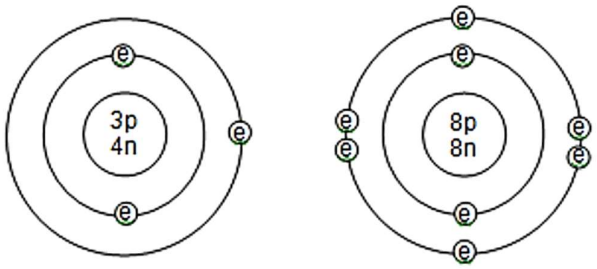
A Ca^{2+} **B** N^{3-}
C Li^{+} **D** Cl^{-}

9 Deuterium, D, is an isotope of hydrogen.

Which of the following statements about deuterium is **not** correct?

A It reacts with ethene, C_2H_4 to form a compound CH_2DCH_2D.
B An atom of deuterium contains one proton.
C It has the same density as hydrogen.
D It forms the ion D^+.

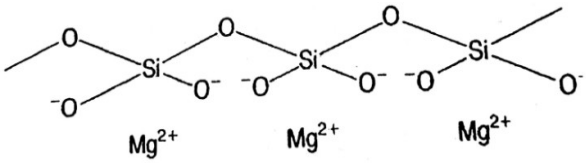
10 The diagrams below show the structures of the atoms of two elements.



What is the relative molecular mass of the compound formed by these two elements?

A 11
B 14
C 23
D 30

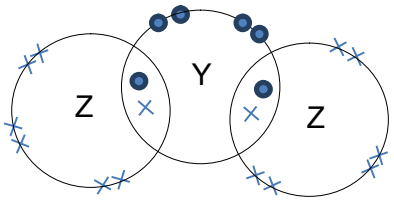
11 The diagram below shows a simplified structure for asbestos.



What is/are the bonding(s) in asbestos?

A covalent only
B ionic only
C covalent and ionic
D ionic and metallic

12 The outer shell electrons in compound YZ_2 are shown.



Atom Y is in Period 2 of the Periodic Table. What is the number of protons in atom Y?

A 6 **B** 8
C 10 **D** 12

13 Silicon carbide has a similar structure to diamond.

Which one of the following are advantages of using a silicon carbide ceramic compound instead of steel in manufacturing industry?

1 Silicon carbide has a higher melting point.
2 Silicon carbide is more resistant to oxidation.
3 Silicon carbide is less likely to deform under compression.

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

14 Element **R** has the following properties.

- forms **R**Br_2 when reacted with liquid bromine
- forms **R**$(NO_3)_3$ when reacted with dilute nitric acid

Which of the following best describes element **R**?

A group 2 element
B group 17 element
C group 18 element
D transition element

15 Which ionic equation represents the reaction when aqueous barium nitrate is added to sulfuric acid?

A $2H^+ (aq) + SO_4^{2-} (aq) \rightarrow H_2SO_4 (aq)$
B $Ba^{2+} (aq) + SO_4^{2-} (aq) \rightarrow BaSO_4 (s)$
C $2H^+ (aq) + Ba^{2+} (aq) \rightarrow H_2 (g) + Ba (s)$
D $H^+ (aq) + NO_3^- (aq) \rightarrow HNO_3 (aq)$

16 1.97 g of an unknown metal carbonate, MCO_3, reacts completely with 50.0 cm^3 of 0.400 mol/dm^3 hydrochloric acid.

What is the relative atomic mass of M?

A 35.0
B 94.5
C 137
D 150

17 It was found that 20.0 cm^3 of 0.500 mol/dm^3 dilute hydrochloric acid completely reacted with 0.70 g of a sample of sodium carbonate contaminated with sodium chloride.

What is the percentage purity of the sodium carbonate in the sample.

A 44.5%
B 45.4%
C 75.7%
D 80.9%

18 Dinitrogen tetroxide, N_2O_4, is a poisonous gas. It can be disposed of safely by reacting with sodium hydroxide, NaOH.

$$N_2O_4(g) + 2NaOH(aq) \rightarrow NaNO_3(aq) + NaNO_2(aq) + H_2O(l)$$

What is the least mass of sodium hydroxide required to dispose of 300 cm^3 of N_2O_4 at room temperature and pressure?

