



**JUNYUAN SECONDARY SCHOOL
PRELIMINARY EXAMINATION 2025
SECONDARY FOUR EXPRESS**

CANDIDATE
NAME

CLASS

4	D
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INDEX NUMBER

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CHEMISTRY

6092

PAPER 1 Multiple Choice

1 September 2025

1 hour

Additional Materials: Multiple Choice Answer Sheet

READ THESE INSTRUCTIONS FIRST

Write your name, class and index number on all the work you hand in.

Write in soft pencil.

Do not use paper clips, glue or correction fluid.

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.

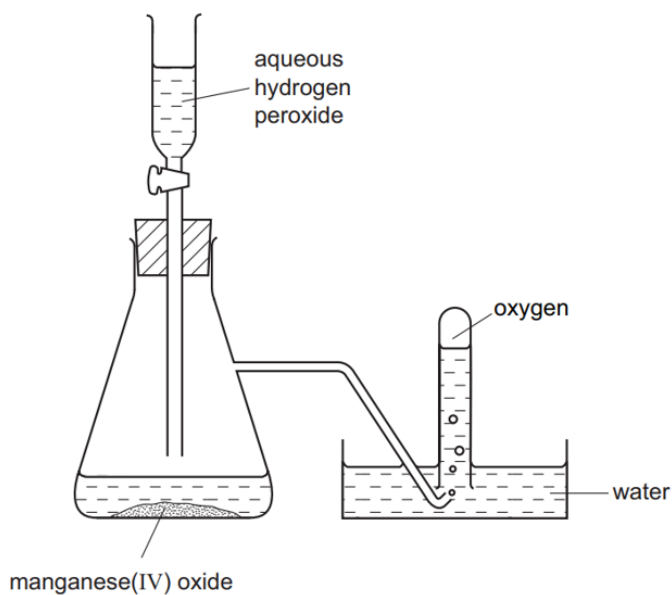
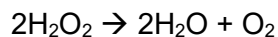
Each correct answer will score one mark. A mark will not be deducted for a wrong answer.

Any rough working should be done in this booklet.

A copy of the Periodic Table is printed on page 17.

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

- 1 Oxygen was prepared from hydrogen peroxide and collected as shown in the diagram.



The first few tubes of gas were rejected because the gas was contaminated by

- A** water vapour.
- B** hydrogen peroxide.
- C** hydrogen.
- D** nitrogen.

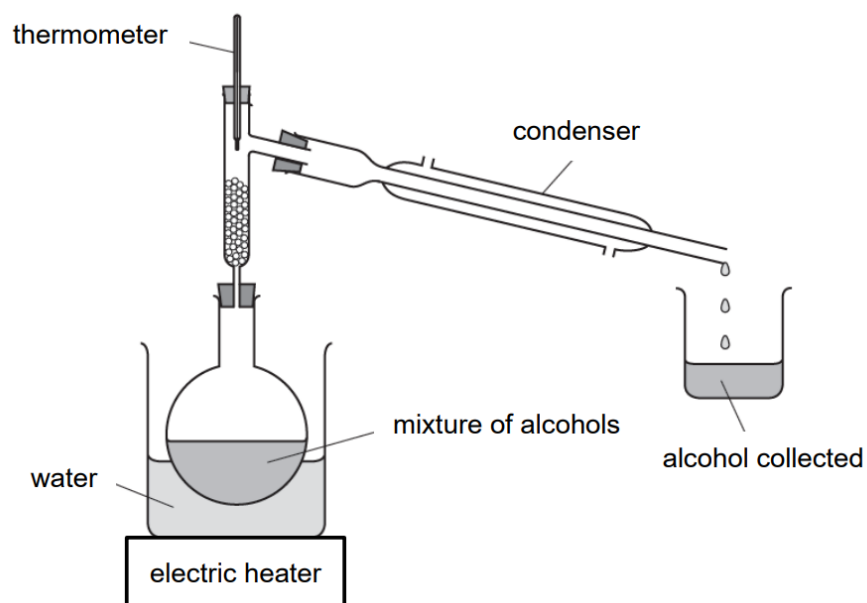
- 2 Three separations are listed.

- 1 obtaining water from aqueous sodium chloride
- 2 obtaining iodine from a solid mixture of iodine and nickel
- 3 obtaining solid sodium chloride from aqueous sodium chloride

Which techniques would be involved in these separations?

	1	2	3
A	distillation	sublimation	evaporation
B	distillation	sublimation	filtration
C	filtration	crystallisation	evaporation
D	sublimation	crystallisation	filtration

- 3 A student sets up the following experiment to separate a mixture containing four alcohols.



