CHUNG CHENG HIGH SCHOOL (YISHUN)

O

2025 Preliminary Examination
Secondary Four Express

CANDIDATE NAME			
CLASS		INDEX NUMBER	

CHEMISTRY

6092/01

Paper 1 Multiple Choice

20 August 2025

Additional Materials: OTAS

1 hour

READ THESE INSTRUCTIONS FIRST

Write your name, class and index number in the spaces at the top of this page and on the OTAS provided.

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 OTAS.

Read the instructions on the OTAS very carefully.

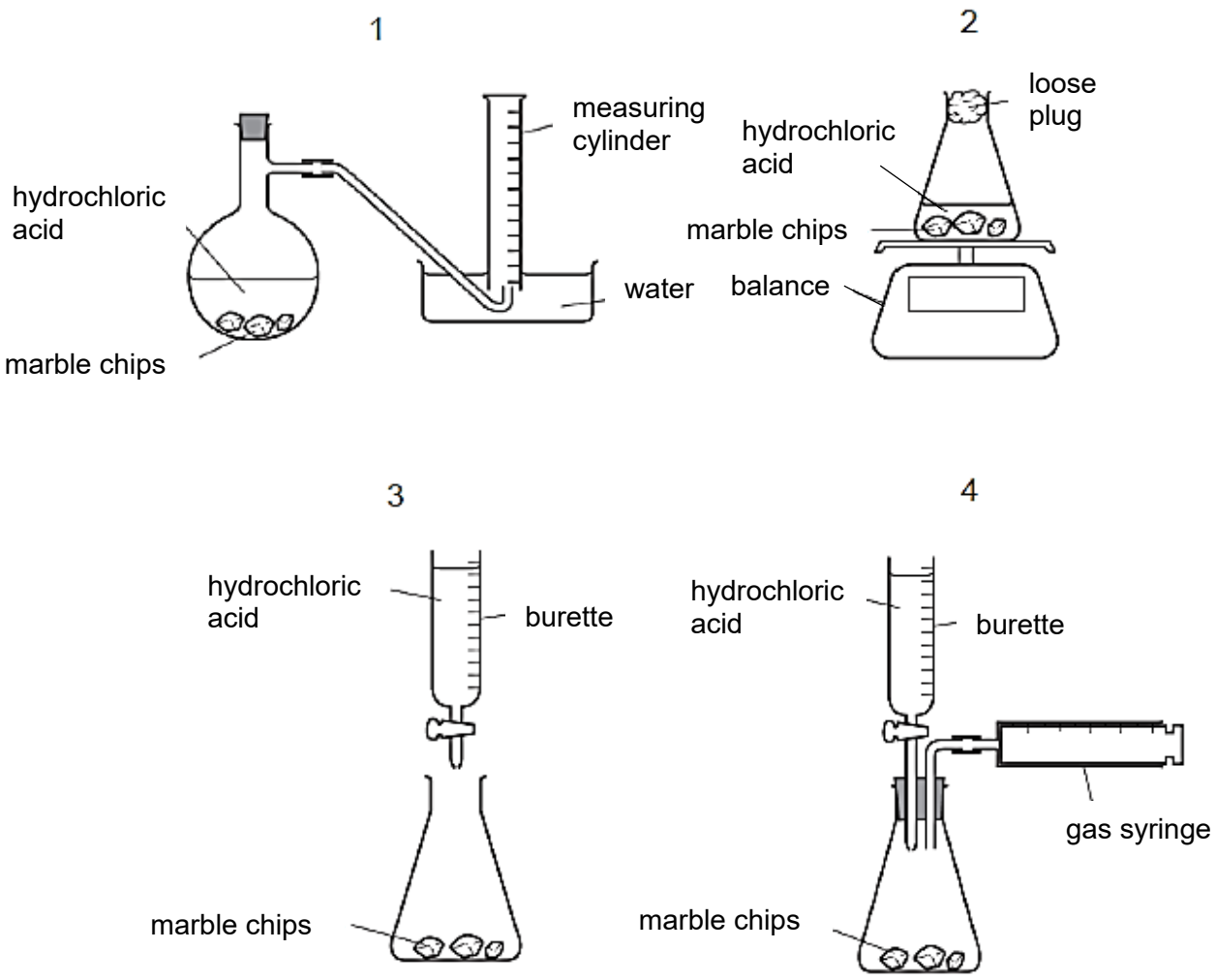
Each correct answer will score one mark. A mark will not be deducted for a wrong answer.
Any rough working should be done in this question paper.
A copy of the Periodic Table is printed on page **20**.
The use of an approved scientific calculator is expected, where appropriate.