A 1.0 g
B 2.0 g
C 10.0 g
D 20.0 g

19 Solution **X** and solid **Y** are mixed in a beaker. After mixing, the final mass of the substances and the beaker is lesser than the initial mass.

What could solution **X** and solid **Y** be?

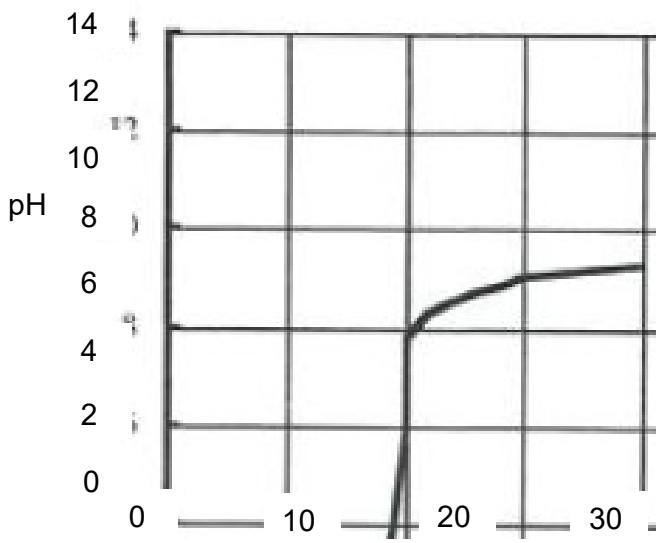
	solution **X**	solid **Y**
A	hydrochloric acid	iron(III) hydroxide
B	nitric acid	magnesium oxide
C	potassium hydroxide	ammonium carbonate
D	sulfuric acid	copper

20 A dilute aqueous solution of a strong alkali, XOH, contains molecules of water and the ions X^+ and OH^-. Which statement is correct?

A The solution also contains H^+ ions.
B The pH value of the alkali is below 7.
C The solution contains more OH^- ions than water molecules.
D The solution contains a high concentration of XOH molecules.

21 Different indicators change colour over different pH ranges and it is important to choose the correct indicator to obtain an accurate result in a titration.

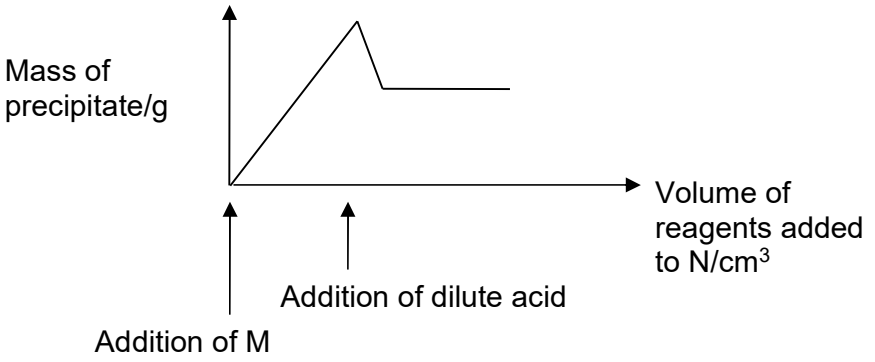
indicator	pH range for the colour change
indigo carmaine	11.6 to 14.0
methyl red	4.2 to 6.3
methyl violet	0.3 to 3.0
phenolphthalein	8.2 to 10.0



Which of the indicators would be the best choice to use in the titration above?

A indigo carmaine
B methyl red
C methyl violet
D phenolphthalein

22 In a qualitative analysis, reagent M is gradually added to a salt solution N followed by the addition of a dilute acid. The graph below shows how the mass of the precipitate formed changes with the reagents added.