The table shows the boiling points of the four alcohols used.

alcohol	boiling point / °C
butanol	117
ethanol	79
pentanol	138
propanol	97

The student manages to collect only two alcohols from the mixture.

Which alcohols did he fail to obtain?

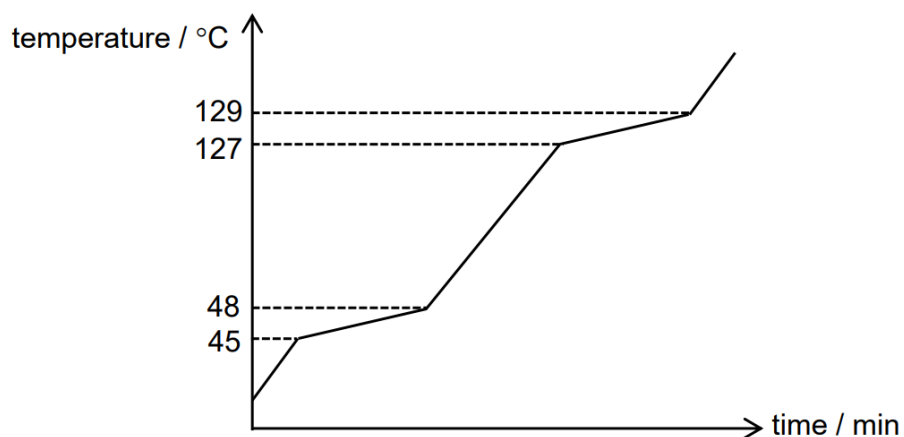
- A** butanol and ethanol
- B** butanol and pentanol
- C** ethanol and propanol
- D** pentanol and propanol

[Turn over

4 In which state does 1 dm^3 of ethene contain the most amount of particles?

- A gas at 100°C
- B gas at room temperature
- C liquid
- D solid

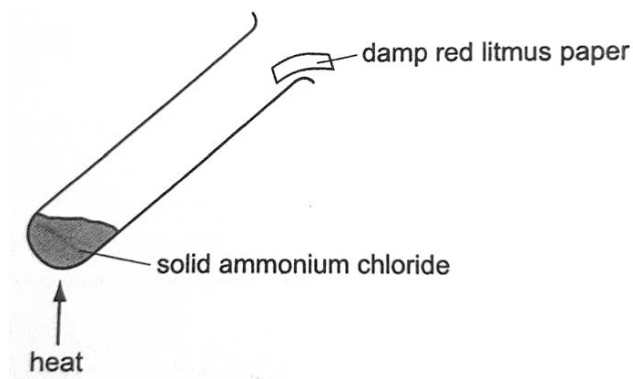
5 The heating curve of an impure sample of X is shown below.



What are the melting point and boiling point of pure substance X?

	melting point / $^\circ\text{C}$	boiling point / $^\circ\text{C}$
A	45	129
B	47	128
C	48	127
D	49	130

- 6 Solid ammonium chloride decomposes on heating according to the following equation.



Which change occurs to the damp red litmus paper in the experiment above?

- A remains red
 - B turns blue and is then bleached
 - C turns blue and remains blue
 - D turns blue and then turns red
- 7 Chlorine-35 and chlorine-37 are two isotopes of chlorine.

Which statements are correct?

- 1 They have the same atomic number.
- 2 They have the same mass number.
- 3 They have the same physical properties.
- 4 They have the same chemical properties.

- A 1 and 2 only
 - B 1 and 4 only
 - C 2 and 3 only
 - D 2 and 4 only
- 8 Which of the following statements is true?
- A Ar has more electrons than Cl^- .
 - B Cl^- has more electrons than K^+ .
 - C Fe^{3+} has more electrons than Fe^{2+} .
 - D K has more electrons than K^+ .

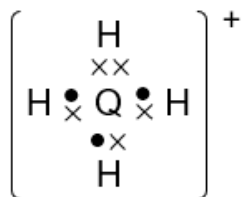
[Turn over

- 9 The formulae of four covalent molecules are shown.

- 1 H_2O
- 2 CO_2
- 3 CH_3OH
- 4 CH_3COOH

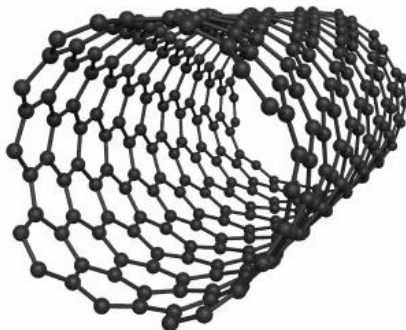
In which pair of molecules does oxygen form at least one double bond in both molecules?

