



YUAN CHING SECONDARY SCHOOL

Secondary Four Express Course

Preliminary Examination 2024

CANDIDATE
NAME

CLASS

INDEX
NUMBER

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CHEMISTRY

6092/01

Paper 1 Multiple Choice

27 Aug 2024

1 hour

Additional Materials: Multiple Choice Answer Sheet

READ THESE INSTRUCTIONS FIRST

Write in soft pencil.

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

Write your name, class and index 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.

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

Any rough working should be done in this booklet.

A copy of the Periodic Table is printed on Page 22.

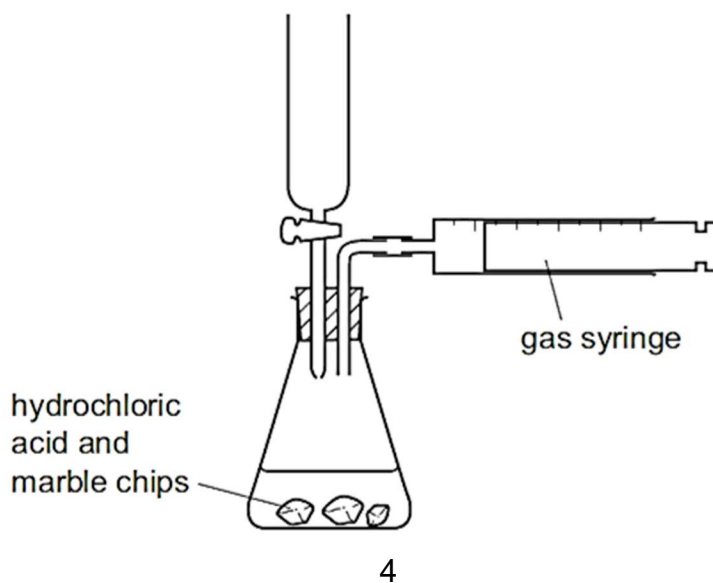
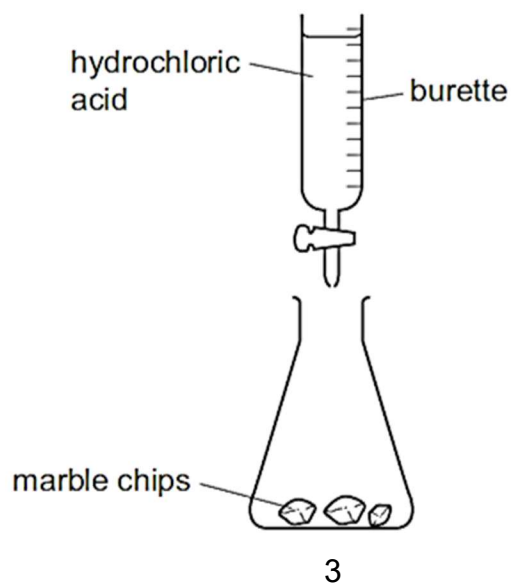
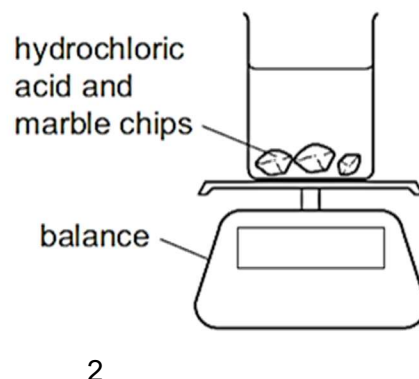
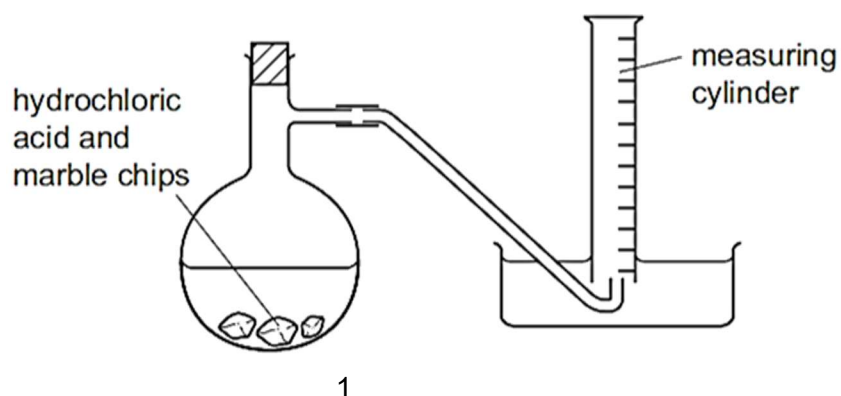
The total number of marks for this paper is 40.

This paper consists of **22** printed 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?