Which of the following set of anions would produce the given results?

	reagents (M and acid) added	anion(s) in N
A	add silver nitrate, followed by dilute nitric acid	Cl^-, CO_3^{2-}
B	add aqueous barium nitrate, followed by dilute hydrochloric acid	CO_3^{2-}
C	add aqueous barium nitrate, followed by dilute hydrochloric acid	Cl^-, CO_3^{2-}
D	add silver nitrate, followed by dilute nitric acid	I^-

23 An aqueous solution of an unknown salt gives the following results when added to the reagents.

reagent added	result
acidified silver nitrate	yellow precipitate
excess aqueous ammonia	colourless solution forms a white precipitate

Which of the following is the unknown salt?

A aluminium iodide
B lead(II) chloride
C calcium iodide
D zinc chloride

24 Colour changes are often observed when redox reactions occur.

Which colour change is due to the reduction of the named reagent?

A Black solid copper oxide changes to a blue solution.
B Colourless aqueous potassium iodide changes to a brown solution.
C Green aqueous iron chloride changes to a yellow solution.
D Purple acidified potassium manganate changes to a colourless solution.

25 In which of the following reactions is sulfur dioxide acting as an oxidizing agent?

A $SO_2 + 2H_2O + Cl_2 \rightarrow H_2SO_4 + 2HCl$
B $SO_2 + NO_2 \rightarrow SO_3 + NO$
C $2SO_2 + O_2 \rightarrow 2SO_3$
D $SO_2 + 2H_2S \rightarrow 2H_2O + 3S$

26 In an electrolysis experiment, the same amount of charge deposited 54.0 g of silver and 8.5 g of vanadium. What was the charge on the vanadium ion?

A 1+ **B** 2+
C 3+ **D** 4+

27 Elements X, Y and Z belong to the same period in the Periodic Table. The properties of oxides of elements X, Y and Z are given in the following table.

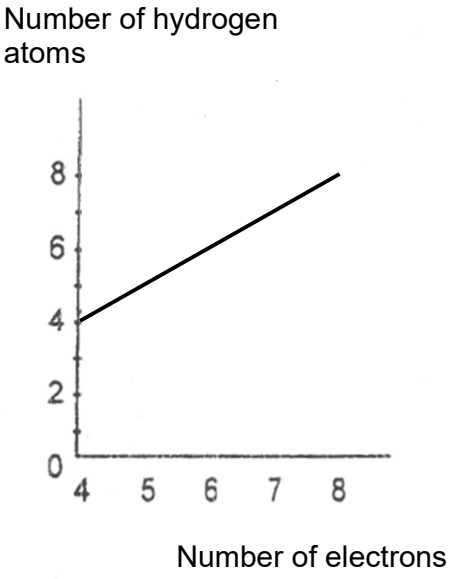
	properties
oxide of X	soluble in both sulfuric acid and aqueous sodium hydroxide
oxide of Y	insoluble in water and aqueous sodium hydroxide but soluble in dilute hydrochloric acid.
oxide of Z	decolourises acidified potassium manganate (VII) solution

Which of the following is the correct order of arrangement of elements X, Y and Z moving from left to right within the period?

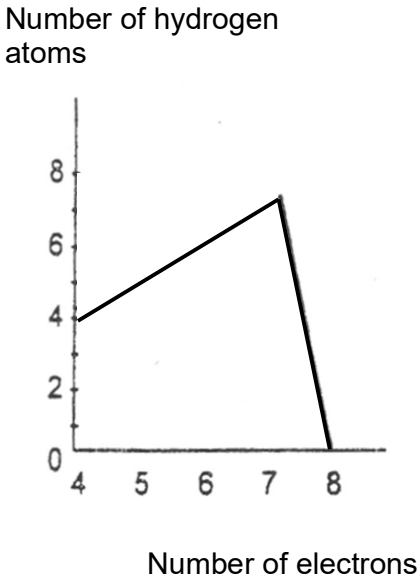
A X, Y, Z **B** Y, Z, X
C Z, Y, X **D** Y, X, Z

28 Which of the following diagrams below best represents the relationships between the number of electrons in the outer shell of an atom and the number of hydrogen atoms with which the atom is most likely to combine?