- A** 1 and 2 **B** 1 and 3 **C** 2 and 4 **D** 3 and 4
- 10 The ion QH_4^+ can be represented by the 'dot and cross' diagram shown.



To which Group in the Periodic Table does Q belong?

- A** 1 **B** 13 **C** 14 **D** 15
- 11 Carbon exists as different forms such as graphite, diamond and, carbon nanotubes as shown.



carbon nanotube

Which statement best describes a property of the carbon nanotube and a suitable use?

	property	use
A	conducts electricity	as a lubricant in machines
B	conducts electricity	in electronic circuits
C	flexible	as pencil leads
D	flexible	in jewellery

- 12** The formula of a nitride of element X is X_3N_2 . 23.8 g of X_3N_2 contains 4.5 g of X.

How many moles of X does 4.5 g of the element contain?

A $\frac{19.3}{14} \times \frac{2}{3}$

B $\frac{19.3}{14} \times \frac{3}{2}$

C $\frac{9.65}{14} \times \frac{2}{3}$

D $\frac{9.65}{14} \times \frac{3}{2}$

- 13** Glucose has a relative molecular mass, M_r , of 180.

How many grams of glucose are added to 50 cm³ of water to make a solution of concentration 0.4 mol/dm³?

A 3.6

B 9.0

C 36

D 72

- 14** What is the ratio of the volume of 2 g of hydrogen to the volume of 16 g of methane, both volumes at room temperature and pressure?

A 1:1

B 1:2

C 1:8

D 2:1

- 15** When 42.0 g of sodium hydrogen carbonate, $NaHCO_3$ ($M_r = 84$), was strongly heated, 3.00 dm³ of carbon dioxide gas, measured at room temperature and pressure was released.



What was the percentage yield of carbon dioxide?

A 25%

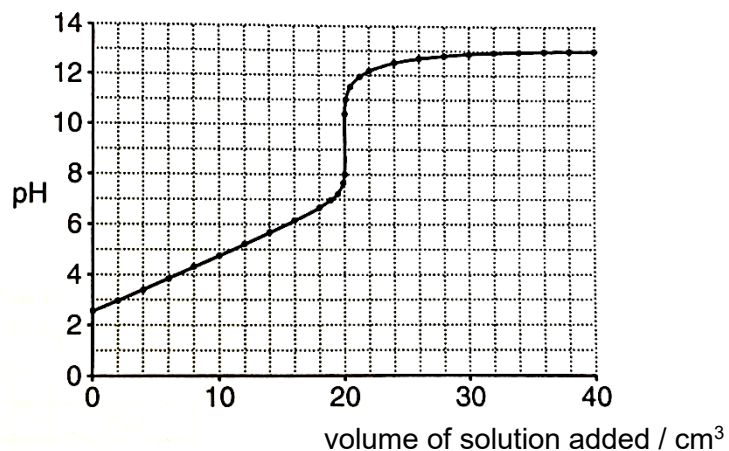
B 50%

C 75%

D 100%

[Turn over

- 16 The following shows a graph of pH against volume of solution added in an acid-alkali titration.



Which of the following statements about the titration is correct?

- 1 20.0 cm³ of alkali neutralised the acid.
- 2 Aqueous sodium hydroxide was added dropwise to dilute ethanoic acid.
- 3 Dilute hydrochloric acid was added dropwise to aqueous sodium hydroxide.
- 4 Universal Indicator is a suitable indicator for this titration.

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

- 17 Glass is silicon dioxide.

Which of the following correctly explains why the respective substance can be added to dissolve glass fragments?

	substance added	explanation
A	zinc oxide	reacts with amphoteric oxides
B	aqueous sodium hydroxide	reacts with acidic oxides
C	dilute sulfuric acid	reacts with basic oxides
D	ethanol	reacts with organic compounds

18 Which three salts are prepared by precipitation?

- A** barium sulfate, calcium nitrate, lead(II) sulfate
- B** barium sulfate, calcium nitrate, silver chloride
- C** barium sulfate, lead(II) sulfate, silver chloride
- D** calcium nitrate, lead(II) sulfate, silver chloride

19 A coin is analysed by dissolving it in nitric acid. To the resulting solution, an excess of aqueous ammonia is added and the mixture is filtered.

A brown precipitate remains in the filter paper and a deep blue solution is obtained as the filtrate.

Which metals does the coin contain?