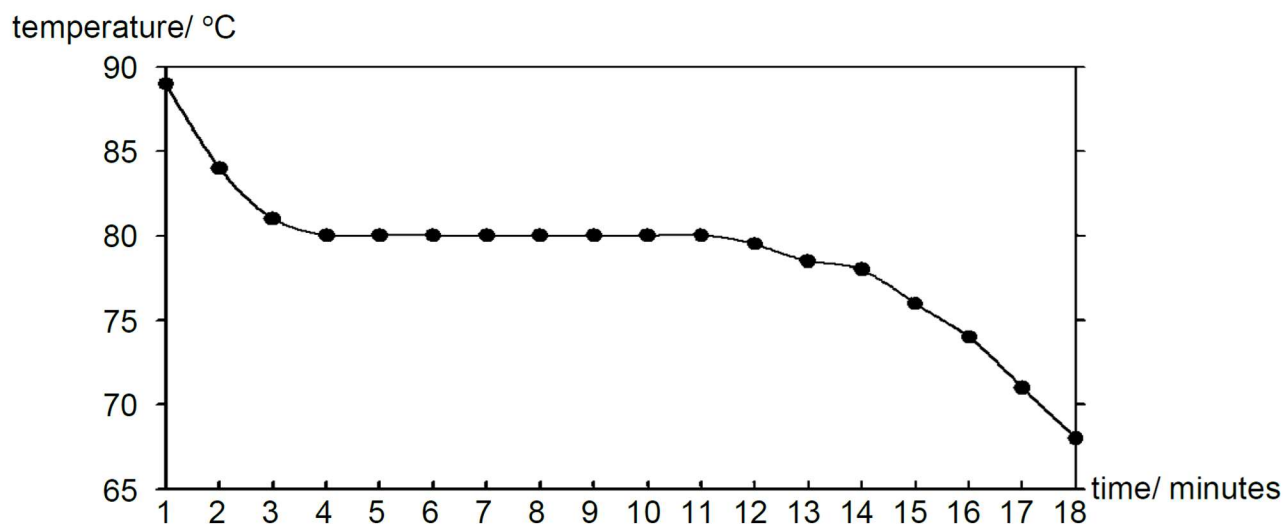
	few drops of aqueous ammonia	excess aqueous ammonia
A	dark blue solution	dark blue solution
B	dark blue solution	light blue solution
C	light blue solution	dark blue solution
D	light blue solution	light blue solution

- 4 Which of the following substances can be used to distinguish these three gases:

- hydrogen
- carbon dioxide
- oxygen

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

- 5 Naphthalene present in mothballs has a melting point of 80.26°C . A heated sample of pure naphthalene is cooled and the temperature is recorded every minute. A graph of the results is shown.



Which process occurs between 6 and 10 minutes?

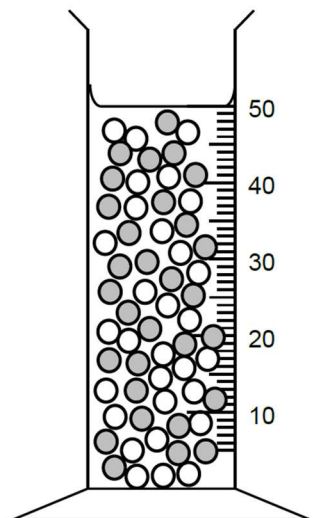
- A boiling
- B condensing
- C freezing
- D melting

- 6 Ethanol forms a miscible mixture with water.

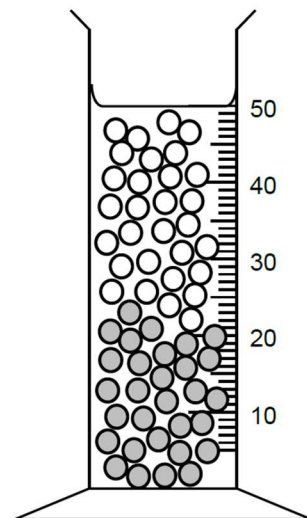
A student mixes 25 cm^3 of ethanol with 25 cm^3 of water.

Which diagram best represents the mixture?

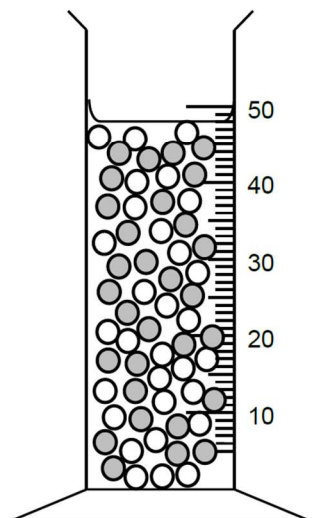
A



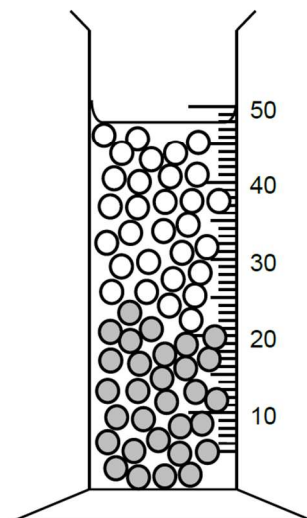
B



C



D



- 7 Carbon has two isotopes, ^{12}C and ^{13}C .

