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中正中學

CHUNG CHENG HIGH SCHOOL (MAIN)

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PRELIMINARY EXAMINATION 2026 SECONDARY 4

CHEMISTRY

6092/01

Paper 1 Multiple Choice

28 August 2026

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 class register number clearly in the spaces provided at the top of this page.

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.

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.

This document consists of **18** printed pages.

[Turn over

- 1** A student prepares a pure sample of copper(II) chloride from dilute hydrochloric acid and solid copper(II) oxide.

Which apparatus does the student use?

- A** a measuring cylinder, a beaker, a filter funnel, filter papers and an evaporating dish
- B** measuring cylinders, a filter funnel, filter papers and a beaker
- C** a burette, an electronic balance, a beaker and an evaporating dish
- D** a burette, a pipette and an evaporating dish

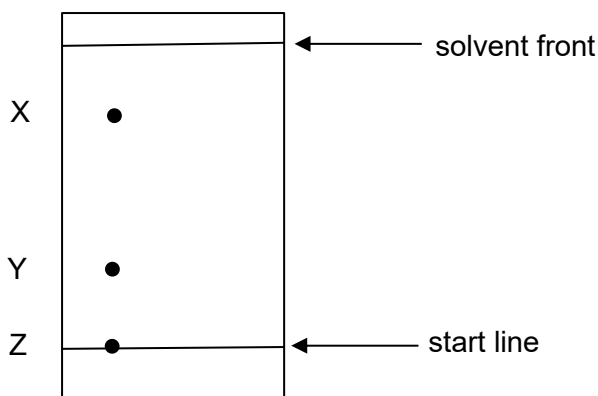
- 2** Four separations are listed.

- 1 obtaining water from potassium chloride solution
- 2 obtaining iodine from iron
- 3 obtaining solid potassium chloride from aqueous potassium chloride
- 4 obtaining ethanol from ethanol and water mixture

Which techniques would be involved in these separations?

- | | 1 | 2 | 3 | 4 |
|----------|-------------------------|-----------------|-------------|-------------------------|
| A | fractional distillation | crystallisation | filtration | distillation |
| B | distillation | sublimation | filtration | fractional distillation |
| C | filtration | crystallisation | evaporation | distillation |
| D | distillation | sublimation | evaporation | fractional distillation |

- 3 A paper chromatogram was prepared using a mixture of substances. After drying, the chromatogram is shown in the diagram below.



Which statement is correct?

- A** The chromatography paper must have been placed with the solvent above level Z.
B When the length of the chromatography paper is doubled, the R_f value of X is doubled.
C Substance X is more soluble in the solvent than substance Y.
D Locating agents are always needed to interpret a chromatogram.
- 4 The rate of diffusion of five gases is measured. The gases are CO, N₂O, C₂H₄, C₃H₈ and N₂.

The list gives four pairs of gases.

- 1 N₂ and C₂H₄
- 2 CO and N₂
- 3 N₂O and C₃H₈
- 4 C₂H₄ and C₃H₈

In which pairs would both gases diffuse at same rates, under the same conditions of temperature and pressure?

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

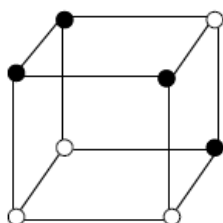
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- 5 The symbols of the ions of three elements are $^{56}\text{Fe}^{2+}$, $^{59}\text{Co}^{3+}$ and $^{56}\text{Mn}^{2+}$.

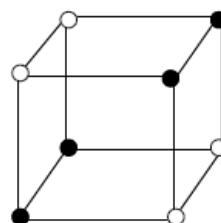
Which statement is correct?

- A** Only two ions have the same number of neutrons.
B Only two ions have the same number of electrons.
C All three ions have the same number of protons.
D All three ions have different relative masses.
- 6 In the molecules CH_3OH , NH_3 and HF , which atoms use all their outer shell electrons in bonding?
- A** C and H
B C and F
C N and H
D H and O
- 7 Which diagram best represents part of the giant lattice structure of calcium sulfide?