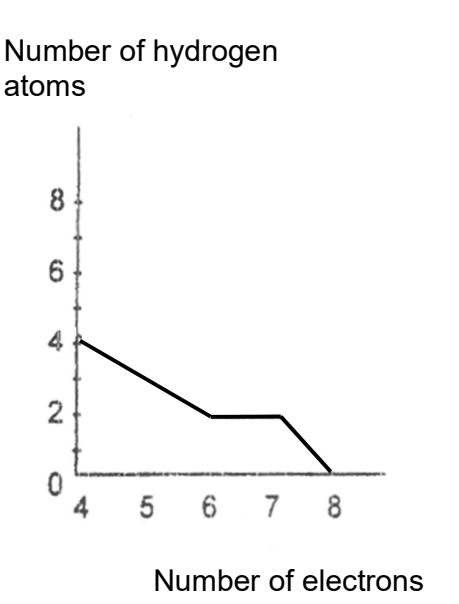
A



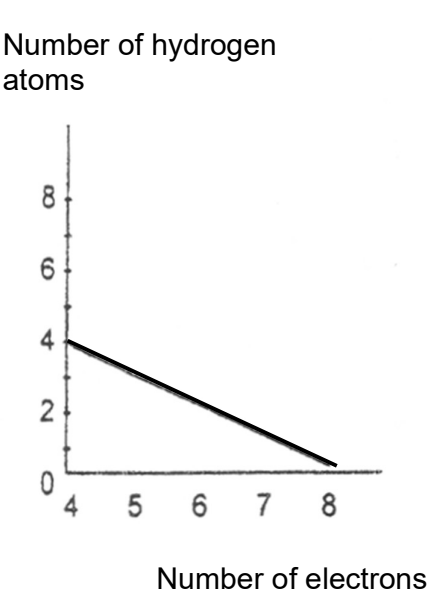
B



C



D

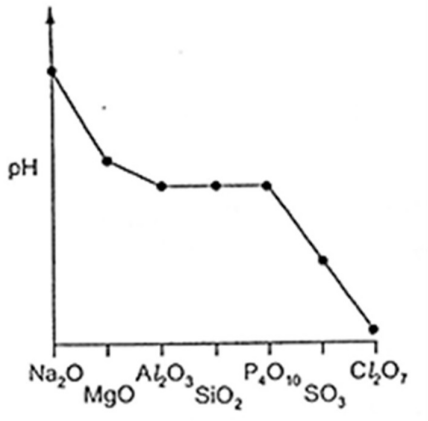


29 The oxides of the elements sodium to chlorine are separately added to water. The following table shows the solubility of the oxides of elements in water.

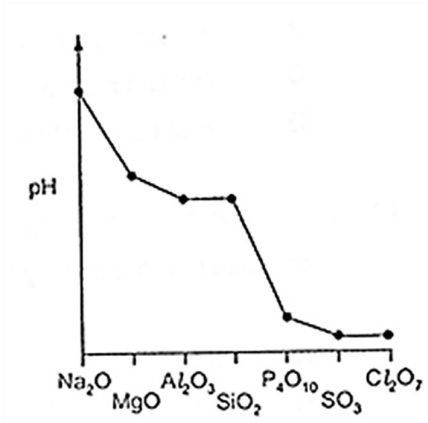
Na_2O	MgO	Al_2O_3	SiO_2	P_4O_{10}	SO_3	Cl_2O_7
soluble	soluble	insoluble	insoluble	soluble	soluble	soluble

Which diagram best represents the pH of the solutions produced?

