

Name: _____

Register No. Class

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‘Perseverance Yields Success’



Ping Yi Secondary School
PRELIMINARY EXAMINATION 2022

Secondary 4 Express
Chemistry

6092/01

Paper 1 Multiple Choice

1 hour

Additional materials: Multiple Choice Answer Sheet

INSTRUCTIONS TO CANDIDATES

Do not open this booklet until you are told to do so.

Write your name, class and register number in the spaces at the top of this page.

You may use a soft pencil for any diagrams, graphs or rough working.

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

There are **forty** questions in 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 Optical Answer Sheet (OAS).

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 Data Sheet is printed on page 17.

A copy of the Periodic Table is printed on page 18.

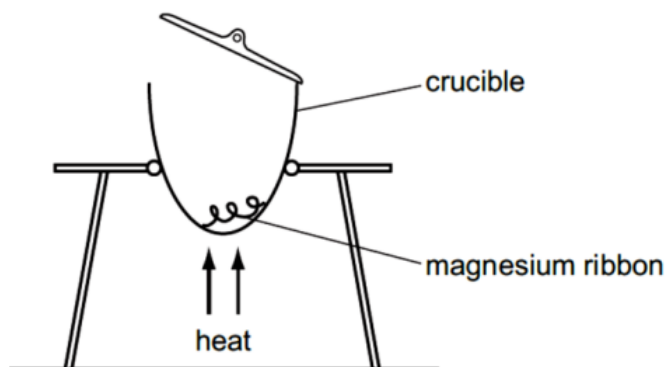
Expected Grade	☐ A1	☐ A2	☐ B3	☐ B4	☐ C5
Teacher's Comment					
Student's Comment					
Parent's Comment and Signature					

This document consists of **18** printed pages including this cover page and inserts.

[Turn over

Answer all the questions in the answer sheet provided.

- 1 The diagram shows an experiment to find the formula of magnesium oxide.



Which piece of apparatus would be needed in addition to those shown above?

- A burette
- B electronic balance
- C measuring cylinder
- D thermometer

- 2 Which of the following substances may be condensed using a water condenser?

	substance	melting point / °C	boiling point / °C
A	ammonia	-78	-33
B	butane	-135	-0.5
C	hydrogen chloride	-115	-85
D	pentane	-130	36

- 3 Which of the following correctly describes the particles in a dilute sugar solution at room temperature?

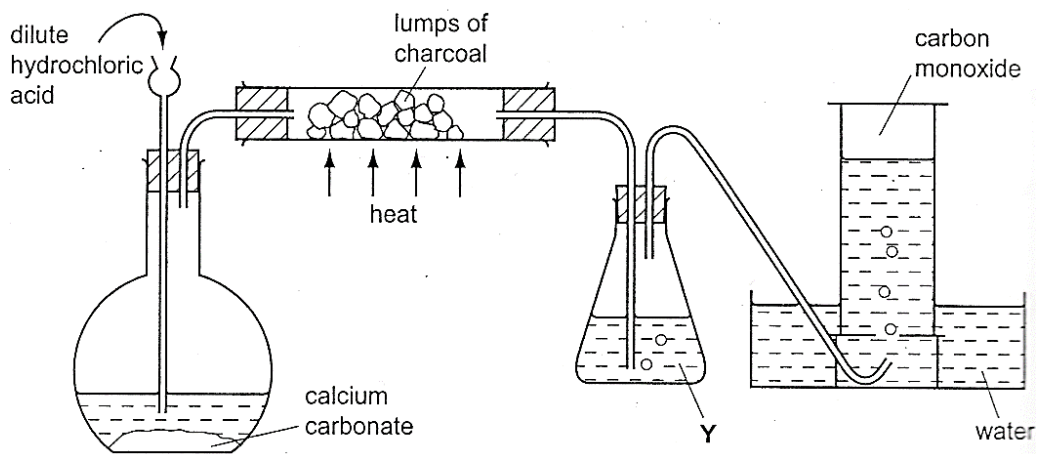
	sugar molecules	water molecules
A	close together, moving at random	close together, moving at random
B	widely separated, not moving	widely separated, moving at random
C	widely separated, moving at random	close together, moving at random
D	widely separated, moving at random	close together, not moving

- 4 At which temperature does a concentrated aqueous solution of sodium chloride begin to boil?

- A 93 °C
- B 99 °C
- C 100 °C
- D 104 °C

[Turn Over

- 5 The diagram shows the apparatus used to obtain carbon monoxide.



What is the main purpose of Y?