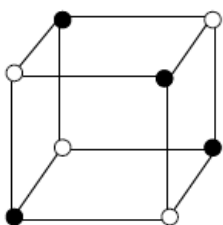
A



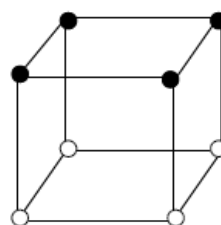
B



C



D



- 8 Sand (silicon dioxide), diamond, poly(ethene) and graphite all contain covalent bonds.

Which statement is correct?

- A** Silicon dioxide has each silicon atom covalently bonded to another two oxide ions in a giant structure.
- B** Diamond has each carbon atom covalently bonded to three other carbon atoms in a tetrahedral structure.
- C** Poly(ethene) changes from solid to liquid when heated as its intermolecular forces of attraction are overcome.
- D** Graphite can conduct electricity due to the free ions between the hexagonal layers of carbon atoms.

- 9 Aqueous copper(II) chloride reacts with aqueous sodium thiocyanate, NaSCN.

A precipitate of copper(II) thiocyanate is formed.

What is the formula of copper(II) thiocyanate?

- A** CuSCN **B** Cu₂SCN **C** Cu(SCN)₂ **D** Cu₂(SCN)₂

- 10 0.5 mol of propene gas is completely combusted in air.

What is the total number of electrons shared by the covalent bonds in the water molecule formed by this reaction?

- A** 3.6×10^{24} **B** 1.2×10^{24} **C** 1.8×10^{24} **D** 6.0×10^{23}

- 11 What is the maximum mass of iron that can be extracted from 116 g of Fe₃O₄?

- A** 56 g **B** 84 g **C** 112 g **D** 168 g

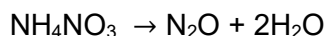
- 12 10 cm³ of an aqueous 2.0 mol/dm³ solution of the hydroxide of metal **M** exactly neutralises 50 cm³ of 0.20 mol/dm³ aqueous sulfuric acid.

What is the formula for the sulfate of **M**?

- A** MSO₄ **B** M₂SO₄ **C** M₂(SO₄)₃ **D** M(SO₄)₂

[Turn over

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



When 90 g of an impure sample of ammonium nitrate is heated, 28 g of water is formed.

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

A $\frac{28}{18} \times \frac{80}{90} \times 100$

B $\frac{28}{36} \times \frac{90}{80} \times 100$

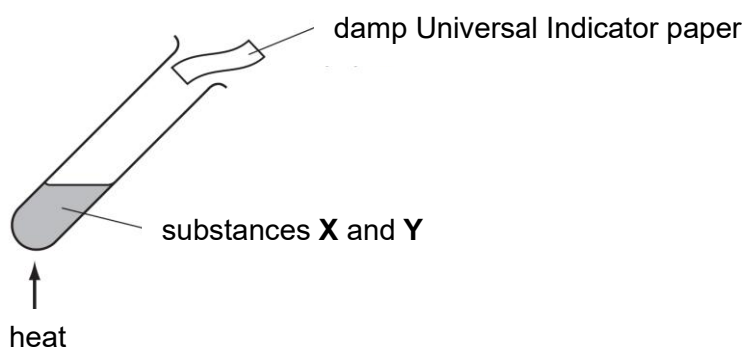
C $\frac{28}{18} \times \frac{90}{80} \times 100$

D $\frac{28}{36} \times \frac{80}{90} \times 100$

- 14 Which of the following statements about an acid is correct?

- A pH is a measure of acid concentration in a solution.
 B When an acid reacts with a reactive metal, hydrogen ions lose electrons.
 C A weak acid can have the same pH as a strong acid.
 D Universal indicator turns blue when placed in an acid.

- 15 Two substances, **X** and **Y**, are mixed and heated.



The damp Universal Indicator paper turns blue during the experiment.

What are the possible substances **X** and **Y**?

- A barium hydroxide and ammonium chloride
 B barium hydroxide and hydrochloric acid
 C hydrochloric acid and barium nitrate
 D hydrochloric acid and ammonium carbonate

- 16 Which pair of reagents would be most suitable to safely prepare a pure sample of the salt in the laboratory?