Using these isotopes, which of the following is unlikely the relative molecular mass for the compound with molecular formula C_2H_4 ?

A 27

C 29

B 28

D 30

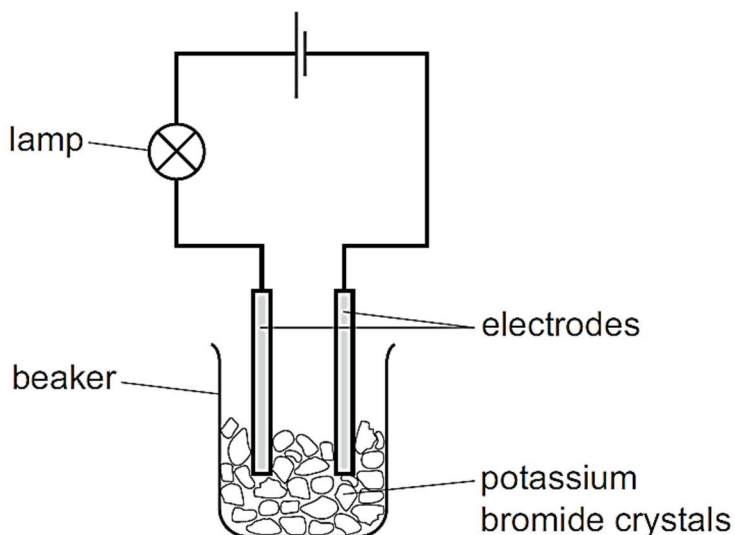
- 8 The compound formed between elements X and Y is ionic.

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 Y.

- 9 The lamp shown in the diagram does not light up.

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

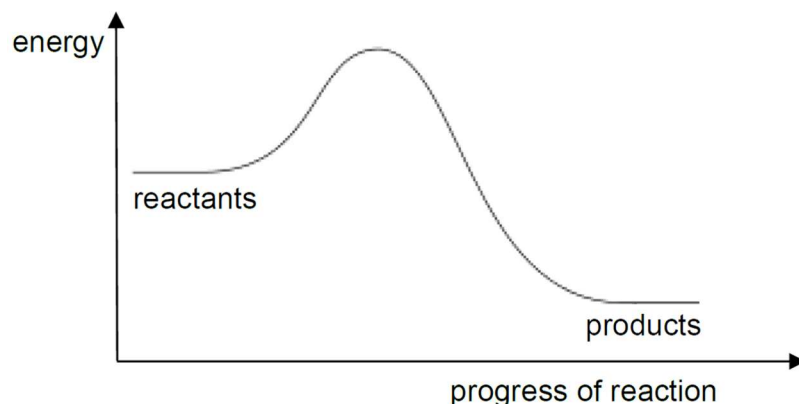


Which statement explains these results?

- 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 in water.

- 10** Propene, $\text{CH}_3\text{CH}=\text{CH}_2$, 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 12 g of carbon, 2 g of hydrogen and 16 g of oxygen only?
- A** CHO
 - B** CHO_2
 - C** CH_2O
 - D** C_2HO
- 12** Which fertiliser contains the greatest percentage by mass of nitrogen?
- A** $\text{CO}(\text{NH}_2)_2$
 - B** NH_4NO_3
 - C** $(\text{NH}_4)_2\text{HPO}_4$
 - D** $(\text{NH}_4)_2\text{SO}_4$
- 13** 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
- 14** Which of these processes are both endothermic?
- A** combustion, cracking
 - B** combustion, fermentation
 - C** cracking, photosynthesis
 - D** fermentation, photosynthesis

15 The diagram below shows the energy profile diagram for a catalysed reaction.



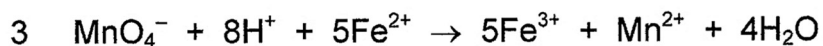
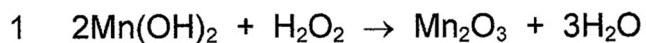
Which of the following statement explains this diagram?

- A It lowers the activation energy so that the reactants have more energy to collide more frequently.
- B It increases the activation energy to allow the reactants to have greater frequency of effective collisions.
- C It provides an alternative pathway that allows reactants to gain more kinetic energy to collide effectively and frequently.
- D It provides an alternative pathway with lowered minimum amount of energy required for reaction so that more reactants can collide effectively per unit time.

