



GAN ENG SENG SCHOOL
Preliminary Examination 2024



**CANDIDATE
NAME**

--

CLASS

--	--

**INDEX
NUMBER**

--	--

CHEMISTRY

Paper 1 Multiple Choice

6092/01

9 September 2024

1 hour

Additional Materials: OTAS

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 OTAS. Shade your index number on the OTAS.

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 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 booklet.

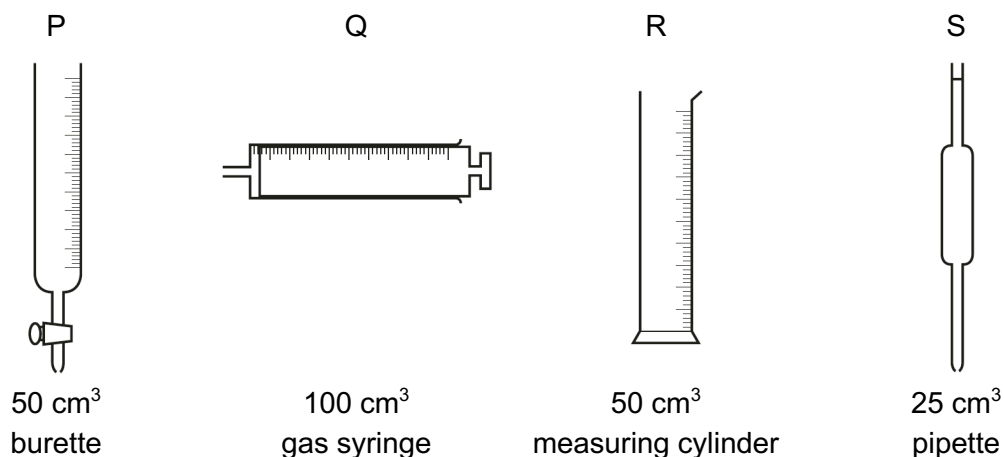
A copy of the Periodic Table is printed on page **18**.

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

Total Marks

40

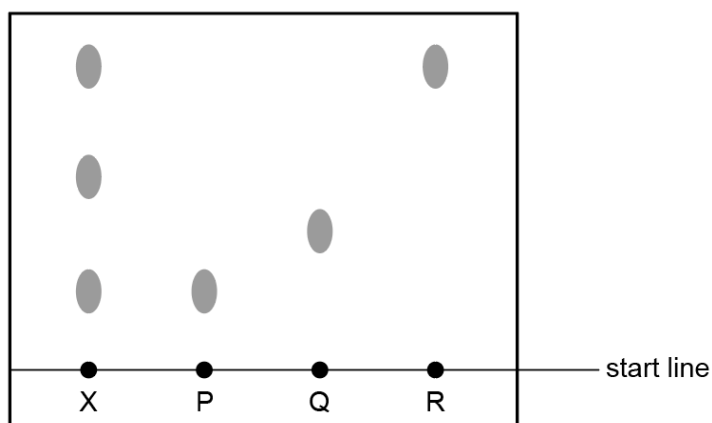
- 1 P, Q, R and S are pieces of apparatus.



Which row describes the correct apparatus for the measurement made?

	apparatus	measurement made
A	P	the volume of acid added to alkali in a titration
B	Q	0.24 dm ³ of hydrogen gas produced when magnesium reacts with an acid
C	R	75 cm ³ of a gas given off in a rate-determining experiment
D	S	20 cm ³ of alkali for use in a titration

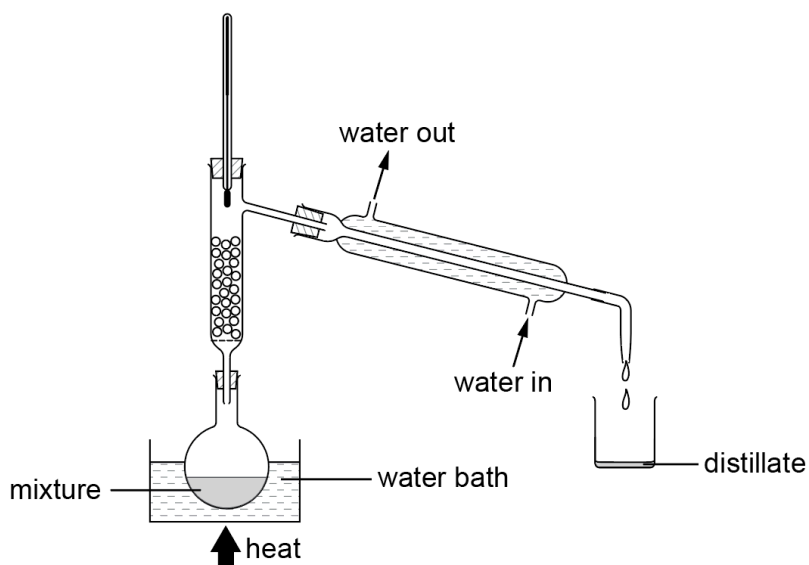
- 2 X is a mixture of colourless compounds. The diagram shows a chromatogram of X and of three pure compounds, P, Q and R.