	<u>reagents</u>	<u>salt</u>
A	potassium and dilute hydrochloric acid	potassium chloride
B	calcium oxide and dilute sulfuric acid	calcium sulfate
C	copper and dilute sulfuric acid	copper(II) sulfate
D	silver nitrate and dilute hydrochloric acid	silver chloride

- 17 Which method of preparation would be suitable for making these salts?

	metal + acid	titration	metal carbonate + acid	precipitation
A	lead sulfate	ammonium sulfate	iron nitrate	zinc chloride
B	iron nitrate	zinc chloride	sodium sulfate	lead sulfate
C	iron nitrate	zinc chloride	lead sulfate	sodium sulfate
D	zinc chloride	ammonium sulfate	iron nitrate	lead sulfate

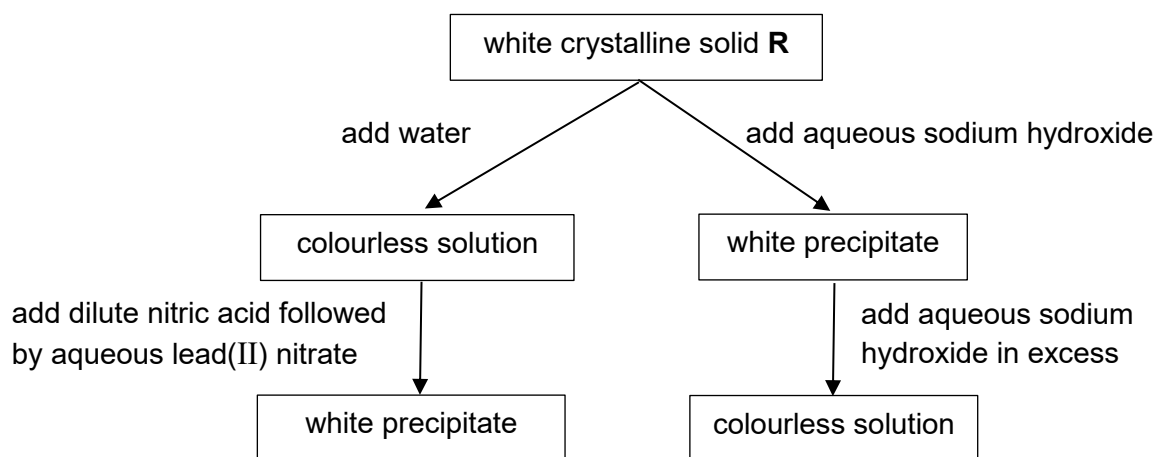
- 18 Ammonia is produced by the Haber Process.

Which statement is **not** correct?

- A Three hydrogen molecules react with one nitrogen molecule to form two molecules of ammonia.
- B A catalyst of iron is used to increase the percentage yield of ammonia.
- C Hydrogen for the process can be obtained from the cracking of oil.
- D The percentage yield of ammonia is less than 100% in a closed system.

[Turn over

- 19** What is observed if excess sodium iodide is added to aqueous silver nitrate?
- A** Two colourless solutions react to give a white precipitate and a colourless solution.
- B** Two colourless solutions react to give a yellow precipitate and a colourless solution.
- C** One yellow solution and one colourless solution react to give a white precipitate and a yellow solution.
- D** One yellow solution and one colourless solution react to give a yellow precipitate and a yellow solution.
- 20** The diagram shows the reaction of an unknown substance.



What is solid **R**?

- A** aluminium nitrate
- B** sodium carbonate
- C** zinc chloride
- D** calcium sulfate
- 21** Disproportionation is a reaction in which the same element is both oxidised and reduced.
- Which of the following reactions is an example of disproportionation?
- A** $\text{Cu} + 4\text{HNO}_3 \rightarrow \text{Cu}(\text{NO}_3)_2 + 2\text{H}_2\text{O} + 2\text{NO}_2$
- B** $\text{Br}_2 + 2\text{NaOH} \rightarrow \text{NaBr} + \text{NaOBr} + \text{H}_2\text{O}$
- C** $\text{H}_2\text{SO}_3 + \text{H}_2\text{O}_2 \rightarrow \text{H}_2\text{SO}_4 + \text{H}_2\text{O}$
- D** $\text{Cu} + 2\text{H}_2\text{SO}_4 \rightarrow \text{CuSO}_4 + 2\text{H}_2\text{O} + \text{SO}_2$