16 Which reaction does **not** involve either oxidation or reduction?

- A $\text{C (s)} + \text{O}_2 \text{ (g)} \rightarrow \text{CO}_2 \text{ (g)}$
- B $\text{N}_2\text{(g)} + 3\text{H}_2 \text{ (g)} \rightarrow 2\text{NH}_3 \text{ (g)}$
- C $\text{Pb(NO}_3)_2 \text{ (s)} \rightarrow \text{PbO (s)} + 2\text{NO}_2 \text{ (g)} + \text{O}_2 \text{ (g)}$
- D $\text{ZnCO}_3 \text{ (s)} + 2\text{HNO}_3 \text{ (aq)} \rightarrow \text{Zn(NO}_3)_2 \text{ (aq)} + \text{CO}_2 \text{ (g)} + \text{H}_2\text{O (l)}$

17 In which equations is manganese being an oxidising agent?



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

18 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

19 One mole of compound X gives three moles of ions in aqueous solution. X reacts with ammonium carbonate to form an alkaline gas.

What is compound X?

- A** aqueous ammonia
B calcium hydroxide
C sodium hydroxide
D sulfuric acid

- 20** Which mixture would react with dilute sulfuric acid to form two different gases?
- A** copper and magnesium carbonate
- B** copper(II) carbonate and magnesium
- C** copper(II) carbonate and magnesium oxide
- D** copper(II) oxide and magnesium
- 21** The table gives information about the solubilities of the hydroxides, carbonates and sulfates of calcium, sodium and zinc.

	hydroxide	carbonate	sulfate
calcium	slightly soluble	insoluble	slightly soluble
sodium	soluble	soluble	soluble
zinc	insoluble	insoluble	soluble

What is the best way of making zinc carbonate?

- A** Shake aqueous zinc sulfate with aqueous sodium carbonate.
- B** Shake aqueous zinc sulfate with solid calcium hydroxide and bubble in carbon dioxide.
- C** Shake solid zinc hydroxide with aqueous sodium hydroxide and bubble in carbon dioxide.
- D** Shake solid zinc sulfate and solid calcium carbonate with water.
- 22** The positions of four elements are represented and shown on the outline of part of the Periodic Table.

Which letter represents a solid non-metal at r.t.p.?

The diagram shows a simplified periodic table with the following structure:

- Period 1:** 2 cells.
- Period 2:** 8 cells. The 4th cell from the left is labeled **B**.
- Period 3:** 8 cells. The 1st cell from the left is labeled **A**, and the 7th cell from the left is labeled **C**.
- Period 4:** 18 cells. The 17th cell from the left is labeled **D**.

There is an additional empty cell located above the 4th cell of Period 2.

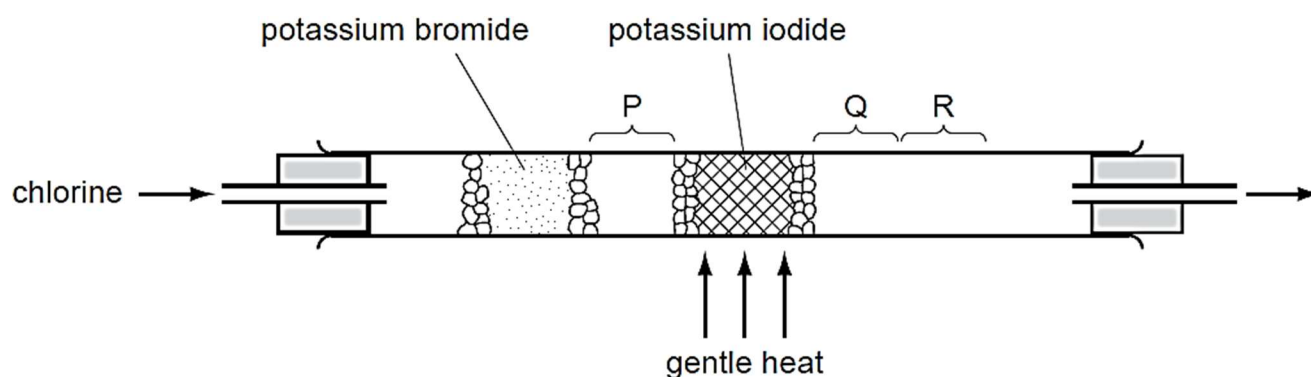
23 P, Q, R and S are elements in the Periodic Table.

- Q and R are formed as elements at the positive electrode during electrolysis.
- P and S both conduct electricity.
- P has a higher melting point than S.
- Q displaces R from aqueous solutions containing R^- ions.

Which statement could be correct?

- A** P could be Na and S could be Li.
- B** Q could be Br_2 and R could be I_2 .
- C** R would be paler in colour than Q.
- D** S exists as diatomic molecules.

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



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

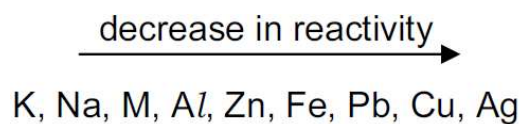
What are these coloured substances?