A



B



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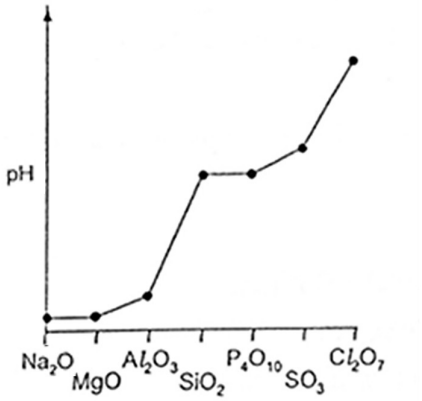
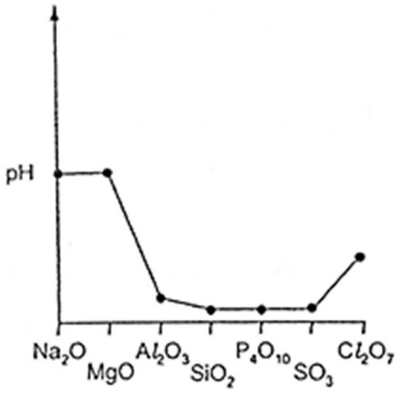
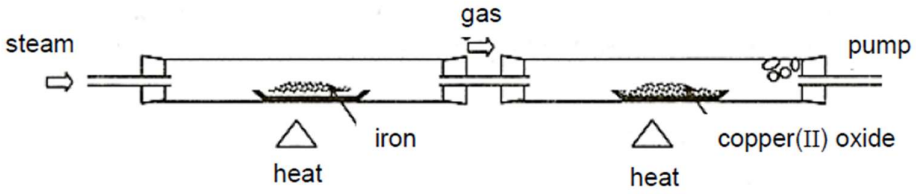


D



30 The diagram shows a reaction sequence.



Which of the following is **not** a product of the reaction sequence?

A copper
B iron (III) oxide
C oxygen
D water vapour

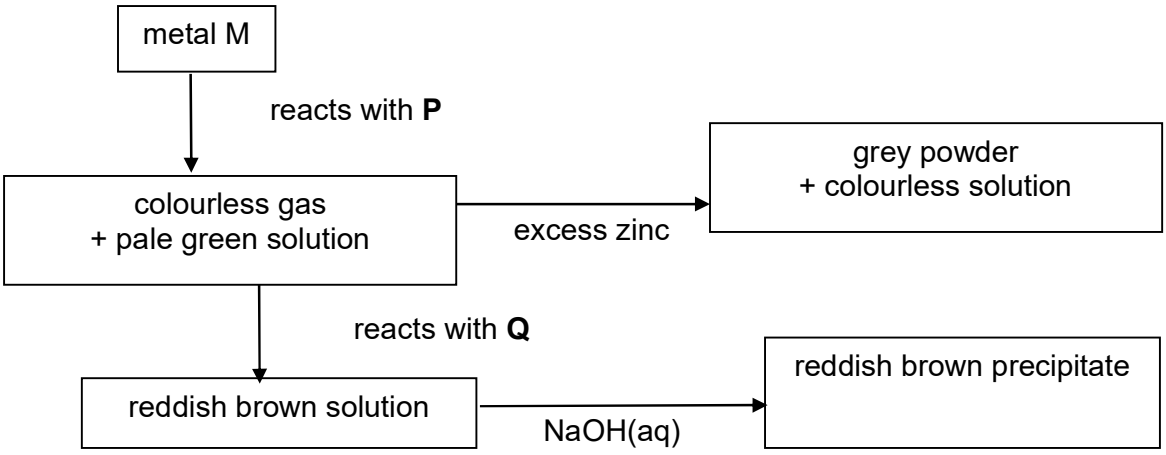
31 The following observations were made during some tests involving metal **M**.

test	results
metal **M** was heated with steam	no reaction
carbonate of metal **M** was heated	decomposes to form carbon dioxide

What could metal **M** be?

A copper
B iron
C magnesium
D sodium

32



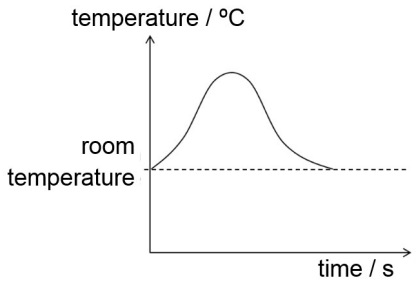
In the reaction scheme above, what are reagents **P** and **Q?**

	P	**Q**
A	dilute carbonic acid	chlorine
B	dilute hydrochloric acid	potassium iodide
C	dilute nitric acid	chlorine
D	dilute nitric acid	potassium iodide

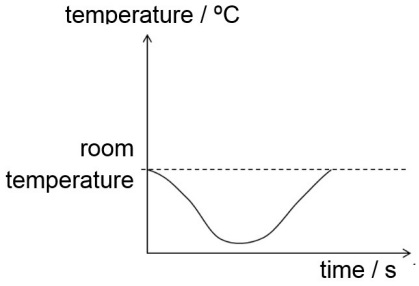
33 The dissolving of ammonium chloride in water is endothermic.