- A to dry the gas
 - B to prevent water from being sucked back into the hot carbon
 - C to remove carbon dioxide from the gas
 - D to remove hydrogen chloride from the gas
- 6 The nucleon number and proton number of an atom of X and an atom of Y are shown.

	X	Y
proton number	19	17
nucleon number	39	37

The following statements are made on X and Y.

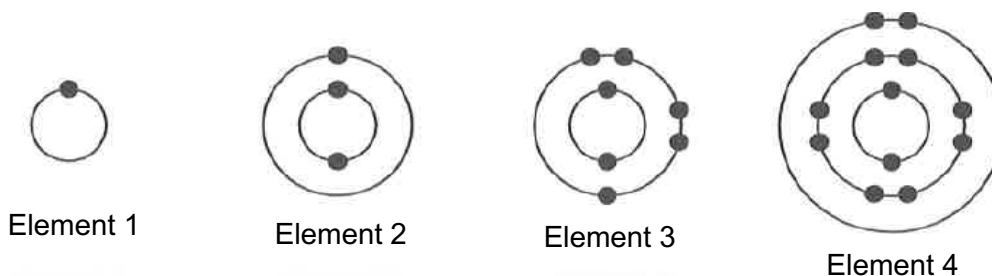
- 1 An ion of X has more electrons than an ion of Y.
- 2 Both ions have the same number of valence electrons.
- 3 Both ions have the same number of neutrons.
- 4 Both react together to form a covalent compound XY.

Which statement(s) is/are correct?

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

[Turn Over

7 The diagrams show the electronic structures of four elements.



The following statements are made on the four elements.

- 1 Elements 1 and 2 are good electrical conductors.
- 2 Elements 2 and 4 have very high melting points.
- 3 Element 2 is more reactive than element 4.
- 4 Element 4 has a giant lattice structure.

Which statement(s) is/are true about the four elements?

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

8 Carbon disulfide is a simple covalent compound used in manufacturing polymers. Which of these statements would you predict to be true about carbon disulfide?

- A** It has a low boiling point and conducts electricity when molten.
B It has a low boiling point and is soluble in organic solvents.
C It is a crystalline solid at room temperature and conducts electricity when molten.
D It is a crystalline solid at room temperature and is soluble in organic solvents.

9 In which pair of covalent molecules does oxygen form at least one double bond on both molecules?

- A** CO_2 and $\text{C}_2\text{H}_5\text{OH}$
B CO_2 and O_2
C H_2O and $\text{C}_2\text{H}_5\text{OH}$
D H_2O and O_2

10 The formula of thallium carbonate is Tl_2CO_3 and that of sodium chlorite is NaClO_2 .

What is the formula of thallium chlorite?

- A** TlClO_2 **B** Tl_2ClO_2 **C** $\text{Tl}(\text{ClO}_2)_2$ **D** $\text{Tl}_2(\text{ClO}_2)_3$

[Turn Over

11 Which molecule has the least number of electrons involved in covalent bonds?

- A** C_2H_2 **B** C_2H_4 **C** H_2S **D** N_2

12 Which statement best explains why graphite is often employed as a dry lubricant in hot machines?

- A** Each carbon atom uses only three out of four valence electrons for bonding.
B The carbon atoms in each layer are held by weak covalent bonds.
C The carbon atoms in graphite are connected in a tetrahedral arrangement.
D The different layers of carbon atoms are held by weak intermolecular forces of attraction.

13 Silicon carbide has a structure similar to diamond. Boron nitride has a structure similar to graphite. Bronze is a mixture of metals.

Which statements about silicon carbide, boron nitride and bronze are correct?

- 1 All are bonded covalently.
 2 All are insoluble in water.
 3 All except silicon carbide conduct electricity when solid.
 4 Bronze has low melting point.

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

14 In an experiment, excess hydrochloric acid was added to 0.5 g of chalk and 100 cm³ of carbon dioxide was produced at room temperature and pressure.

What is the percentage purity of calcium carbonate in the sample of chalk?