	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

25 What is the source of hydrogen in the industrial production of ammonia?

- A** cracking of hydrocarbons
- B** electrolysis of aqueous sodium hydroxide
- C** extraction from the air
- D** reaction of a Group 1 metal with water

26 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

27 The table gives information about five metals.

metal	percentage in the Earth's crust	cost per tonne / \$
aluminium	8.1	750
copper	0.0007	1080
iron	5.0	300
tin	0.0002	9500
zinc	0.015	575

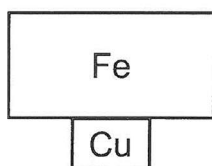
The general pattern suggests that the higher the percentage in the Earth's crust, the lower the cost.

Which metal does **not** fit this pattern?

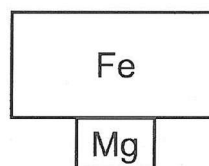
- A aluminium
- B copper
- C iron
- D tin

28 Two large pieces of iron are placed in water. In experiment 1, a small piece of copper is attached to the iron. In experiment 2, a small piece of magnesium is attached to the iron.

experiment 1



experiment 2



Which are the equations of the reactions that would take place in experiment 1 and experiment 2?

	reaction in experiment 1	reaction in experiment 2
A	$\text{Cu (s)} \rightarrow \text{Cu}^{2+} \text{ (aq)} + 2\text{e}^-$	$\text{Fe (s)} \rightarrow \text{Fe}^{2+} \text{ (aq)} + 2\text{e}^-$
B	$\text{Cu (s)} \rightarrow \text{Cu}^{2+} \text{ (aq)} + 2\text{e}^-$	$\text{Mg (s)} \rightarrow \text{Mg}^{2+} \text{ (aq)} + 2\text{e}^-$
C	$\text{Fe (s)} \rightarrow \text{Fe}^{2+} \text{ (aq)} + 2\text{e}^-$	$\text{Fe (s)} \rightarrow \text{Fe}^{2+} \text{ (aq)} + 2\text{e}^-$
D	$\text{Fe (s)} \rightarrow \text{Fe}^{2+} \text{ (aq)} + 2\text{e}^-$	$\text{Mg (s)} \rightarrow \text{Mg}^{2+} \text{ (aq)} + 2\text{e}^-$

- 29 Calcium carbonate was reacted with an excess of dilute hydrochloric acid at room temperature.

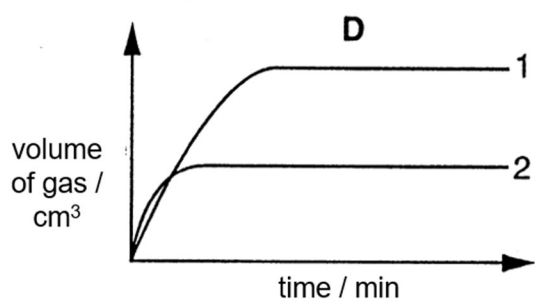
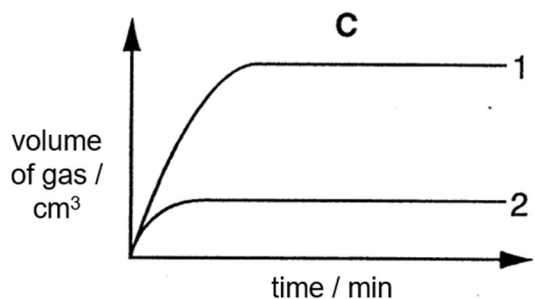
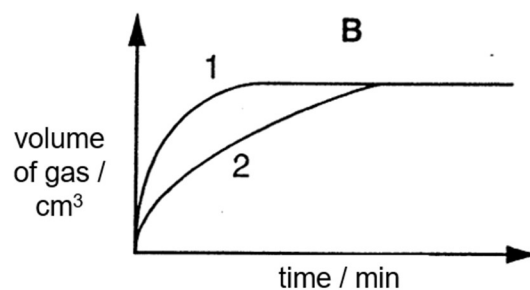
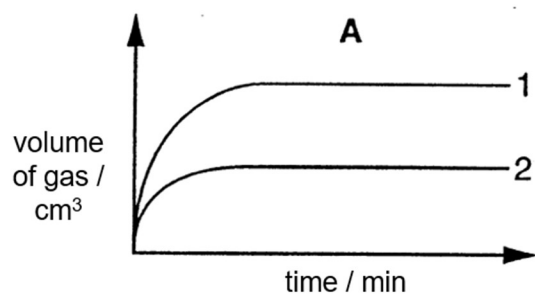


Two experiments were carried out.