Which graph shows how the temperature alters as ammonium chloride is added to water and then the resulting solution is left to stand?

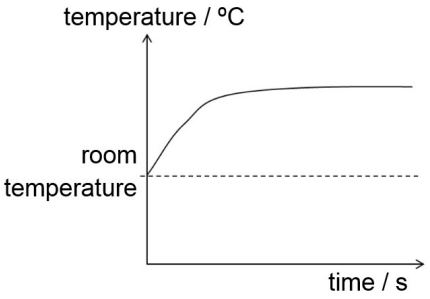
A



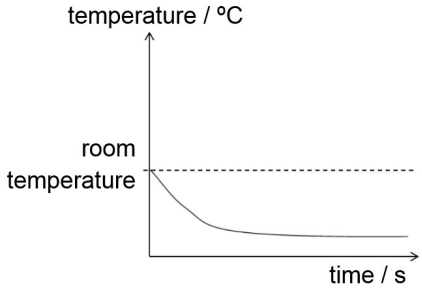
B



C



D



34 The following statements are used to describe the chemical reaction shown below.

$$2\ X\ (s)\ +\ Y_2\ (aq)\ \rightarrow\ 2\ XY\ (g)$$

1 All collision between particles of X and Y_2 produce XY.
2 The frequency of collisions is affected by an increase in pressure on the reactant particles.
3 The frequency of collisions is increased by an increased in the temperature of the reaction mixture.
4 The frequency of collisions is increased by an increase in the concentration of Y_2.

Which statements are correct?

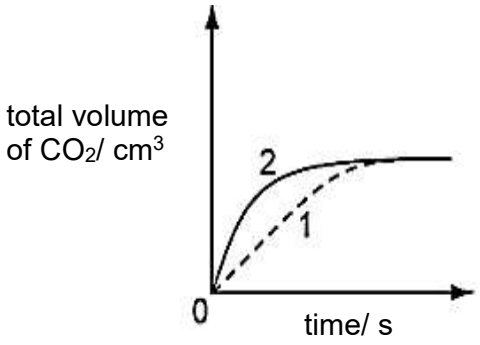
A 1, 2 and 4
B 2, 3 and 4
C 1, 3 and 4
D 3 and 4

35 In two separate experiments, the reaction of powdered calcium carbonate with an excess of dilute hydrochloric acid is investigated.

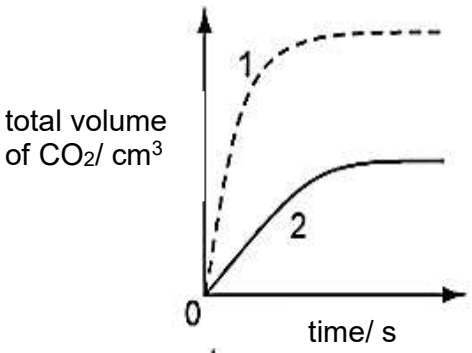
The powder used in experiment 1 is finer than that used in experiment 2. All other conditions are identical in both experiments.

Which graph shows the results?