Which statement is **not** correct?

- A** X could contain P and R.
- B** Q has a greater R_f value than R.
- C** P and R have different solubilities in the solvent.
- D** A locating agent was used to develop the chromatogram of X.

3 Which substance can be distilled using the apparatus below?

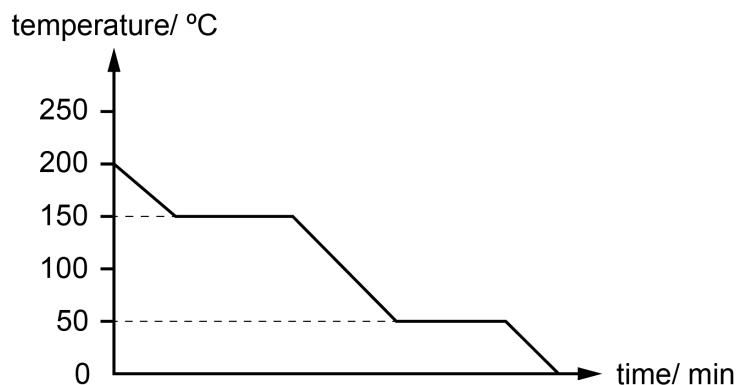


	melting point/ °C	boiling point/ °C
A	-138	0
B	-123	50
C	0	108
D	41	182

4 Which row about a change of state is correct?

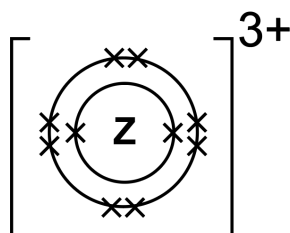
	change of state	energy change	process
A	solid → liquid	heat given out	melting
B	gas → liquid	heat taken in	evaporation
C	solid → gas	heat taken in	sublimation
D	liquid → solid	heat given out	condensing

- 5 The cooling curve for substance **X** is shown below.



At which temperature does both solid and liquid exist?

- A** 0 °C
B 50 °C
C 150 °C
D 200 °C
- 6 The ion of an element **Z** is shown below.



In which group and period does element **Z** belong to in the Periodic Table?

	group	period
A	13	2
B	13	3
C	15	2
D	15	3

- 7 Which row includes an element, a compound and a mixture?

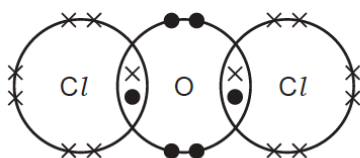
- A** sea water, tap water, pure water
B sodium chloride, chlorine, pure water
C sea water, sodium chloride, chlorine
D sodium chloride, sea water, pure water

- 8 Which row correctly classifies how graphite, aluminium and molten sodium chloride conduct electricity?

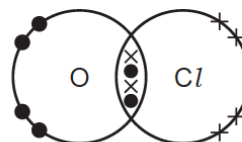
	using mobile ions and electrons	using mobile electrons only	using mobile ions only
A	molten sodium chloride	graphite	aluminium
B	molten sodium chloride	aluminium, graphite	none of the above
C	aluminium	graphite	molten sodium chloride
D	none of the above	aluminium, graphite	molten sodium chloride

- 9 Which dot and cross diagram for a compound of oxygen and chlorine is correct?

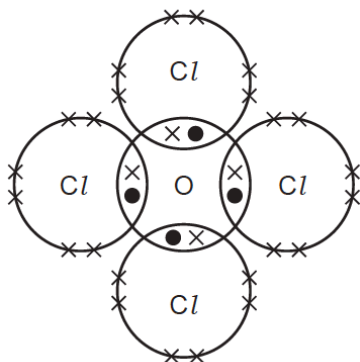
A



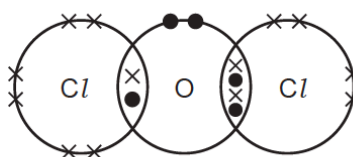
B



C



D



- 10 Which statement about the structure and properties of silicon(IV) oxide is **not** correct?