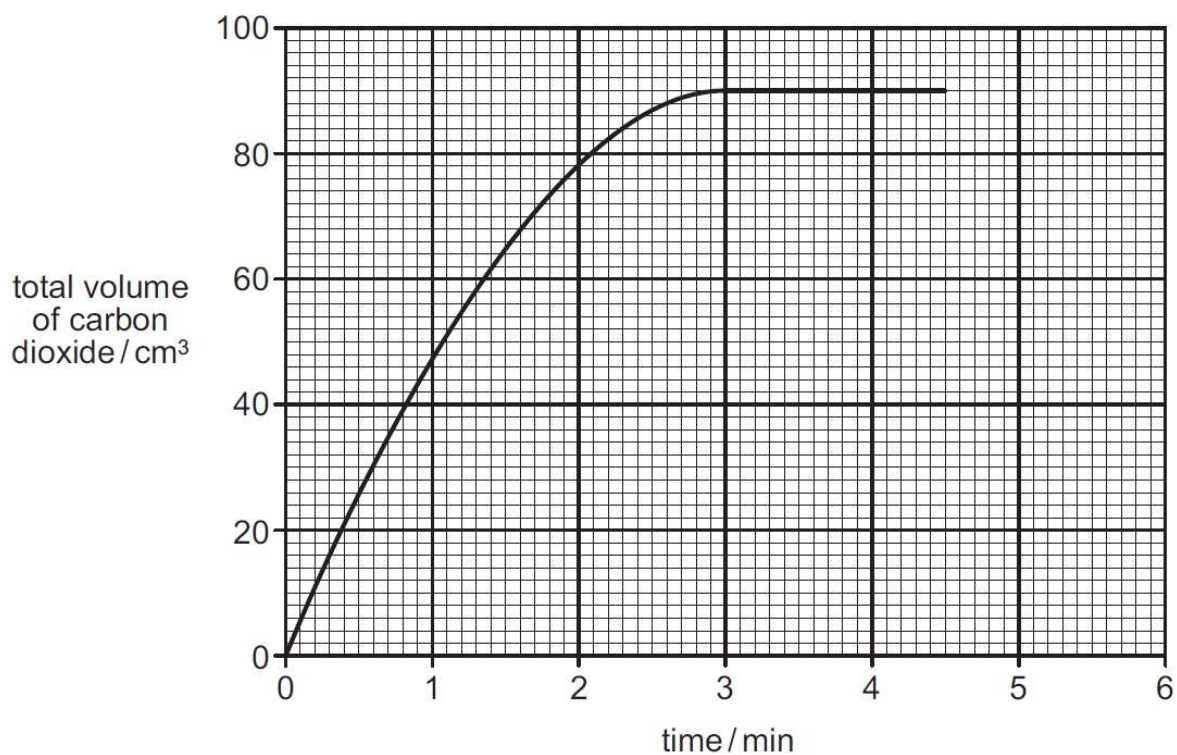
Experiment 1 100 g of calcium carbonate in large lumps.

Experiment 2 50 g of calcium carbonate as a fine powder.

Which of the graphs is correct?



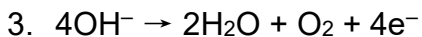
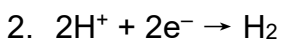
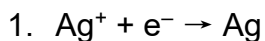
- 30** The rate of the reaction between a given mass of calcium carbonate and an excess of hydrochloric acid is studied by collecting the carbon dioxide in a graduated syringe. The results are shown in the graph.



How much time is required for half the calcium carbonate to react?

- A** 0.95 min
- B** 1.5 min
- C** 2.0 min
- D** 3.0 min

31 In the electrolysis of aqueous silver nitrate using inert electrodes, the following three reactions take place.



Which reaction(s) take place at the cathode?

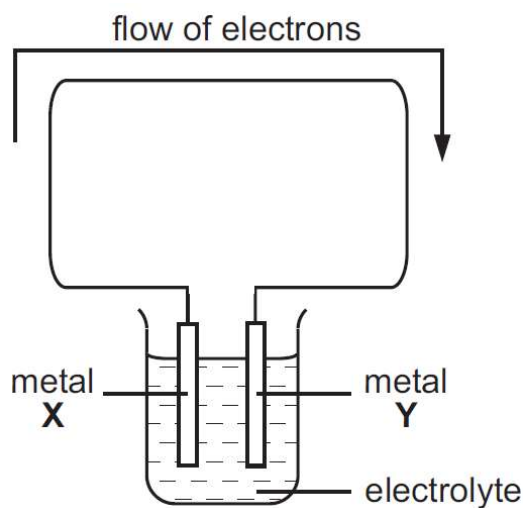
A 1 only

C 1 and 2

B 2 only

D 2 and 3

32 The apparatus was set up as shown.



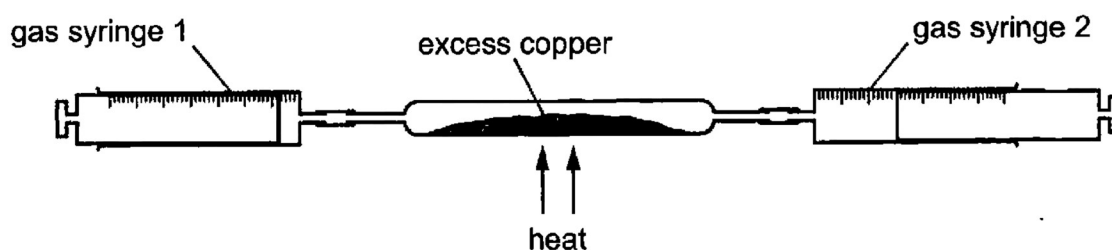
For which pair of metals would electrons flow in the direction shown?