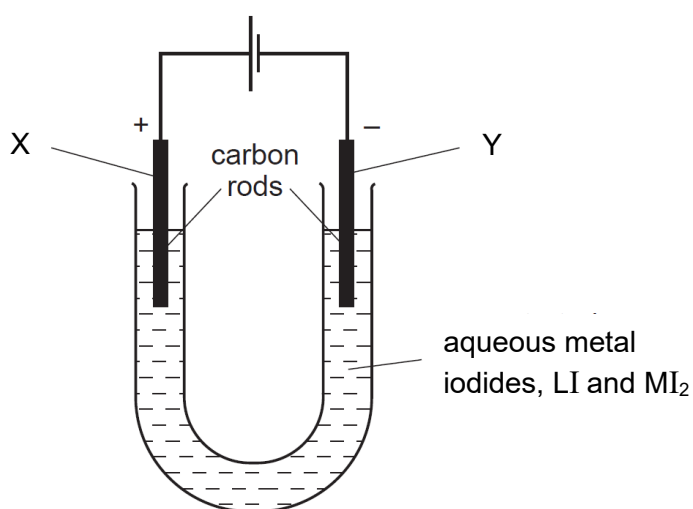
22 What happens to the ions during the electrolysis of molten potassium chloride?

- A** The chloride ions move towards the negative electrode to form chlorine.
- B** The chloride ions are reduced to form chlorine.
- C** The potassium ions gain electrons to form potassium.
- D** The potassium ions move towards the positive electrode to form potassium.

23 The diagram shows the electrolysis of two soluble metal iodides, LI and MI_2 .

L is a more reactive metal than M .

Equal and high concentrations of both aqueous metal iodides are used in this electrolysis.

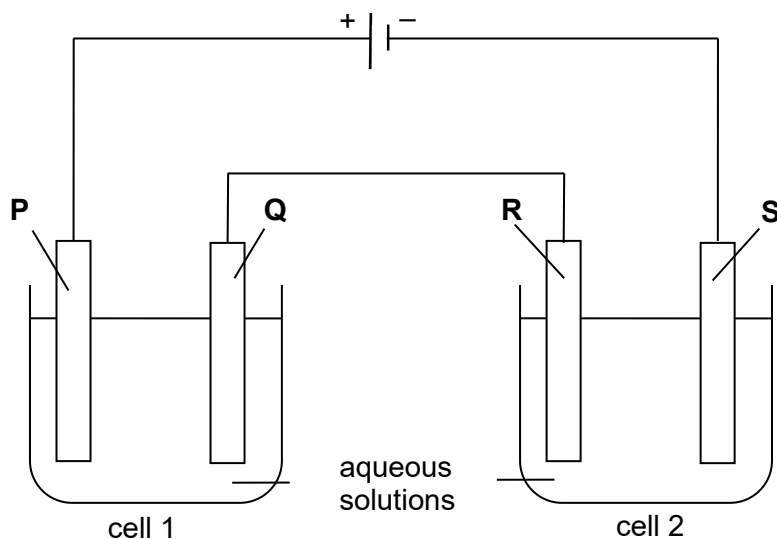


What is produced at each of the electrodes?

	electrode X	electrode Y
A	iodine	M
B	oxygen	L
C	M	iodine
D	L	oxygen

[Turn over

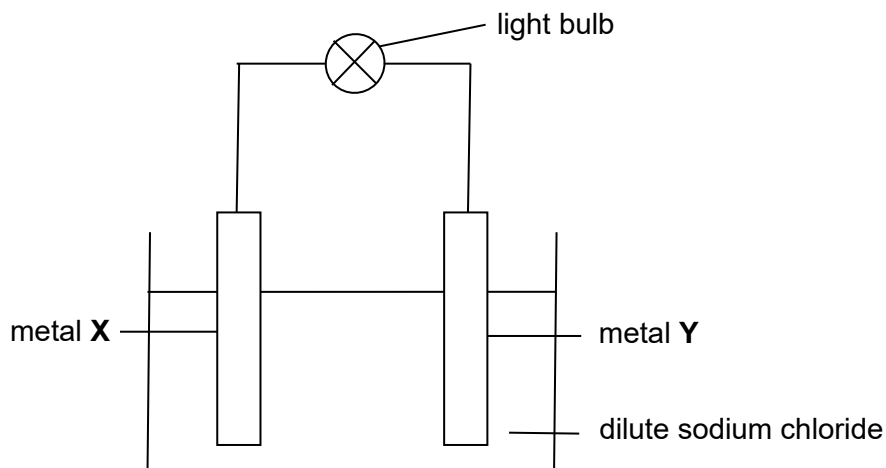
- 24** In the diagram, each cell contains an aqueous solution of a single salt and all the four electrodes are made of platinum. Electrode **Q** and **S** increase in mass during the electrolysis and no gas is given off at **Q** or **S**.