- A** 1.20 % **B** 2.20 % **C** 41.7 % **D** 83.3 %

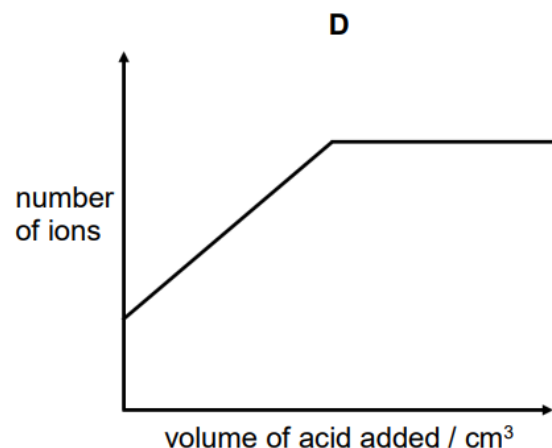
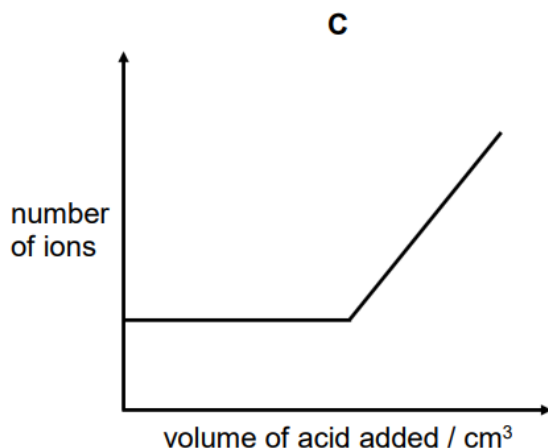
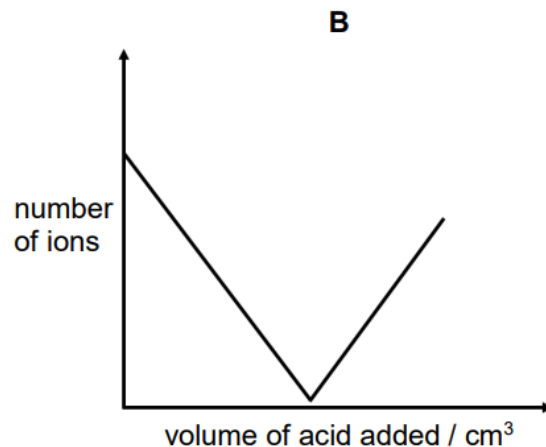
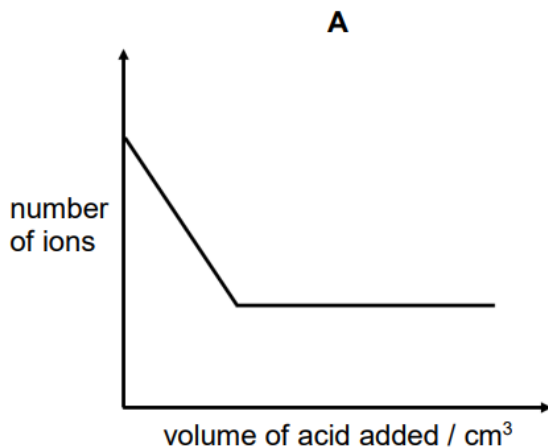
15 In which reaction does the smallest percentage change in volume occur?

- A** $\text{CH}_4(\text{g}) + 2\text{O}_2(\text{g}) \rightarrow \text{CO}_2(\text{g}) + 2\text{H}_2\text{O}(\text{l})$
B $\text{C}_3\text{H}_8(\text{g}) + 5\text{O}_2(\text{g}) \rightarrow 3\text{CO}_2(\text{g}) + 4\text{H}_2\text{O}(\text{l})$
C $2\text{H}_2\text{S}(\text{g}) + \text{SO}_2(\text{g}) \rightarrow 3\text{S}(\text{s}) + 2\text{H}_2\text{O}(\text{l})$
D $4\text{NH}_3(\text{g}) + 3\text{O}_2(\text{g}) \rightarrow 2\text{N}_2(\text{g}) + 6\text{H}_2\text{O}(\text{l})$

[Turn Over

16 Dilute sulfuric acid was added to aqueous barium hydroxide until the acid was in excess.

Which graph shows the variation in the total number of ions in the solution?

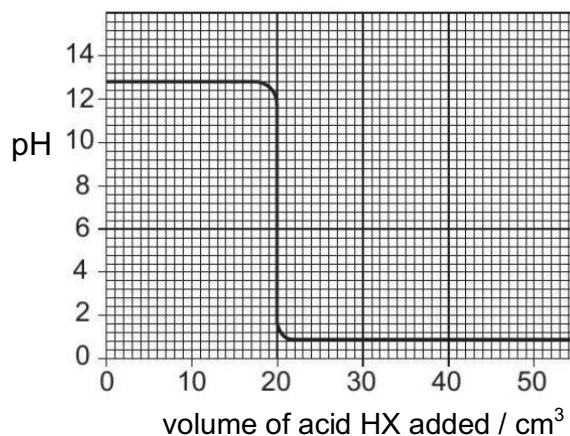


17 49.2 g of hydrated magnesium sulfate is heated and cooled repeatedly until it reaches a constant mass of 24.0 g. Assuming only water of crystallisation is lost when hydrated magnesium sulfate is heated, what is the formula of the hydrated magnesium sulfate?