- A** It has a giant covalent structure similar to that of diamond.
- B** There are strong covalent bonds between silicon and oxygen atoms.
- C** Each silicon atom is bonded to four neighbouring oxygen atoms.
- D** It has a high melting point due to the strong attractive force between molecules.

- 11 What is the number of molecules in 500 cm^3 of oxygen gas at room temperature and pressure?

A 1.25×10^{22}
B 1.34×10^{22}
C 3.0×10^{22}
D 3.0×10^{26}

- 12 The percentage by mass of magnesium in chlorophyll-a ($M_r = 893$) is 2.69%.

How many magnesium atoms are there in one molecule of chlorophyll-a?

A 1
B 2
C 24
D 100

- 13 Saline solution is a solution of sodium chloride dissolved in water. It is commonly used in hospitals for cleaning wounds and treating dehydration.

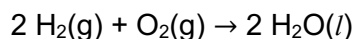
A 0.9% saline solution has 0.9 g of sodium chloride for every 100 cm^3 of solution.

What is the concentration of the 0.9% saline solution in mol/dm^3 ?

A 0.00154 mol/dm^3
B 0.0154 mol/dm^3
C 0.154 mol/dm^3
D 1.54 mol/dm^3

- 14 A mixture containing 8.0 g of hydrogen gas with 8.0 g of oxygen gas is ignited.

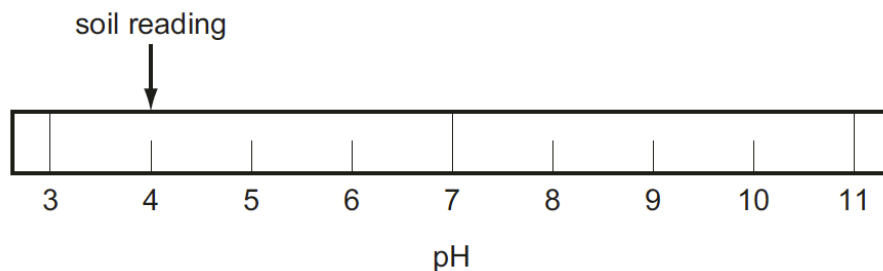
The reaction is represented by the following chemical equation.



What is the mass of water formed?

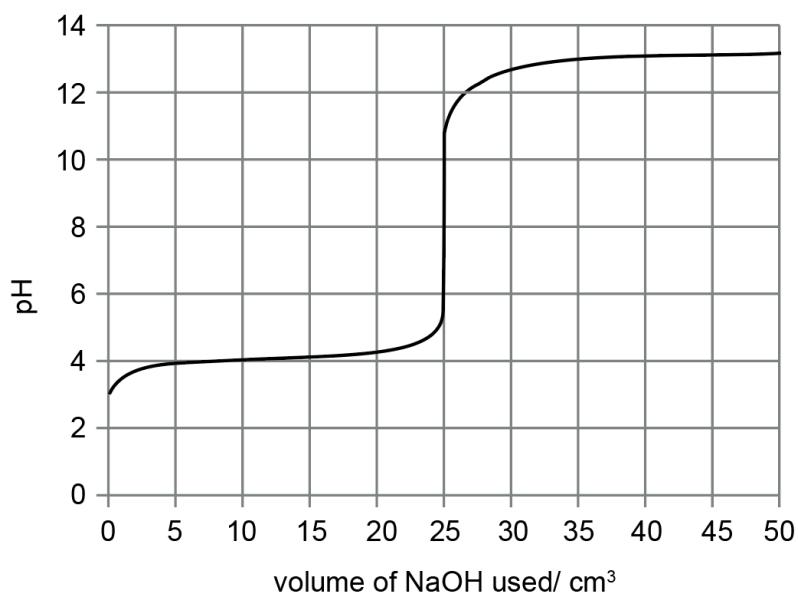
A 9.0 g
B 16.0 g
C 18.0 g
D 36.0 g

- 15 The diagram shows the results of a pH test on a sample of garden soil.



What could be added to the soil to change its pH to 7?