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

- 33 Which reactions take place during the electrolysis of aqueous copper(II) sulfate with copper electrodes?

	reaction at positive electrode	reaction at negative electrode
A	$\text{Cu}^{2+} + 2\text{e}^{-} \rightarrow \text{Cu}$	$\text{Cu} \rightarrow \text{Cu}^{2+} + 2\text{e}^{-}$
B	$4\text{OH}^{-} \rightarrow 2\text{H}_2\text{O} + \text{O}_2 + 4\text{e}^{-}$	$\text{Cu}^{2+} + 2\text{e}^{-} \rightarrow \text{Cu}$
C	$\text{Cu} \rightarrow \text{Cu}^{2+} + 2\text{e}^{-}$	$2\text{H}^{+} + 2\text{e}^{-} \rightarrow \text{H}_2$
D	$\text{Cu} \rightarrow \text{Cu}^{2+} + 2\text{e}^{-}$	$\text{Cu}^{2+} + 2\text{e}^{-} \rightarrow \text{Cu}$

- 34 The oxygen in air can be removed by passing air over heated copper using the apparatus in the diagram.

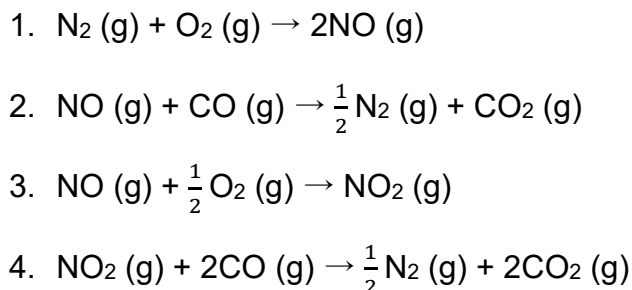


50 cm³ of air is collected in gas syringe 1. Each syringe, 1 and 2, is pushed alternately so that the air passes repeatedly over the heated copper.

When the volume of gas no longer changes, and the gas has cooled to room temperature, what is the volume of gas that will remain?

- A** 10 cm³
- B** 20 cm³
- C** 40 cm³
- D** 80 cm³

- 35** Catalytic converters are used in the removal of harmful pollutants from exhaust gases. Which equations show reactions that are useful in removing such pollutants?

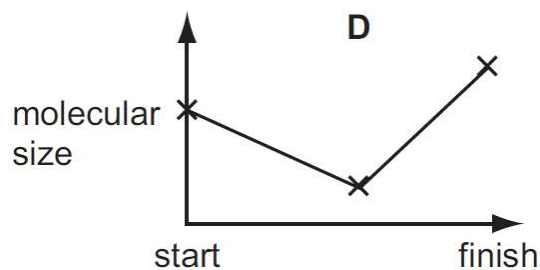
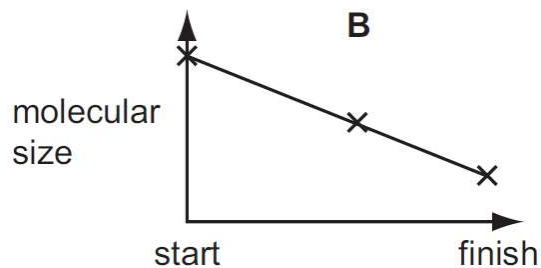
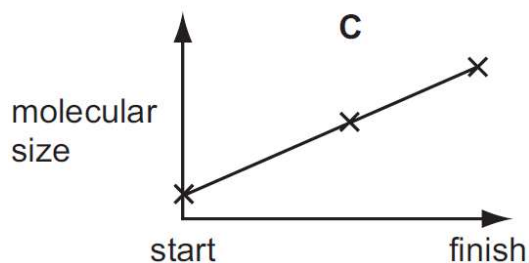
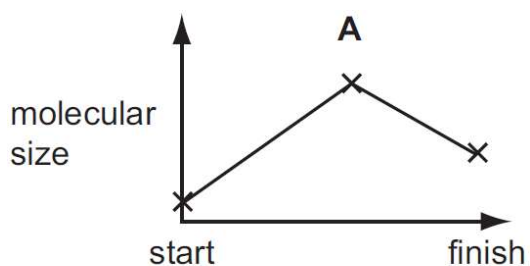