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1 A student follows the rate of reaction between marble chips, $CaCO_3$ and dilute hydrochloric acid.

$$CaCO_3 + 2HCl \rightarrow CaCl_2 + CO_2 + H_2O$$

Which set-ups show the apparatus that are suitable for this experiment?



A 1 and 2 only

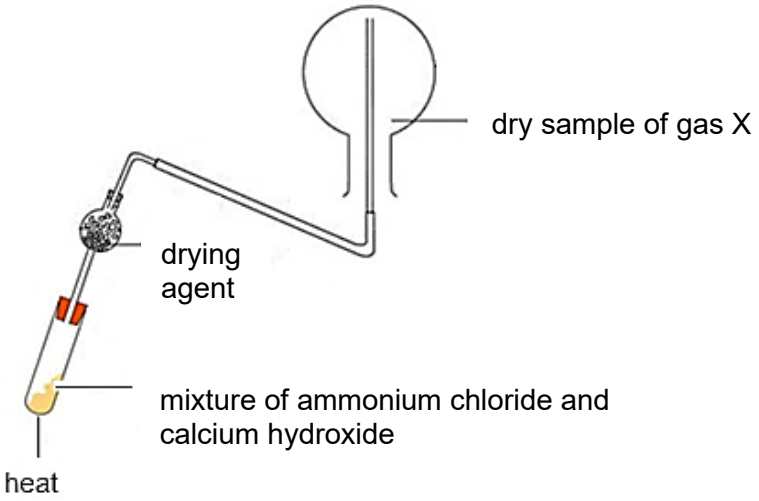
B 1 and 3 only

C 2 and 4 only

D 1, 2 and 4 only

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2 A student sets up the apparatus as shown below to collect a sample of clean, dry gas X.



Which row correctly gives the identity of gas X and drying agent?

	gas X	drying agent
A	ammonia	calcium oxide
B	ammonia	concentrated sulfuric acid
C	hydrogen chloride	calcium oxide
D	hydrogen chloride	concentrated sulfuric acid

3 Which sequence of procedures is used to separate a pure, dry sample of hydrated copper(II) sulfate, $CuSO_4.5H_2O$, from a mixture containing hydrated copper(II) sulfate and calcium carbonate, $CaCO_3$?

A dissolve in water → distillation → crystallisation

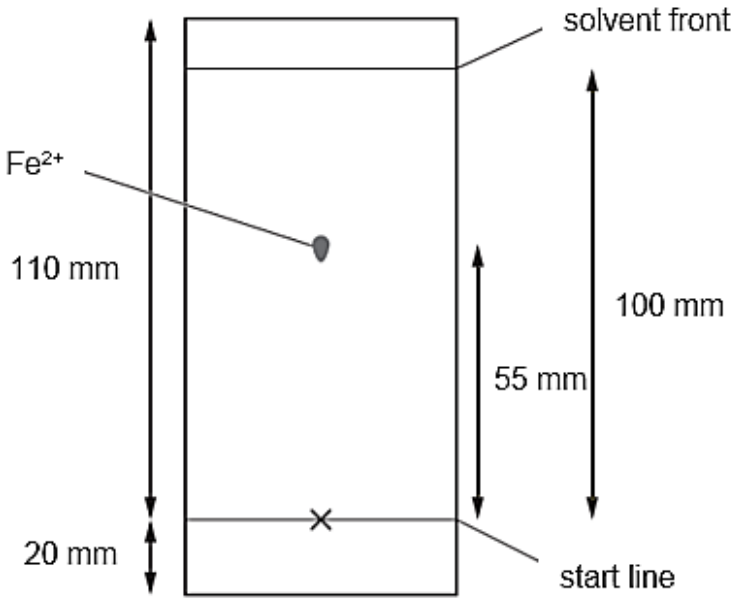
B dissolve in water → filtration → crystallisation

C distillation → crystallisation → heating to remove all water

D fractional distillation → filtration → heating to remove all water

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4 A paper chromatography experiment is used to find the R_f value for $Fe^{2+}(aq)$. The chromatogram is shown.



To make the spot containing $Fe^{2+}(aq)$ more visible, the paper is sprayed with a locating agent that forms a precipitate of iron(III) hydroxide on the spot.

In the chromatogram, the R_f of $Fe^{2+}(aq)$ is given by …….(1)……. and the colour of the precipitate is ……(2)…….