- A calcium oxide
 - B sodium oxide
 - C sodium chloride
 - D ammonium nitrate
- 16 The graph shows how pH changes as 0.1 mol/dm^3 of dilute sodium hydroxide is gradually added to 0.1 mol/dm^3 of ethanoic acid.



Which indicator is most suitable to be used in the titration to identify the end-point of neutralisation?

	indicator	colour change	pH at which colour change occurs
A	crystal violet	yellow → violet	0.0 – 2.0
B	methyl orange	red → yellow	3.1 – 4.4
C	phenolphthalein	colourless → pink	8.3 – 10.0
D	indigo carmine	blue → yellow	11.4 – 13.0

- 17 Copper(II) sulfate is made by reacting excess insoluble solid M and solution N.

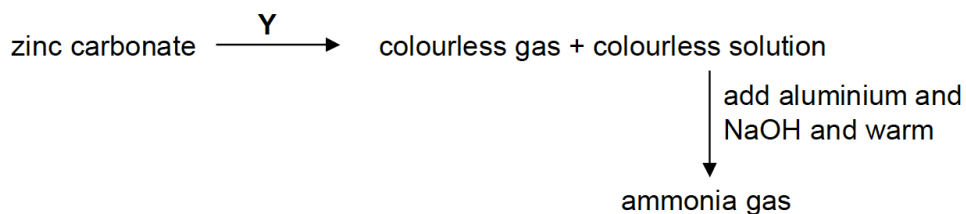
Which row identifies M and N and the method used to extract crystals of copper(II) sulfate from the mixture?

	M	N	method
A	copper	sodium sulfate	filter the mixture to obtain the residue
B	copper	sulfuric acid	filter the mixture and evaporate filtrate until crystals form
C	copper(II) oxide	sulfuric acid	filter the mixture to obtain the residue
D	copper(II) carbonate	sulfuric acid	filter the mixture and evaporate filtrate until crystals form

- 18 Which of the following pairs of gases changes the colour of damp red litmus paper?

- A** ammonia and chlorine
- B** ammonia and carbon dioxide
- C** chlorine and hydrogen
- D** chlorine and sulfur dioxide

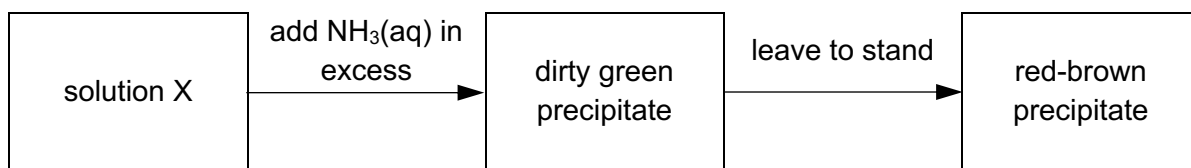
- 19 The diagram shows a reaction scheme.



What is Y?

- A** dilute nitric acid
- B** dilute hydrochloric acid
- C** aqueous sodium nitrate
- D** aqueous ammonia

- 20 The flowchart below shows the reactions of solution X.



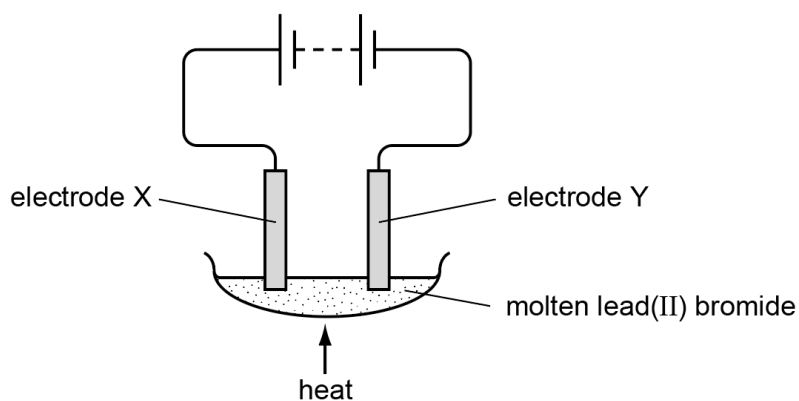
Which row is correct?

	formula of dirty green precipitate	reaction that resulted in red-brown precipitate
A	$\text{Fe}(\text{OH})_2$	reduction
B	$\text{Fe}(\text{NH}_4)_2$	reduction
C	$\text{Fe}(\text{OH})_2$	oxidation
D	$\text{Fe}(\text{NH}_4)_2$	oxidation

- 21 In which reaction is the underlined substance acting as a reducing agent?