If the increase in mass of **Q** is greater than the increase in mass of **S** in the same time, which one of the following statements is necessarily true?

- A** The current flowing in cell 1 is greater than the current flowing in cell 2.
- B** The anion of the solution in cell 1 is different from the anion of the solution in cell 2.
- C** The cation of the solution in cell 1 is different from the cation of the solution in cell 2.
- D** The loss in mass of electrode **P** is less than the loss in mass of electrode **R**.

25 The apparatus was set up as shown.



For which pair of metals would effervescence be seen at metal Y?

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

26 Some properties of elements in the same period of the Periodic Table are listed.

- 1 charge on the ion
- 2 number of outer shell electrons
- 3 total number of inner shell electrons
- 4 non-metallic character

Which properties show an increase from left to right across the period of the Periodic Table?

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

[Turn over

- 27 The table shows data for the atoms of the elements P, Q, R and S. The letters do not represent the chemical symbols of the elements.

	number of proton
P	11
Q	19
R	35
S	53

Which statement is correct?

- A** P is more reactive than Q.
B P and R react to form a covalent compound.
C R and S react to form a compound with giant structure.
D R is a stronger oxidising agent than S.

- 28 Metals are found naturally as the metal or as metal compounds.

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

Which row is correct?

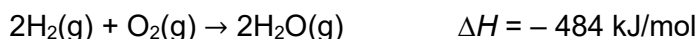
	can be found as the metal	obtained by reduction using carbon	obtained by electrolysis
A	Mg	Fe, Zn	Na, K
B	Ag	Fe, Zn	Mg, Na
C	Ag	Na, Zn	Fe, K
D	Mg	Fe, K	Ag, Na

- 29 A reversible reaction is endothermic in the reverse direction and the heat taken in is 196 kJ/mol. The activation energy for the reverse reaction is 271 kJ/mol.

What is the activation energy of the **forward** reaction?

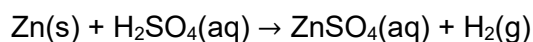
- A** 75 kJ/mol **B** 121 kJ/mol **C** 196 kJ/mol **D** 271 kJ/mol

- 30** Hydrogen reacts explosively with oxygen to form steam. The equation for the reaction and enthalpy change are shown.



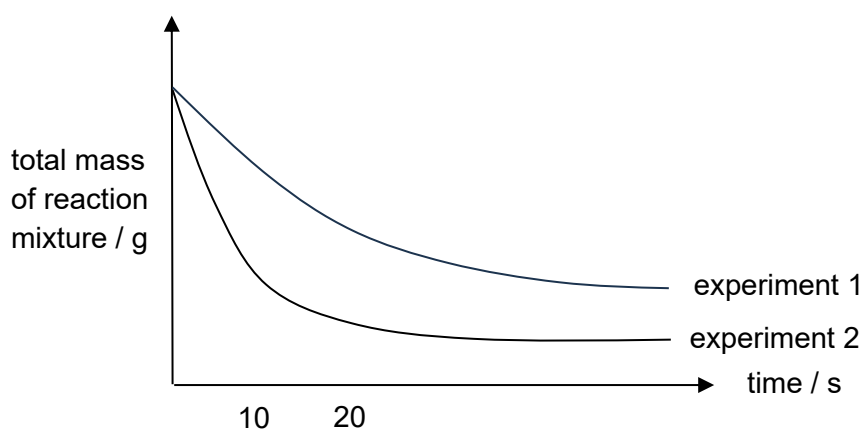
What can be deduced from this information?