	(1)	(2)
A	0.50	red-brown
B	0.50	green
C	0.55	red-brown
D	0.55	green

5 A liquid is suspected to be pure ethanol.

What is the best way to test its purity?

A burn it completely in oxygen

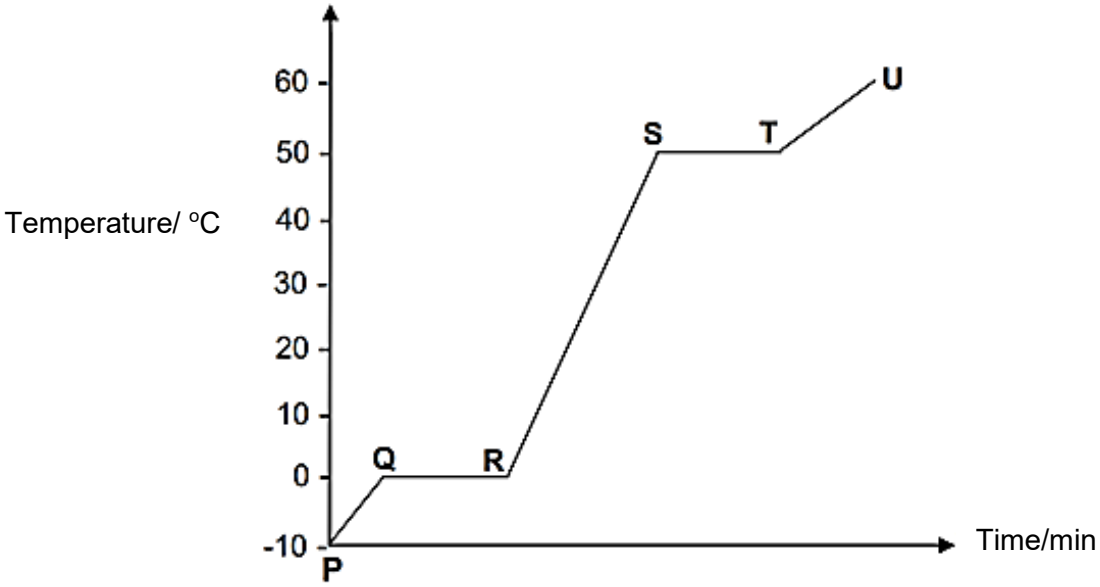
B measure its boiling point

C react with ethanoic acid

D test with litmus paper

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6 The graph shows the change in the temperature of a substance with time when it is heated from -10ºC to 60ºC.



Which statement describes the change taking place between the points?

A Energy is released from points P to Q.

B Kinetic energy of the particles remains constant from points P to U.

C Particles gain energy to weaken the forces of attraction from points S to T.

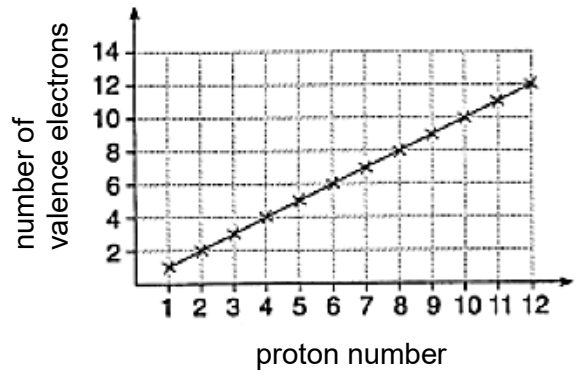
D There is a large increase in the volume of the substances from points R to S.

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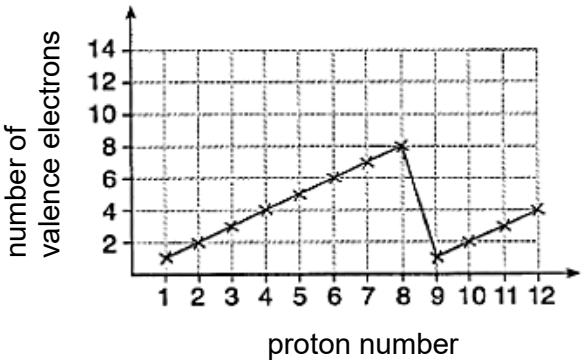
7 The number of valence electrons for elements hydrogen to magnesium was plotted against the proton number of the element.

Which graph was obtained?