- A** $2 \text{CuO} + \text{C} \rightarrow \text{CO}_2 + 2 \text{Cu}$
B $\text{Fe}_2\text{O}_3 + 3 \text{CO} \rightarrow 2 \text{Fe} + 3 \text{CO}_2$
C $2 \text{Mg} + \text{O}_2 \rightarrow 2 \text{MgO}$
D $\text{MnO}_2 + 4 \text{HCl} \rightarrow \text{MnCl}_2 + 2 \text{H}_2\text{O} + \text{Cl}_2$

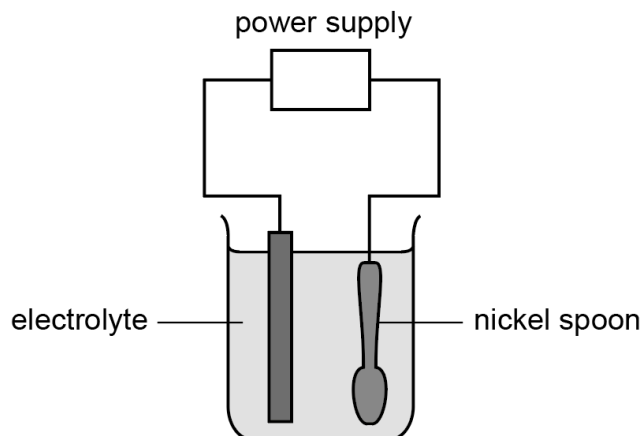
- 22 The diagram shows the electrolysis of molten lead(II) bromide.



What is seen at each electrode?

	electrode X	electrode Y
A	brown gas	grey metal
B	colourless gas	grey metal
C	grey metal	colourless gas
D	grey metal	brown gas

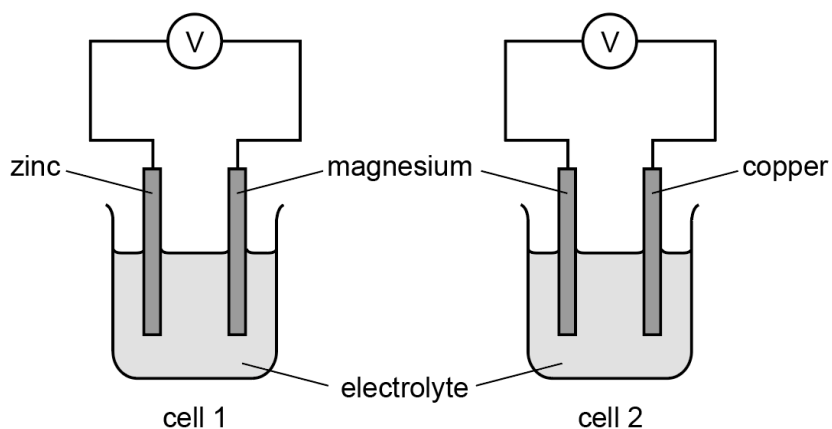
- 23 The diagram shows an experiment to electroplate a nickel spoon with silver.



Which row correctly describes the positive electrode, the negative electrode and the electrolyte?

	positive electrode	negative electrode	electrolyte
A	nickel spoon	pure nickel	silver nitrate solution
B	nickel spoon	pure silver	nickel nitrate solution
C	pure nickel	nickel spoon	silver nitrate solution
D	pure silver	nickel spoon	silver nitrate solution

- 24 The electrical energy, or voltage, of two simple cells is measured.



Which statement correctly describes the results of the experiment?

- A** The voltage of cell 1 is greater than cell 2.
- B** The electrolyte gradually turns blue in cell 2.
- C** Electrons flow from zinc to magnesium in cell 1.
- D** Magnesium loses electrons and undergoes oxidation in both cells.

- 25** Sodium and rubidium are elements in Group 1 of the Periodic Table.

Which statement is correct?

- A** Sodium atoms have more electrons than rubidium atoms.
- B** Sodium has a lower density than rubidium.
- C** Sodium has a lower melting point than rubidium.
- D** Sodium is more reactive than rubidium.

- 26** Elements X and Y are in Group 17 of the Periodic Table.
X is a liquid at room temperature. Y is a solid at room temperature.

Which statements are correct?