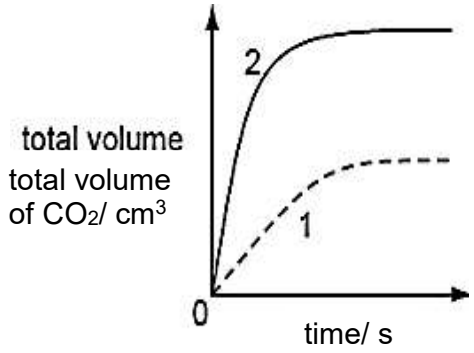
A



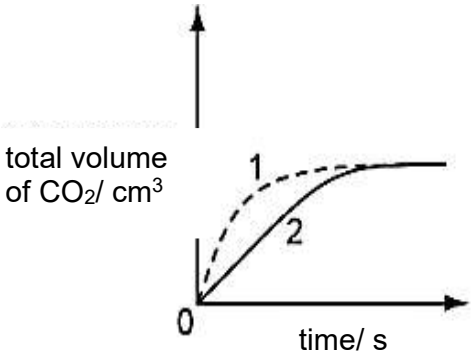
B



C



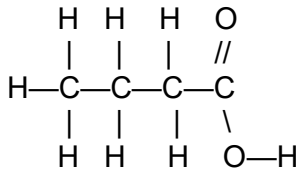
D



36 Which compound, without the addition of any other reagent, polymerises to produce a polymer with ester linkages?

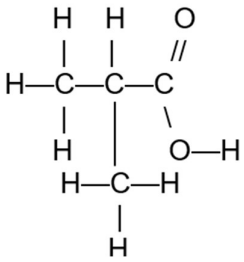
A $C_2H_5CO_2H$
B $C_2H_5NH_2$
C $HO(CH_2)_4CO_2H$
D $H_2N(CH_2)_4CO_2H$

37 The diagram below shows the structure of butanoic acid.

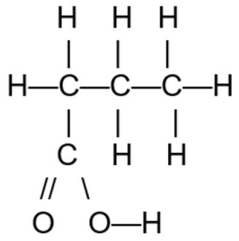


Which of the following is **not** an isomer of butanoic acid?

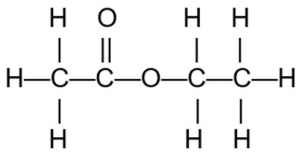
A



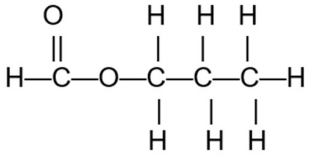
B



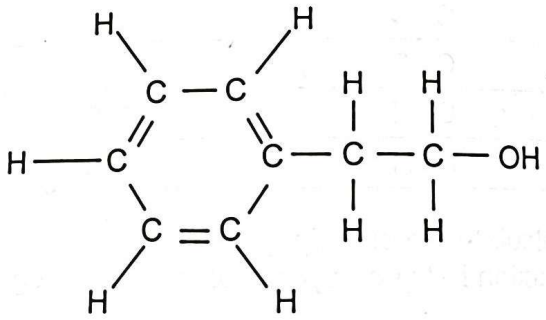
C



D



38 One substance which is responsible for the fragrance of roses is 2-phenylethanol. The structure of the molecule is shown below.



Which of the following statements about the molecule is correct?

A It is a saturated molecule.
B It can undergo condensation polymerisation to form a polyester.
C It does not decolourise bromine water under any conditions.
D It can be oxidised by acidified potassium manganate(VII).

39 Methane, sulfur dioxide and carbon dioxide are gases which affect the atmosphere and the environment.

How do these gases affect the environment?

	methane	sulfur dioxide	carbon dioxide
A	depletion of ozone layer	acid rain	global warming
B	global warming	photochemical smog	acid rain
C	global warming	acid rain	global warming
D	photochemical smog	global warming	depletion of ozone layer

40 The carbon cycle is a set of processes that regulates the amount of carbon dioxide in the atmosphere. Some processes include photosynthesis, respiration, ocean uptake, combustion and decomposition.

Which of the following statements on the processes is correct?

A All of the processes in the carbon cycle are initiated by nature.
B Respiration is the only process that converts oxygen into carbon dioxide.
C Photosynthesis is the only process in the carbon cycle that involves the absorption of carbon dioxide.
D The carbon dioxide taken in by the ocean supports photosynthesis of marine life and making up the shells of marine organisms.

END OF PAPER

The Periodic Table of Elements

Group																	
1	2											13	14	15	16	17	18
							1 H hydrogen 1										2 He helium 4
3 Li lithium 7	4 Be beryllium 9		**Key** proton (atomic) number atomic symbol name relative atomic mass									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	3	4	5	6	7	8	9	10	11	12	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 –

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 dm^3 at room temperature and pressure (r.t.p.). The Avogadro constant, $L = 6.02 \times 10^{23}$ mol^{-}