- A** $\text{MgSO}_4 \cdot 3\text{H}_2\text{O}$
- B** $\text{MgSO}_4 \cdot 5\text{H}_2\text{O}$
- C** $\text{MgSO}_4 \cdot 7\text{H}_2\text{O}$
- D** $\text{MgSO}_4 \cdot 10\text{H}_2\text{O}$

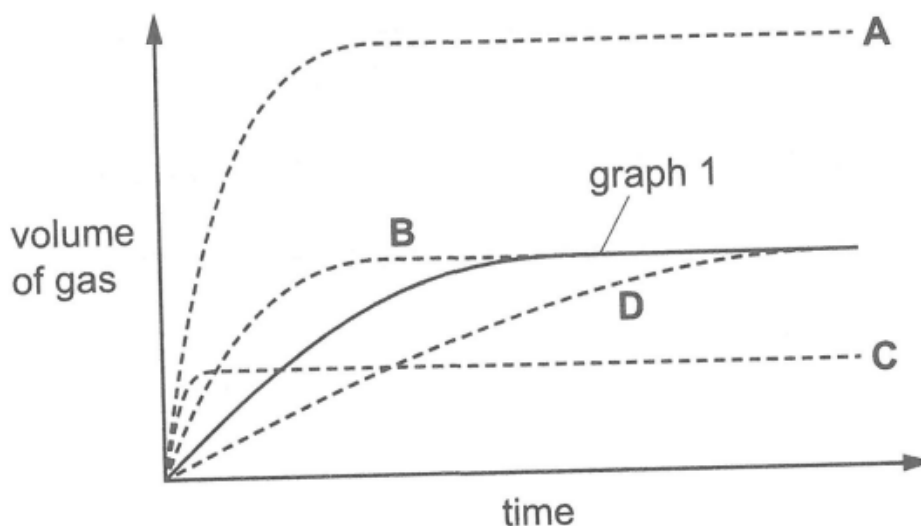
[Turn Over

- 18** A pH probe measures the pH changes during a titration experiment. In the experiment, an unknown acid, HX of concentration 0.1 mol/dm^3 , was added from a burette to 25.0 cm^3 of dilute sodium hydroxide. The graph shows the results of the experiment.



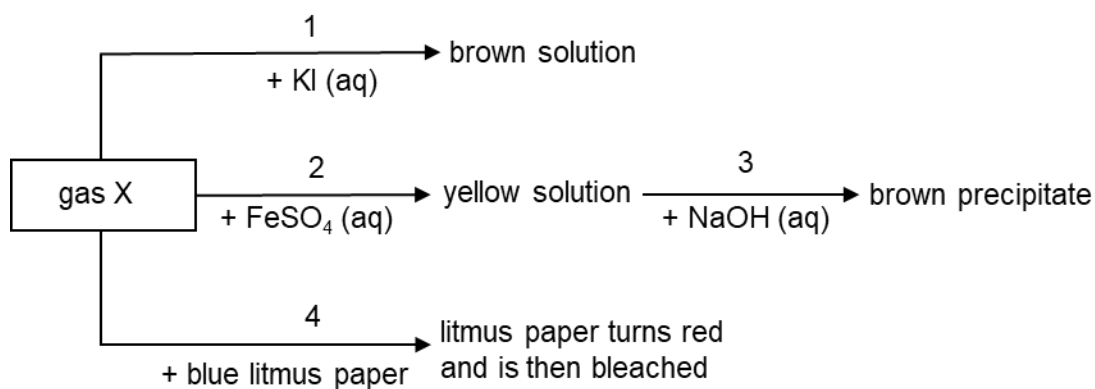
Which statement about the results obtained from the experiment is incorrect?

- A** Concentration of alkali used is less than 0.1 mol / dm^3 .
 - B** Formula of salt formed is NaX.
 - C** HX is a strong acid.
 - D** Neutralisation only occurs when 20.0 cm^3 of HX is added to sodium hydroxide.
- 19** A sample of 0.5 g of magnesium ribbon is reacted with an excess of 1.0 mol/dm^3 hydrochloric acid.
The volume of hydrogen gas produce over time is measured.
The results are plotted to give graph 1.
Which graph would be produced when 1.0 g of magnesium ribbon is reacted with an excess of 1.0 mol/dm^3 of hydrochloric acid under the same conditions?