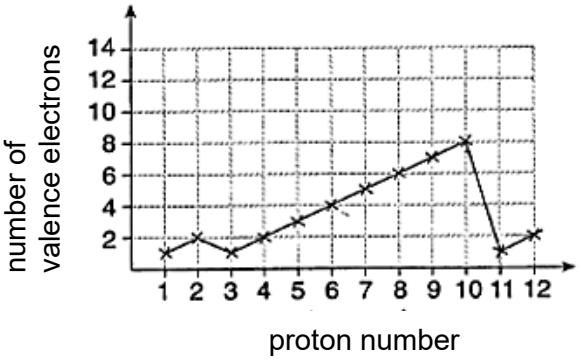
A



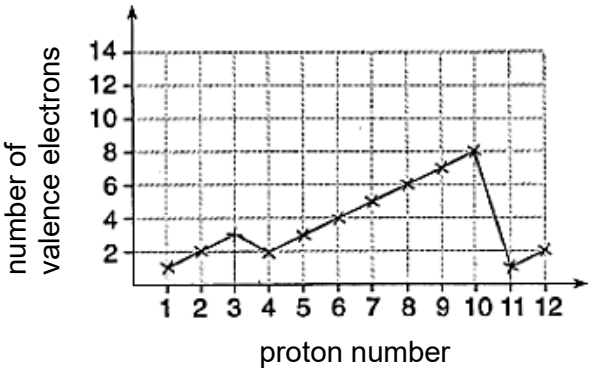
B



C

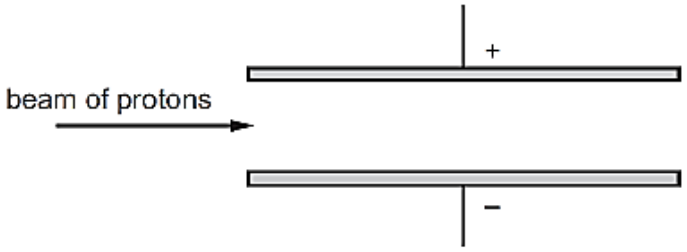


D



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8 A beam of protons was passed through an electrostatic field between two charged plates. The electrostatic field deflected the beam of protons towards the negatively charged plates. The lower the relative mass of the particle, the larger the deflection.



The experiment was repeated using a beam of electrons in place of the beam of protons.

Which row correctly shows the extent of deflection and the direction of the beam of electrons?

	extent of deflection of beam of electrons	direction of deflection of beam of electrons
A	deflected less than beam of protons	opposite direction to beam of protons
B	deflected less than beam of protons	same direction as beam of protons
C	deflected more than beam of protons	opposite direction to beam of protons
D	deflected more than beam of protons	same direction as beam of protons

9 An atom of element X is represented by $^{9}_{4}X$.

Which statement about an atom of X is correct?

A It is in Group 14 of the Periodic Table.

B It is in Period 4 of the Periodic Table.

C It forms an ion with a 2+ charge.

D The total number of protons and neutrons is 13.

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10 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 number of electrons.

C Bromine isotopes have different number of protons.

D Bromine is radioactive.

11 Which substance contains both ionic and covalent bonds?

A ammonium chloride

B hydrogen chloride

C lithium oxide

D silicon dioxide

12 A substance Y

- has a high melting point;
- is a good conductor of electricity;
- is malleable.

What could Y be?

A graphite

B iron

C potassium chloride

D silicon dioxide

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13 Some properties of substances P, Q and R are given in the table below.

substance	percentage composition by mass	electrical conductivity when solid	effect of heat
P	constant	yes	solid burns in air to form an oxide
Q	varies	no	liquid burns to form carbon dioxide and water
R	constant	no	solid decomposes to form two products

Which row shows the correct classification of the substances as an element, a mixture or a compound?

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

14 0.24 g of an element, X, is reacted with 240 cm^3 Cl_2 to form a chloride with the formula XCl_2 at r.t.p.

What is element X?

A carbon

B calcium

C magnesium

D titanium

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15 The manufacture of nitric acid, HNO_3, involves 2 steps.

Step 1: $2NO + O_2 \rightarrow 2NO_2$
Step 2: $4NO_2 + 2H_2O + O_2 \rightarrow 4HNO_3$

What is the maximum number of moles of nitric acid that could be formed from 0.50 moles of nitrogen monoxide, NO?

A 0.125 **B** 0.25 **C** 0.50 **D** 1.00

16 Which hydrocarbon has the highest percentage of hydrogen by mass?

A CH_4 **B** C_3H_8 **C** C_4H_{10} **D** C_5H_{12}

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

$$NH_4NO_3 \rightarrow N_2O + 2H_2O$$

When 100 g of an impure sample of ammonium nitrate is heated, 30 g of water is formed.