- A** The energy released to form bonds is less than the energy taken in to break bonds.
B The energy released to form bonds is greater than the energy taken in to break bonds.
C The energy taken in to form bonds is less than the energy released to break bonds.
D The energy taken in to form bonds is greater than the energy released to break bonds.
- 31** In experiment 1, 1.0 g of zinc granule is added to the 50 cm³ of 0.50 mol/dm³ dilute sulfuric acid.



The total mass of the reaction mixture for this experiment is measured. The results for experiment 1 are plotted on a graph.

The experiment is repeated with one change. The results for experiment 2 are plotted on the same graph.



Which statement about the graph is correct?

- A** A catalyst is only used in experiment 1 but not in experiment 2.
B More zinc granules are used in experiment 1 than experiment 2.
C Experiment 1 is carried out at a higher temperature than experiment 2.
D The concentration of the acid for both experiments at 20 s is lower than at 10 s.

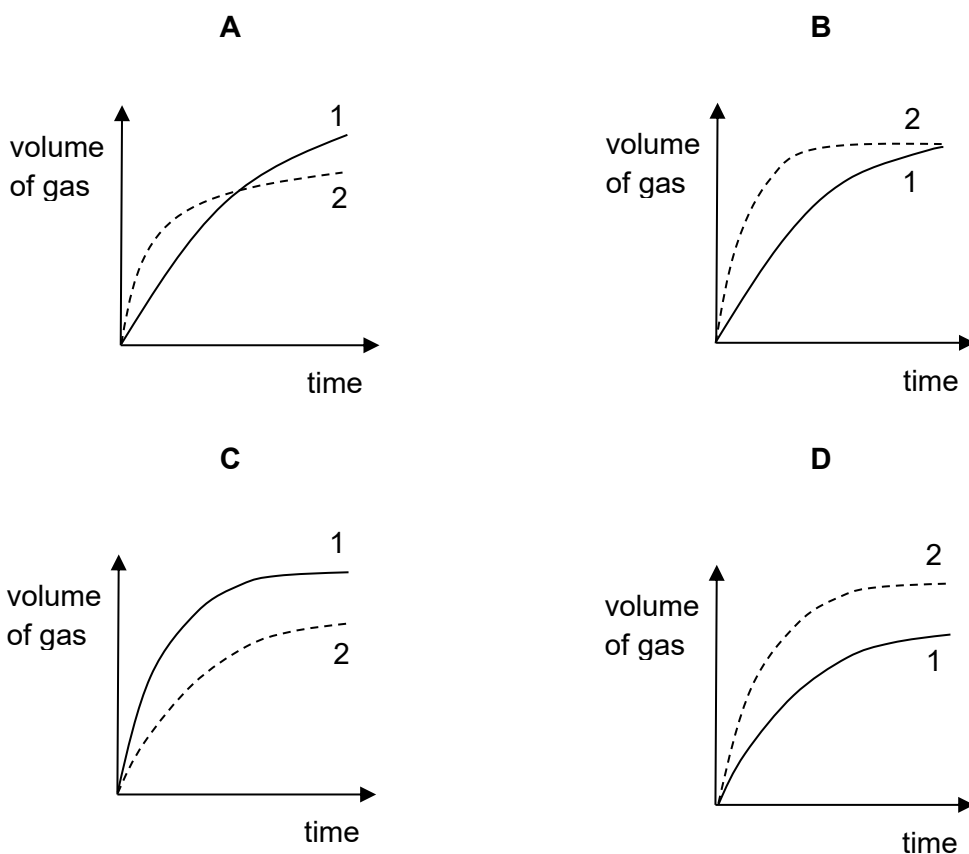
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- 32** Two experiments are carried out to measure the volume of carbon dioxide produced when different concentrations of hydrochloric acid are added to excess calcium carbonate.

experiment	acid
1	50 cm ³ of 0.20 mol/dm ³ hydrochloric acid
2	20 cm ³ of 0.50 mol/dm ³ hydrochloric acid

A graph of volume of carbon dioxide against time is plotted for both experiments.

Which graph best shows the results for these experiments?



- 33** When crude oil is fractionally distilled, which compounds leave from the bottom of the fractionating column?
- A** The compounds that are least flammable.
 - B** The compounds that are the least viscous.
 - C** The compounds with the lowest relative molecular mass.
 - D** The compounds with the lowest boiling points.