[Turn Over

20 The scheme below shows reactions of a gas X.



Which statement is incorrect?

- A** Gas X is chlorine.
- B** In stage 1, iodide ion is oxidised as it gains electrons to form iodine.
- C** In stage 2, iron(II) sulfate acts as a reducing agent.
- D** The brown precipitate formed in stage 3 is iron(III) hydroxide.

21 Metals are found naturally as the metal or as metal compounds.

The metal compounds can be reduced to the metal using carbon as a reducing agent or by electrolysis.

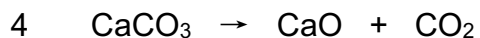
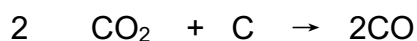
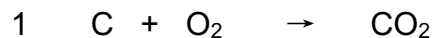
Which row is correct?

	can be found as the metal	obtained by reduction using carbon	obtained by electrolysis
A	Mg	Fe, Zn	Na, K
B	Ag	Na, Zn	Fe, K
C	Ag	Fe, Zn	Mg, Na
D	Mg	Fe, K	Ag, Na

[Turn Over

22 Iron is extracted from iron ore in the Blast Furnace.

The equations show some reactions that happen in the Blast Furnace.



Which two equations show elements in compounds being reduced?

- A** 1 and 2 **B** 2 and 3 **C** 3 and 4 **D** 4 and 5

23 Elements W, X, Y and Z are in the same period but different groups of the Periodic Table.

W reacts with oxygen to form W_2O , a basic oxide.

X reacts with oxygen to form XO_2 , an acidic oxide.

Y is an oxide which reacts with both an acid and a base.

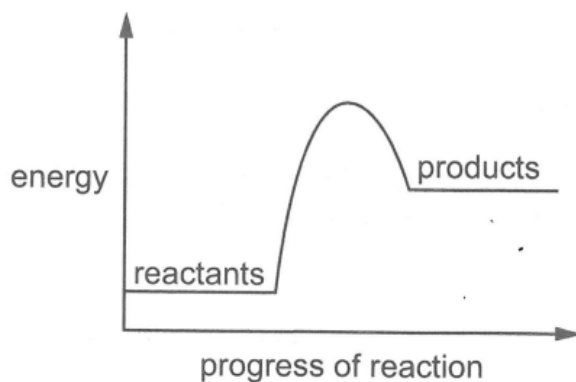
Z reacts with W to form an ionic compound of formula WZ.

What is the order of these four elements across the Periodic Table?

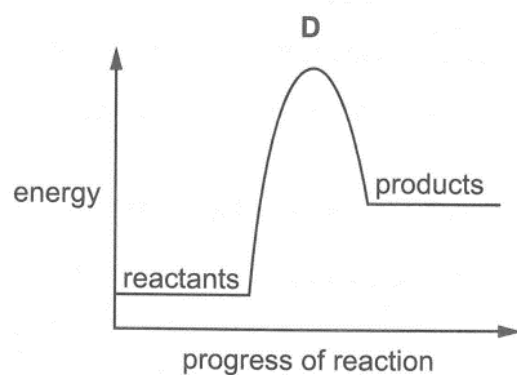
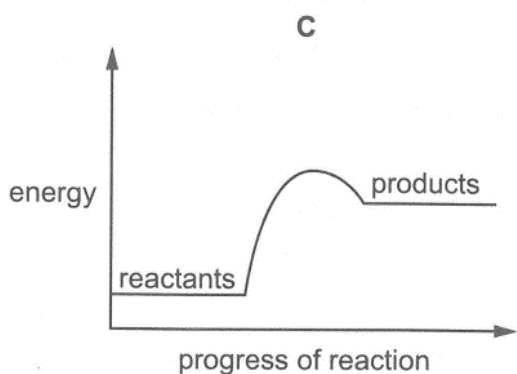
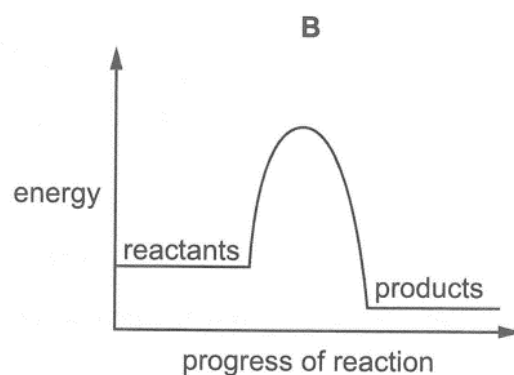
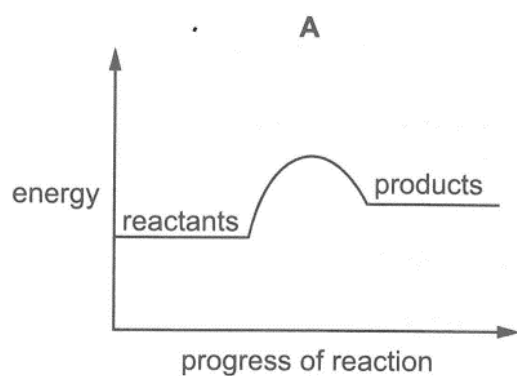
- A** WXYZ **B** WYXZ **C** WYZX **D** ZWYX