What is the percentage purity of ammonium nitrate in the sample?

A 33.3% **B** 66.7% **C** 75% **D** 88.3%

18 A student titrates 25.00 cm^3 of 0.100 mol/dm^3 of sulfuric acid with 0.250 mol/dm^3 of sodium hydroxide using a methyl orange indicator.

$$H_2SO_4(aq) + 2NaOH(aq) \rightarrow Na_2SO_4(aq) + 2H_2O(l)$$

She records the volume of sodium hydroxide used to be 24.00 cm^3.

Which statement(s) is/are correct?

1 The colour of the solution at the end of the titration is yellow.
2 The colour of the solution at the end of the titration is orange.
3 She has exceeded the end-point of the titration.
4 She has just reached the end-point of the titration.

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

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19 Which of the following oxides can react with aqueous potassium hydroxide?

A CO_2 and BaO

B CO_2 and H_2O

C CO_2 and PbO

D CO_2 only

20 When an excess of lead(II) carbonate reacts with dilute sulfuric acid, the reaction stops after only a small amount of gas has been given off.

Which statement best explain why this happens?

A An insoluble layer of lead(II) sulfate is formed on lead(II) carbonate.

B The concentration of acid decreases rapidly.

C The lead(II) carbonate is unreactive.

D The lead(II) carbonate is impure.

21 Which method of preparation is suitable for making these salts?

	titration	metal + acid	metal carbonate + acid	precipitation
A	potassium nitrate	silver chloride	copper(II) sulfate	zinc sulfate
B	potassium nitrate	zinc sulfate	copper(II) sulfate	silver chloride
C	zinc sulfate	sodium nitrate	silver chloride	copper(II) sulfate
D	zinc sulfate	copper(II) sulfate	potassium nitrate	silver chloride

22 Industrial ammonia is obtained by the Haber process.

$$N_2(g) + 3H_2(g) \rightleftharpoons 2NH_3(g) \qquad \Delta H = -92 \text{ kJ / mol}$$

Which statement is **incorrect** about the process?

A The industrial catalyst used is finely divided iron.

B The reaction is endothermic, hence a temperature of 450°C is used.

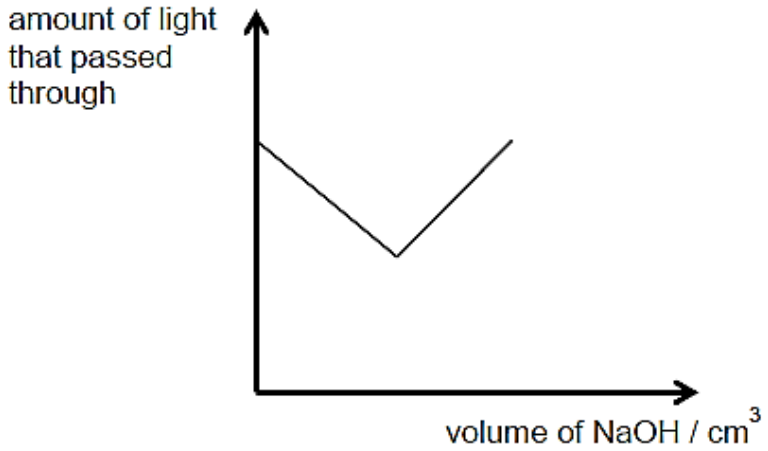
C The hydrogen needed is obtained mainly by cracking of petroleum oil.

D 250 atm favours the production of ammonia but is difficult to maintain.

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23 An aqueous solution of a salt, X, is placed in a test-tube and sodium hydroxide is gradually added. A light meter is used to measure the amount of light passing through the test-tube.

The amount of light that passes through the test-tube was plotted against the volume of sodium hydroxide solution added.



What is X?

A ammonium chloride

B calcium nitrate

C copper(II) nitrate

D zinc chloride

24 Disproportionation is a reaction in which the same element is oxidised and reduced simultaneously.

Which reaction is an example of disproportionation?