- 1 Atoms of Y have more protons than atoms of X.
- 2 Molecules of Y have more atoms than molecules of X.
- 3 Y displaces X from aqueous solutions of X^- ions.

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

- 27** The statements refer to a number of elements in the Periodic Table.

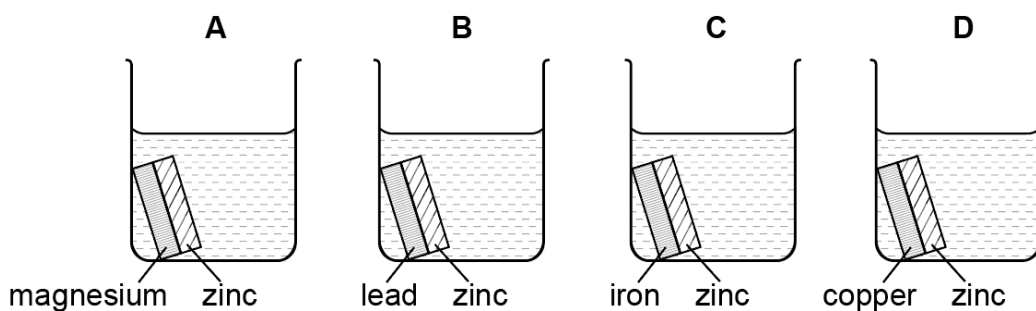
- 1 The elements form coloured compounds.
- 2 The elements have variable oxidation states.

For which pair of elements is each statement correct?

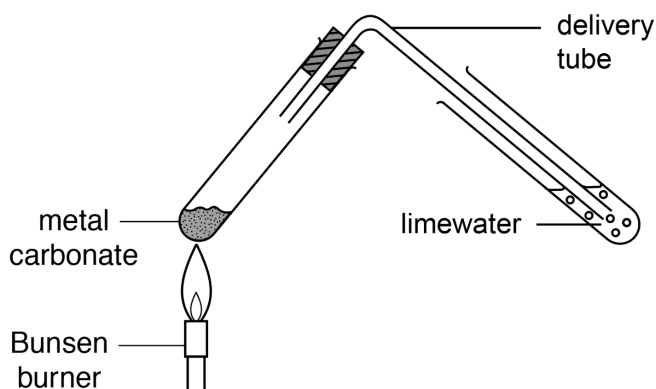
	form coloured compounds	have variable oxidation states
A	Co, Mg	Fe, Al
B	Fe, V	Co, Mn
C	Co, Mn	Mg, Al
D	Mg, Al	Fe, V

- 28 Each beaker contains two strips of metal fastened together and immersed in hydrochloric acid. All the strips are of the same size.

After 5 minutes, which beaker contains the least amount of zinc ions?



- 29 Three metal carbonates were each heated as shown below.

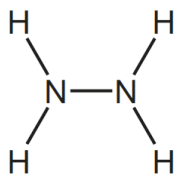


On mild heating of the carbonate of **Y**, a white precipitate formed in the limewater. Heating more strongly gave the same observation for the carbonate of **X** but not for the carbonate of **Z**.

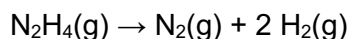
What could **X**, **Y** and **Z** be?

	X	Y	Z
A	Zn	Cu	Na
B	Zn	Na	Cu
C	Na	Zn	Cu
D	Na	Cu	Zn

- 30 The compound hydrazine is used as a rocket fuel. It has the structural formula shown.



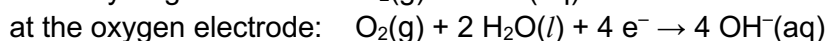
One of the reactions of hydrazine is shown.



	H—H	N—H	N—N	N≡N
bond energy in kJ / mol	436	390	160	945

What is the enthalpy change for this reaction?

- A** -339 kJ/mol
B -97 kJ/mol
C $+97 \text{ kJ/mol}$
D $+339 \text{ kJ/mol}$
- 31 When a hydrogen–oxygen fuel cell is in operation, a different reaction happens at each electrode.



The electrons that are lost at the hydrogen electrode travel through the external circuit to the oxygen electrode, where they are gained by the oxygen and water.