- A** 1 and 2 only
B 1 and 3 only
C 2 and 4 only
D 3 and 4 only

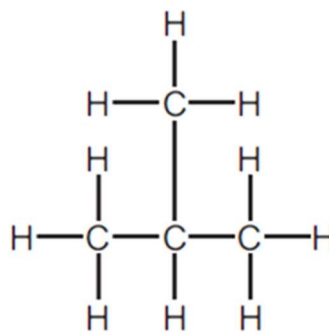
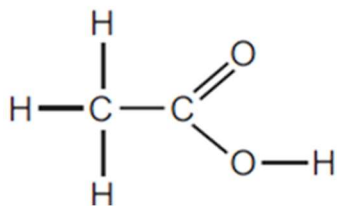
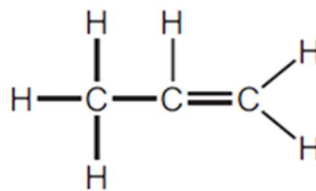
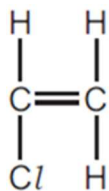
- 36** Poly(ethene) can be manufactured by the process below.



Which diagram shows the change in molecular size during this process?



37 How many of the structures show an unsaturated hydrocarbon molecule?



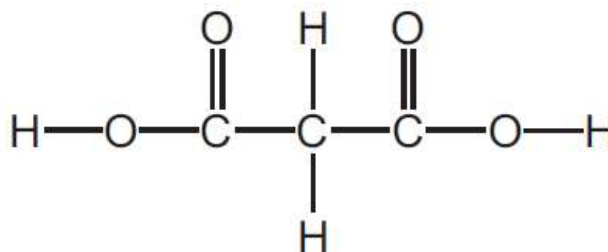
A 1

B 2

C 3

D 4

38 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 mole ratio.
2. In aqueous solution, it would have a pH of 9.5.
3. It would react with an alcohol to form an ester.

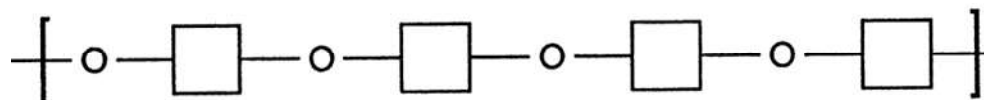
A 1 only

B 1 and 2

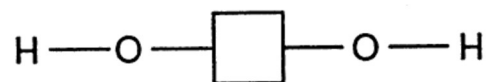
C 2 and 3

D 3 only

39 A section of a polymer is shown.



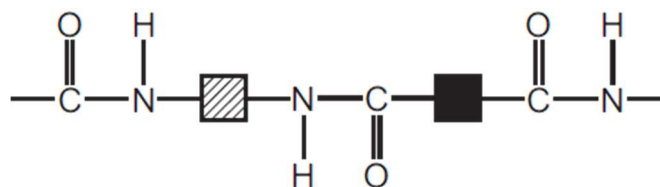
The monomer is given below:



The monomer undergoes condensation polymerisation. What is made each time a monomer adds to the polymer?

- A** hydrogen molecules, H_2
- B** hydroxide ions, OH^-
- C** oxygen atoms, O
- D** water molecules, H_2O

40 The diagram shows the partial structure of a polymer.



Which of the following represents the correct pair of monomer that made this polymer?

- A**
-
- and
- B**
-
- and
- C**
-
- and
- D**
-

END OF PAPER

The Periodic Table of Elements

Group																															
1	2	1 H hydrogen 1												13	14	15	16	17	18												
		Key proton (atomic) number atomic symbol name relative atomic mass																													
3	4																	5	6	7	8	9	10	11	12	13	14	15	16	17	18
Li lithium 7	Be beryllium 9																	B boron 11	C carbon 12	N nitrogen 14	O oxygen 16	F fluorine 19	Ne neon 20								
11	12																	13	14	15	16	17	18								
Na sodium 23	Mg magnesium 24																	Al aluminium 27	Si silicon 28	P phosphorus 31	S sulfur 32	Cl chlorine 35.5	Ar argon 40								
19	20																	31	32	33	34	35	36								
K potassium 39	Ca calcium 40																	Ga gallium 70	Ge germanium 73	As arsenic 75	Se selenium 79	Br bromine 80	Kr krypton 84								
37	38																	49	50	51	52	53	54								
Rb rubidium 85	Sr strontium 88																	In indium 115	Sn tin 119	Sb antimony 122	Te tellurium 128	I iodine 127	Xe xenon 131								
55	56																	81	82	83	84	85	86								
Cs caesium 133	Ba barium 137																	Tl thallium 204	Pb lead 207	Bi bismuth 209	Po polonium —	At astatine —	Rn radon —								
87	88																	113	114	115	116	117	118								
Fr francium —	Ra radium —																	Nh nihonium —	Fl flerovium —	Mc moscovium —	Lv livermorium —	Ts tennessine —	Og oganeson —								
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, $L = 6.02 \times 10^{23} \text{ mol}^{-1}$.