A $3Cu + 8HNO_3 \rightarrow 3Cu(NO_3)_2 + 2NO + 4H_2O$

B $2KOH + H_2SO_4 \rightarrow K_2SO_4 + 2H_2O$

C $2NO_2 + H_2O \rightarrow HNO_3 + HNO_2$

D $2Pb(NO_3)_2 \rightarrow 2PbO + 4NO_2 + O_2$

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25 A student is presented with two gases, X and Y. He bubbles both gases in different solutions and makes the following observations.

gas	observations
X	colourless solution of potassium iodide turns brown
Y	purple acidified potassium manganate(VII) turns colourless

Which row correctly gives the identity of gas X and gas Y?

	gas X	gas Y
A	oxidising agent	oxidising agent
B	oxidising agent	reducing agent
C	reducing agent	oxidising agent
D	reducing agent	reducing agent

26 The table gives statements about the properties between an electrolytic cell and a simple cell.

In which row are both statements correct?

	electrolytic cell	simple cell
A	converts chemical energy to electrical energy	converts electrical energy to chemical energy
B	movement of positive and negative ions across electrolyte	flow of electrons from reactive metal to less reactive metal
C	reduction takes place at positive electrode	oxidation takes place at positive electrode
D	electrolyte decomposes to form new substances	positive electrode dissolves

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27 In an electrolysis experiment, the same amount of charge deposited 38.4 g of copper and 14.4 g of titanium. The charge on the copper ion is 2+ and titanium has a relative atomic mass of 48.

What was the charge on the titanium ion?

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

28 Four elements identified only as W, X, Y and Z are all found in the third period of the Periodic Table. W, X, Y and Z are not the actual chemical symbols of the elements.

1 W does not lose, gain or share electrons with other elements.
2 X forms an alkaline solution when reacted with cold water.
3 Y is diatomic.
4 X and Z forms ions which are smaller than their atoms.

Using the information provided, what is the most likely order of arrangement of these elements from left to right in the third period?

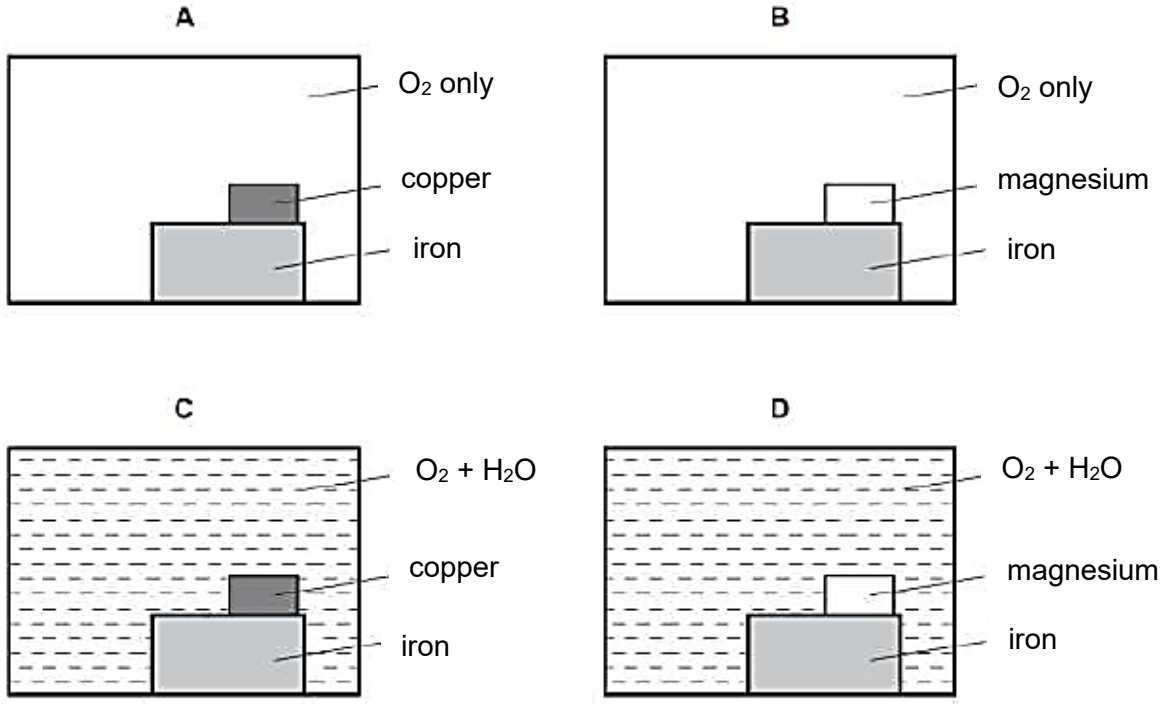
A W, Y, Z, X

B X, Y, Z, W

C X, Z, Y, W

D Z, Y, W, X

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?



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30 Which metal carbonate is most likely to melt but not decompose upon heating?