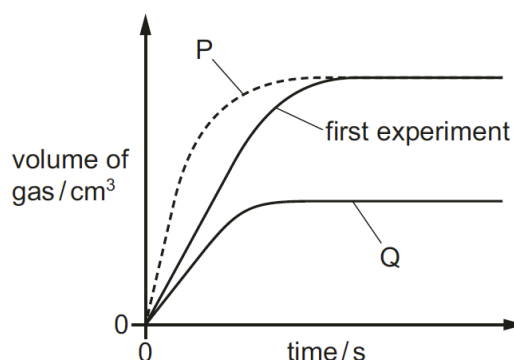
A hydrogen–oxygen fuel cell is operated for a period of time and 4 mol of oxygen molecules are consumed.

Which mass of hydrogen is consumed?

- A** 2.0 g
B 4.0 g
C 8.0 g
D 16.0 g

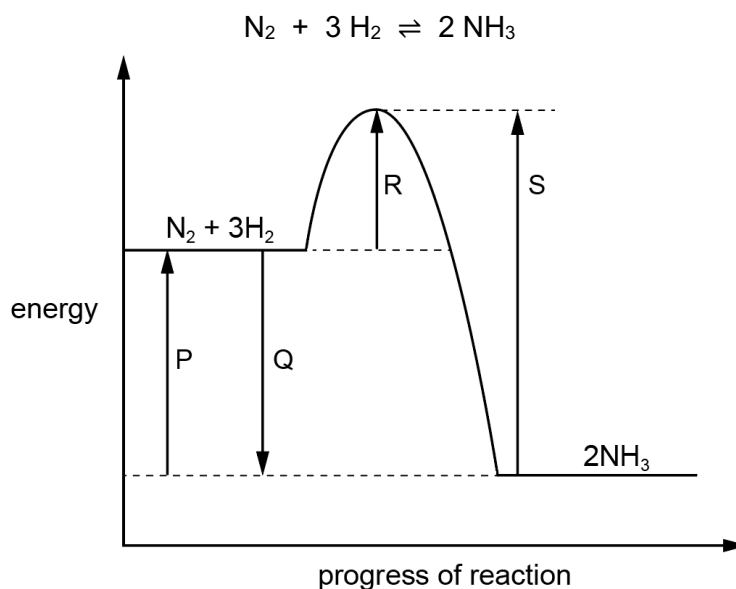
- 32 25 cm³ of 1.0 mol/dm³ hydrochloric acid reacts with excess of a solid to produce a gas.

The graph labelled first experiment shows the volume of gas produced over time. Graphs P and Q show the volume of gas produced under different conditions.



Which changes in conditions produce graphs P and Q, if all other conditions are kept the same?

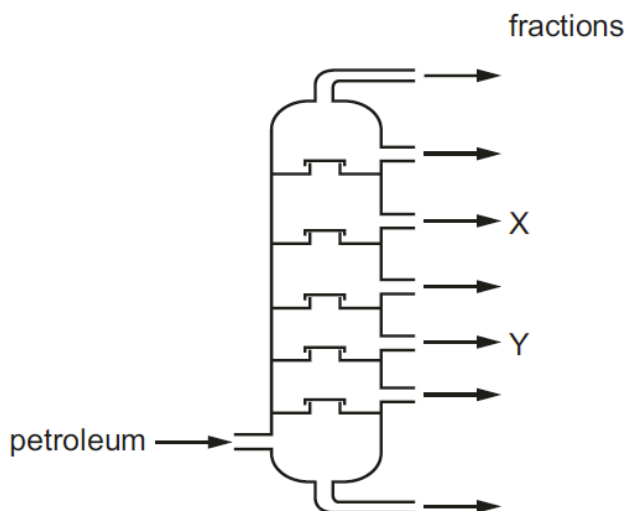
- A P uses a catalyst and Q has a lower temperature.
 - B P uses 25 cm³ of more concentrated acid and Q uses smaller pieces of solid.
 - C P uses a higher temperature and Q uses 25 cm³ of 0.5 mol/dm³ hydrochloric acid.
 - D P uses smaller pieces of solid and Q uses larger pieces of solid.
- 33 The equation and the energy profile diagram for the reversible reaction in the Haber process are shown.



Which statement about the arrows P, Q, R and S is correct?