[Turn Over

24 The energy profile diagram for a reaction is shown.

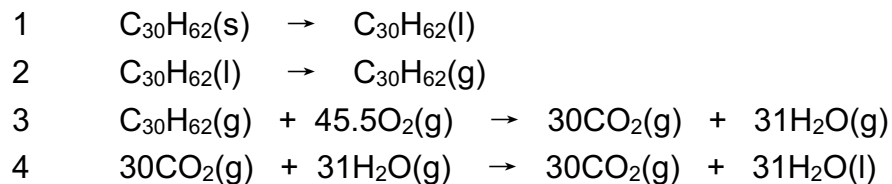


A catalyst was added and no other reaction condition was changed. Which energy profile diagram is correct for the catalysed reaction?



[Turn Over

- 25** The scheme shows four stages 1 to 4, in the conversion of solid candle wax, $C_{30}H_{62}$, into carbon dioxide and water.



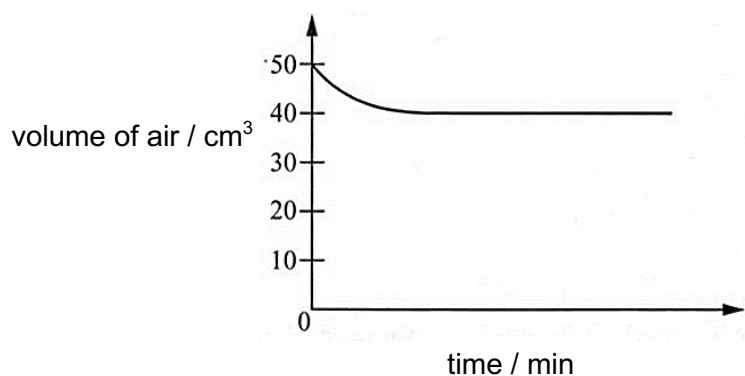
Which stages are exothermic?

- A** 1 and 2 **B** 1 and 4 **C** 2 and 3 **D** 3 and 4
- 26** A catalytic converter in a car exhaust system changes pollutants into less harmful products.

Which change does not occur in a catalytic converter?

- A** carbon dioxide $\rightarrow$ carbon
B carbon monoxide $\rightarrow$ carbon dioxide
C nitrogen oxides $\rightarrow$ nitrogen
D unburned hydrocarbons $\rightarrow$ carbon dioxide and water

- 27** The graph below shows the change in the volume of air in a vessel.



Which of the following reactions is likely to cause this change?

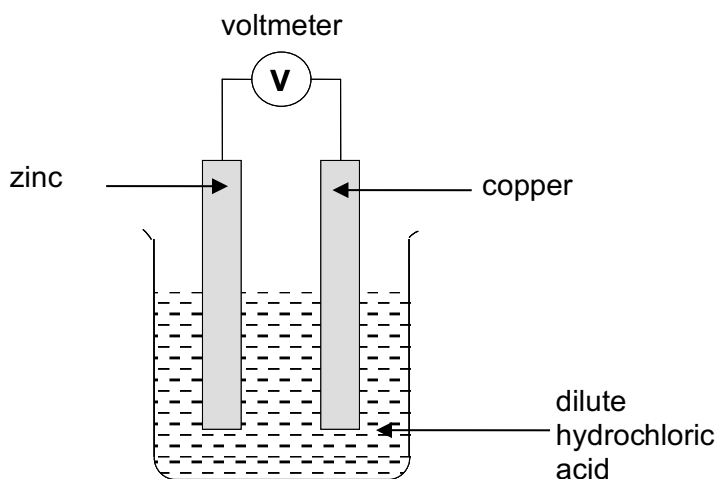
- A** $CH_4 + 2O_2 \rightarrow CO_2 + 2H_2O$
B $2H_2O_2 \rightarrow 2H_2O + O_2$
C $2Mg + O_2 \rightarrow 2MgO$
D $N_2 + 3H_2 \rightarrow 2NH_3$

[Turn Over

- 28 An article to be copper-plated is made the cathode of a cell. What would be the most suitable materials for the anode and the electrolyte?

	anode	electrolyte
A	carbon	aqueous copper (II) sulfate
B	copper	aqueous copper (II) sulfate
C	copper	sulfuric acid
D	platinum	sulfuric acid

- 29 The diagram shows a set-up of a simple cell.