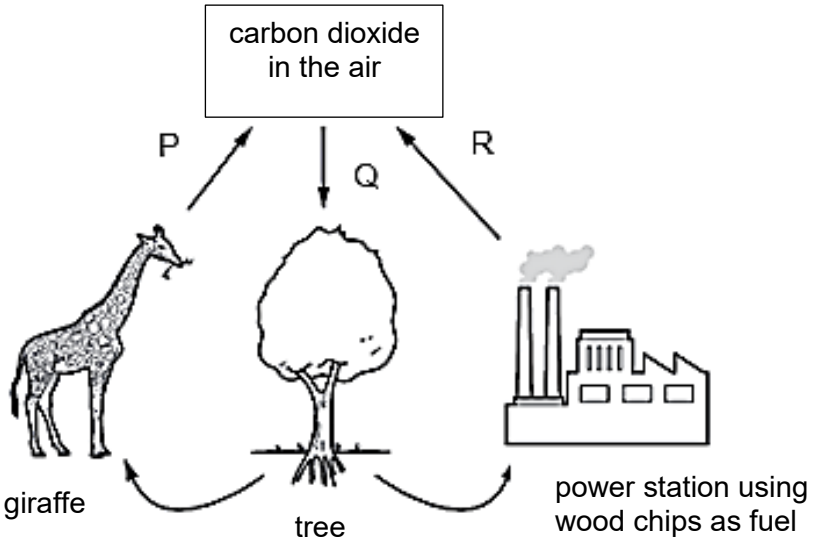
A copper(II) carbonate

B iron(III) carbonate

C lead(II) carbonate

D potassium carbonate

31 The diagram shows part of the carbon cycle. P, Q and R refer to specific processes of the carbon cycle.

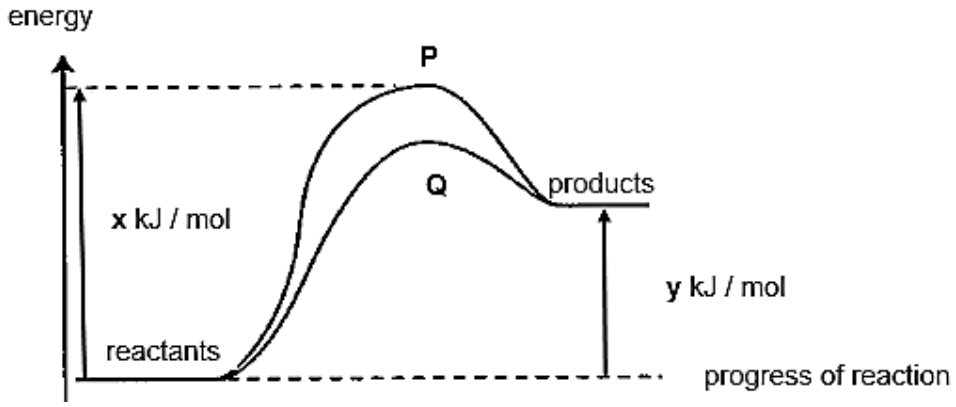


Which row correctly describe the energy changes of these processes?

	P	Q	R
A	endothermic	exothermic	endothermic
B	endothermic	exothermic	exothermic
C	exothermic	endothermic	endothermic
D	exothermic	endothermic	exothermic

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32 The energy profile diagram shows two different paths, P and Q.



Which conclusion can be made based on the diagram?

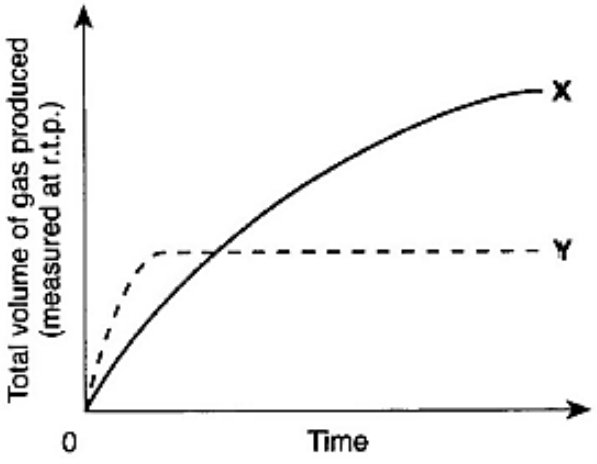
A Enthalpy change of the reaction equals (x-y) kJ/mol.

B The path Q is achieved by using a catalyst.

C The temperature of the surrounding increases when the products are formed.

D More products are formed through path Q than through path P.