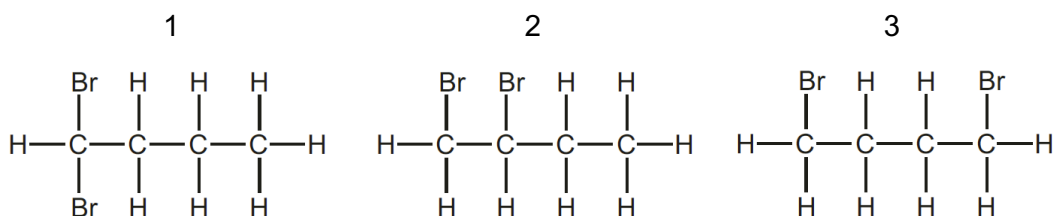
- A P represents the enthalpy change for the forward reaction.
- B Q represents the enthalpy change for both the forward and reverse reaction.
- C R represents the activation energy for both the forward and reverse reaction.
- D S represents the activation energy for the reverse reaction.

- 34 Petroleum (crude oil) is separated into useful fractions by fractional distillation. The positions at which fractions X and Y are collected from the fractionating column are shown.



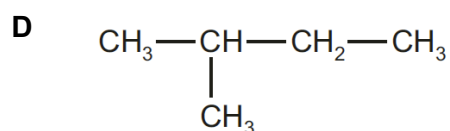
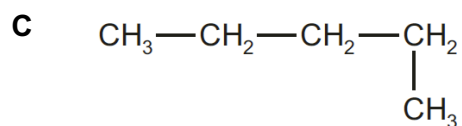
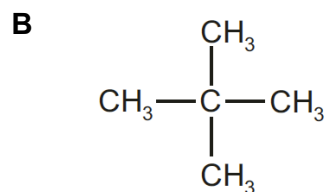
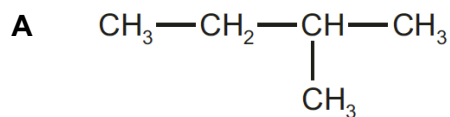
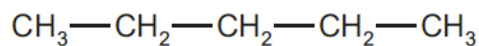
Which statement is correct?

- A The temperature increases up the column.
 - B X condenses at a lower temperature than Y.
 - C X has a higher boiling point than Y.
 - D X has longer chain molecules than Y.
- 35 When butene reacts with bromine in an addition reaction, which compound could be made?



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

36 Which structure is **not** an isomer of the structure shown?



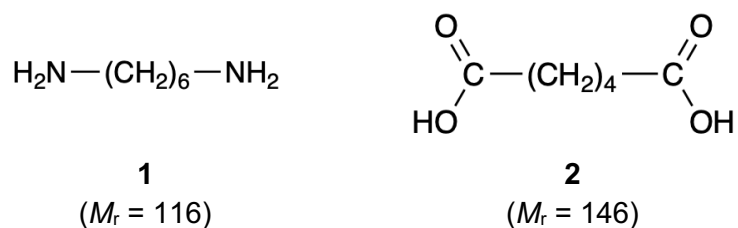
37 In which chemical reaction does the named product formed have a lower molecular mass than the reactant?

- A** the formation of an ester from ethanol
- B** the formation of ethanoic acid from ethanol
- C** the formation of ethanol from ethene
- D** the formation of ethanol from glucose

38 Which bond in a molecule of propanoic acid is broken when it reacts with magnesium?

- A** C—H bond
- B** C—O bond
- C** C—C bond
- D** O—H bond

- 39 Molecule **1** and molecule **2** react together to make a condensation polymer.



What is the relative molecular mass of the repeating unit of the polymer formed from molecules **1** and **2**?

- A** 224
B 226
C 244
D 262
- 40 Catalytic converters in car exhausts change polluting gases into non-polluting gases.
- Which statement(s) about oxides of nitrogen and car engines is/are correct?
- 1 The nitrogen in oxides of nitrogen comes from compounds in petrol.
 - 2 The oxygen in oxides of nitrogen comes from the air in the car engine.
 - 3 Catalytic converters convert oxides of nitrogen into nitrogen and other gases.
- A** 2 only
B 3 only
C 1 and 2
D 2 and 3

End of paper

Group																	
1	2	1 H hydrogen 1															
		Key proton (atomic) number atomic symbol name relative atomic mass															
3 Li lithium 7	4 Be beryllium 9	3 Sc scandium 45	4 Ti titanium 48	5 V vanadium 51	6 Cr chromium 52	7 Mn manganese 55	8 Fe iron 56	9 Co cobalt 59	10 Ni nickel 59	11 Cu copper 64	12 Zn zinc 65	13 B boron 11	14 C carbon 12	15 N nitrogen 14	16 O oxygen 16	17 F fluorine 19	18 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		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		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 oganeson –

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