Which of the following describes the reaction at the cathode?

- A** $2\text{Cl}^- \rightarrow \text{Cl}_2 + 2\text{e}^-$
B $\text{Cu} \rightarrow \text{Cu}^{2+} + 2\text{e}^-$
C $2\text{H}^+ + 2\text{e}^- \rightarrow \text{H}_2$
D $4\text{OH}^- \rightarrow 2\text{H}_2\text{O} + \text{O}_2 + 2\text{e}^-$

[Turn Over

- 30** Two metals and an electrolyte can be used to produce electrical energy. A voltage is set up between the metals. One of the metals used is zinc.

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

metal tested	voltage / V	direction of electron flow
P	0.2	zinc to metal P
Q	0.5	metal Q to zinc
R	1.1	zinc to metal R

Arrange the three metals according to their reactivity in the reactivity series, starting with the least reactive metal.

- A** P, Q, R **B** P, R, Q **C** Q, P, R **D** R, P, Q

- 31** During the electrolysis of dilute aqueous hydrochloric acid, 9.6 cm³ of hydrogen gas is collected at the cathode at room temperature and pressure.

Which statement about the electrolysis is correct?

- A** 4.8 cm³ of chlorine gas is collected at the anode.
B 4.8 cm³ of oxygen gas is collected at the anode.
C 9.6 cm³ of chlorine gas is collected at the anode.
D 9.6 cm³ of oxygen gas is collected at the anode.

- 32** The boiling point of a covalent compound is determined by the strength of the intermolecular forces between its molecules.

Which covalent compound has the strongest forces of attraction between its molecules?

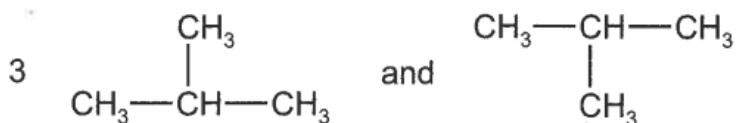
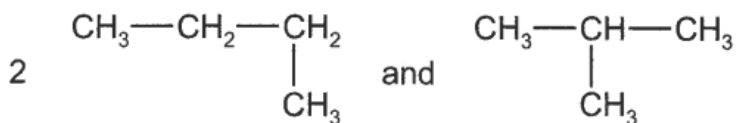
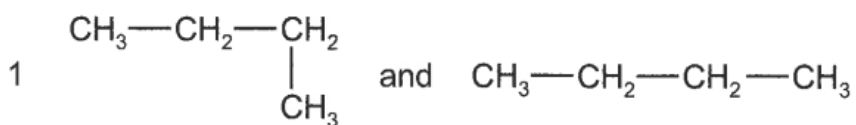
- A** butane **B** ethane **C** methane **D** propane

- 33** What will propanol, C₃H₇OH, form on complete oxidation?

- A** CH₃CO₂H **B** C₂H₅CO₂H **C** C₃H₇CO₂H **D** C₄H₉CO₂H

[Turn Over

34 Which diagram(s) represent(s) the two isomers of butane, C_4H_{10} ?



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

35 Which bond in a molecule of ethanoic acid is broken when it reacts with magnesium?

- A** the C-H bond
- B** the C-C bond
- C** the O-H bond
- D** the C=O bond

36 Which alcohol and acid can be reacted together to make the ester, $\text{CH}_3\text{CH}_2\text{CH}_2\text{CO}_2\text{CH}_3$?

- A** $\text{C}_4\text{H}_9\text{OH}$ and HCO_2H
- B** $\text{C}_3\text{H}_7\text{OH}$ and $\text{CH}_3\text{CO}_2\text{H}$
- C** $\text{C}_2\text{H}_5\text{OH}$ and $\text{C}_2\text{H}_5\text{CO}_2\text{H}$
- D** CH_3OH and $\text{C}_3\text{H}_7\text{CO}_2\text{H}$

[Turn Over

37 The equation for the cracking of alkane is shown.



X decolourises aqueous bromine.