33 In the graph shown below, curve X represents the results of the reaction between 2 g of zinc granules and an acid in excess at 25°C.



Which change will produce curve Y?

A using 2 g of zinc granules at 30°C

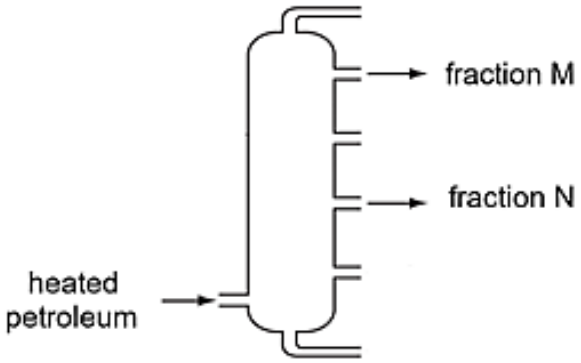
B using 1 g of zinc granules at 15°C

C using 1 g of zinc granules at 30°C

D using 2 g of zinc powder at 15°C

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34 The diagram shows the fractional distillation of petroleum.



Which row about fraction M and N is correct?

	M burns more easily than N	M has a higher boiling point than N	M is more viscous than N
A	true	false	false
B	true	true	false
C	false	true	true
D	false	false	true

35 Which statement is correct about vegetable oil and the margarine made from it?

A Both are liquids at room temperature and pressure.

B Both occur naturally.

C Margarine has a higher melting point.

D Vegetable oil has fewer carbon-carbon double bonds than margarine.

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36 An alcohol X was fully oxidised to a carboxylic acid. Neutralisation of the acid with calcium carbonate gave a salt of formula $(CH_3CO_2)_2Ca$.

What was alcohol X?

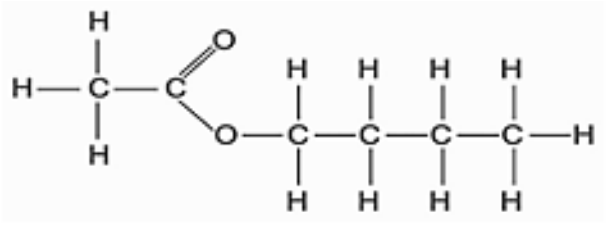
A CH_3OH

B C_2H_5OH

C C_3H_7OH

D C_4H_9OH

37 A food chemist wants to create the odour of pineapples using the organic compound shown below.



Which row correctly shows the pair of reactants that would react to form this compound and the name of the compound?

	reactant 1	reactant 2	name of compound
A	CH_3CH_2OH	$CH_3CH_2CH_2CH_2OH$	ethyl butanoate
B	CH_3CH_2OH	$CH_3CH_2CH_2COOH$	ethyl butanoate
C	CH_3COOH	$CH_3CH_2CH_2CH_2OH$	butyl ethanoate
D	$CH_3CH_2CH_2COOH$	CH_3COOH	butyl ethanoate

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38 What are formed when glucose is fermented?

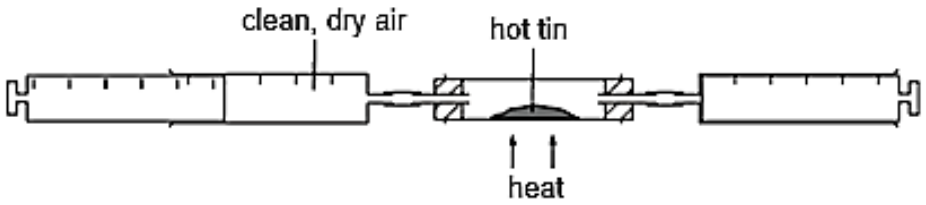
A ethanol and carbon dioxide

B ethanol and oxygen

C ethene and carbon dioxide

D ethene and oxygen

39 A sample of clean, dry air is passed over hot tin until all the oxygen in the air has reacted with tin.



The volume of air decreases by 30 cm^3.

What was the estimated original volume of the sample of air?

A 6 cm^3 **B** 40 cm^3 **C** 120 cm^3 **D** 145 cm^3

40 Which statement is true about atmospheric pollutants?

A Carbon monoxide is oxidised by oxygen and dissolves in rainwater to form acid rain.

B Hydrocarbons react with fluorine to produce a gas that depletes the ozone layer.

C Ozone at low altitudes in the atmosphere helps to block off ultraviolet rays.

D Sulfur dioxide can be removed from flue gases by passing over calcium carbonate.

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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, $L = 6.02 \times 10^{23} mol^{-1}$.

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