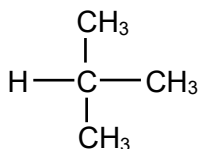
- 34** When dodecane, $C_{12}H_{26}$, is cracked, only three hydrocarbons are formed.

The hydrocarbons are ethene, propane and propene.

What is the ratio of the hydrocarbons formed?

	ethene	propane	propene
A	1	1	1
B	1	1	3
C	3	1	1
D	1	3	1

- 35** An isomer of butane is shown.



The isomer undergoes substitution reactions with chlorine.

How many different isomers with the molecular formula $C_4H_8Cl_2$ can be formed from these substitution reactions?

- A** 2 **B** 3 **C** 4 **D** 6

- 36** The reaction between a carboxylic acid, $C_xH_yCO_2H$, and an alcohol, $C_nH_{2n+1}OH$, produces an ester.

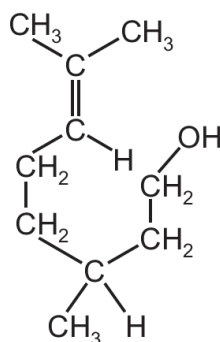
How many hydrogen atoms does one molecule of ester contain?

- A** $y + 2n + 3$ **B** $y + 2n + 1$ **C** $y + 2n + 2$ **D** $y + 2n$

[Turn over

37 Citronellol is found in rose oil.

The structure of citronellol is shown.

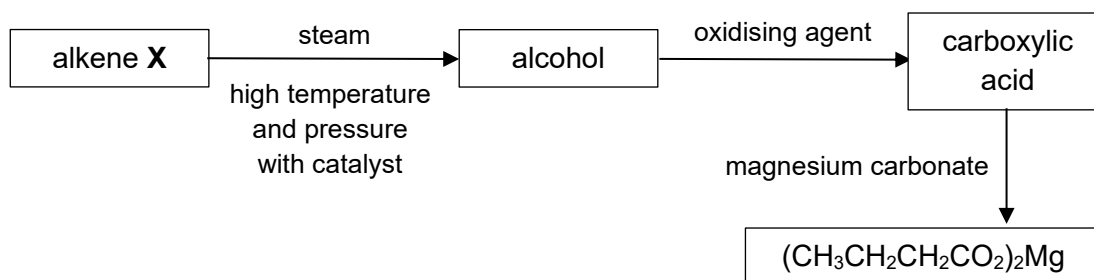


- 1 Citronellol can react with chlorine in the presence of uv light.
- 2 Citronellol can turn purple acidified potassium manganate(VII) colourless.
- 3 Citronellol can react with sodium hydroxide to give a salt and water.
- 4 Citronellol can form a polymer with the same empirical formula as its monomer.

Which statements about citronellol are correct?

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

38 A reaction scheme for an alkene **X** is given. The alkene underwent a series of reactions to obtain the salt, $(\text{CH}_3\text{CH}_2\text{CH}_2\text{CO}_2)_2\text{Mg}$.



What was alkene **X**?

- A** $\text{CH}_3\text{CH}=\text{CH}_2$
B $\text{CH}_3\text{CH}_2\text{CH}=\text{CH}_2$
C $\text{CH}_3\text{CH}=\text{CHCH}_3$
D $\text{CH}_3\text{CH}_2\text{CH}_2\text{CH}=\text{CH}_2$

- 39** The table refers to the polymers nylon and poly(ethene).

Which row is correct?

	polymer	type	use
A	nylon	addition	cling film
B	nylon	condensation	sleeping bags
C	poly(ethene)	addition	sleeping bags
D	poly(ethene)	condensation	cling film

- 40** Which pair of gases are involved in the formation of acid rain?

- A** CO and SO₂
- B** CH₄ and NO₂
- C** NO₂ and CO
- D** SO₂ and NO₂

[Turn over

The Periodic Table of Elements

Group																							
1	2	1 H hydrogen 1														13	14	15	16	17	18		
		Key																					
3	4	proton (atomic) number atomic symbol name relative atomic mass																					
Li lithium 7	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 —	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 dm³ at room temperature and pressure (r.t.p.).

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