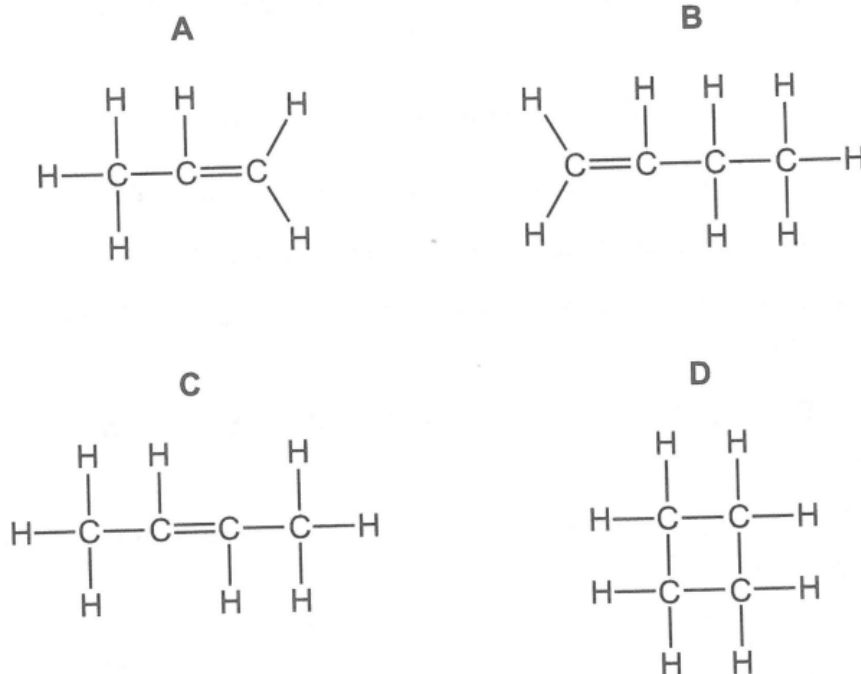
What is the formula of X and Y?

	compound X	compound Y
A	C_2H_4	C_4H_8
B	C_2H_4	C_4H_{10}
C	C_2H_6	C_4H_8
D	C_2H_6	C_4H_8

38 Compound Z

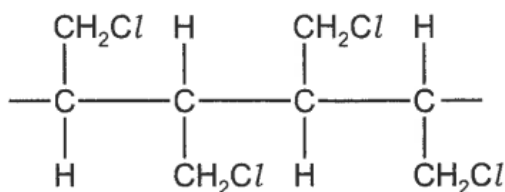
- has an empirical formula of CH_2 ,
- has an M_r of 56,
- reacts with steam to form two alcohols that have different structural formulae.

What is compound Z?



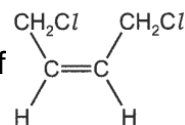
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39 The diagram shows the partial structure of a polymer.

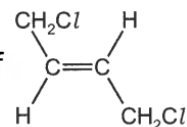


Which statement about this polymer is correct?

A It could be made by the addition polymerisation of



B It could be made from the condensation polymerisation of



C Its monomer has the empirical formula $\text{C}_4\text{H}_6\text{Cl}_2$.

D Its monomer could be made by the reaction of an alkane with chlorine.

40 Two compounds, X and Y, react together to form the polymer nylon.

compound X	compound Y
$\text{H}_2\text{N}-(\text{CH}_2)_6-\text{NH}_2$	$\text{HOOC}-(\text{CH}_2)_4-\text{COOH}$

What is the formula of the partial structure which repeats within the polymer?

A $\text{C}_{10}\text{H}_{22}\text{N}_2\text{O}_2$

B $\text{C}_{12}\text{H}_{22}\text{N}_2\text{O}_2$

C $\text{C}_{10}\text{H}_{20}\text{N}_2\text{O}_4$

D $\text{C}_{12}\text{H}_{20}\text{N}_2\text{O}_4$

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DATA SHEET**Colours of some common metal hydroxides**

aluminium hydroxide	white
calcium hydroxide	white
copper (II) hydroxide	light blue
iron (II) hydroxide	green
iron (III) hydroxide	red-brown
lead (II) hydroxide	white
zinc hydroxide	white

The Periodic Table of Elements

Group																							
I	II	Key										III	IV	V	VI	VII	0						
		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	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 -	117 Ts tennessine -	118 Og oganesson -	119 Nh nihonium -	120 Ds darmstadtium -						
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.).