- A** aluminium and copper
- B** copper and iron
- C** iron and zinc
- D** zinc and copper

20 Some chemical tests are performed on a sample of polluted gas. The results are shown as follows:

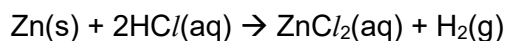
- 1 white precipitate forms in limewater
- 2 moist blue litmus turns red
- 3 acidified potassium manganate(VII) turns colourless

What gases are present in the sample?

- A** carbon dioxide and sulfur dioxide
- B** carbon monoxide and ammonia
- C** chlorine and carbon dioxide
- D** nitrogen oxides and methane

[Turn over

- 21 The reaction between zinc and hydrochloric acid is as follows.



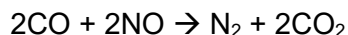
The experiment is repeated with changes in the following conditions.

- 1 increase in concentration of the acid
- 2 increase in particle size of zinc
- 3 increase in pressure on the system
- 4 increase in temperature of the system

Which pair of changes will increase the rate of reaction?

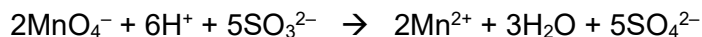
- A** 1 and 2 **B** 1 and 4 **C** 2 and 3 **D** 3 and 4
- 22 Waste gases from a car engine are passed through a catalytic converter to remove the pollutant gases.

One of the pollutant gases is nitrogen monoxide. The equation below shows how it is removed.



Which statement about the reaction is **not** correct?

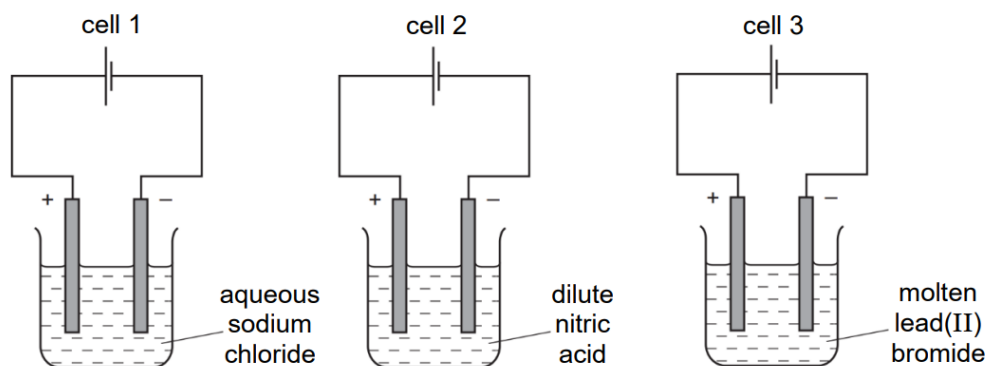
- A** The oxidation state of carbon changes from +2 to +4.
B The oxidation state of nitrogen changes from +4 to 0.
C The oxidation state of oxygen is unchanged.
D The reaction is a redox reaction.
- 23 The equation for the reaction between sodium sulfite and potassium manganate(VII) is shown.



Which ion is reduced and what is the reducing agent in this reaction?

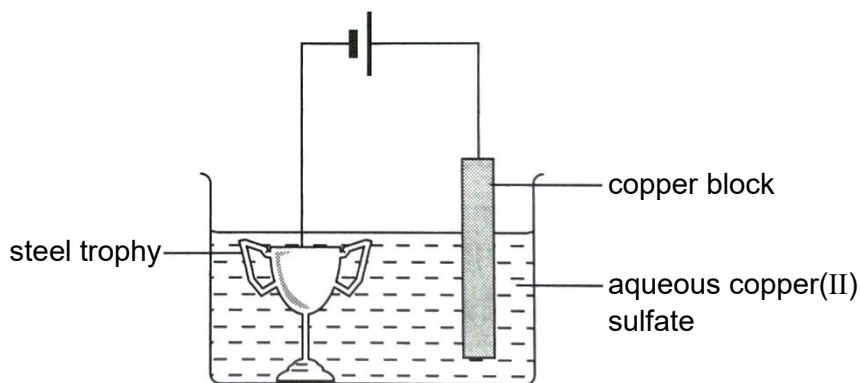
	ion that is reduced	reducing agent
A	MnO_4^-	H^+
B	MnO_4^-	SO_3^{2-}
C	SO_3^{2-}	H^+
D	SO_3^{2-}	MnO_4^-

- 24 Three electrolysis cells are set up. Each cell uses platinum as electrodes.



In which of these cells is a gas formed at both electrodes?

- A** 1 and 2 **B** 1 and 3 **C** 2 only **D** 3 only
- 25 A circuit used to copper-plate a steel trophy was set up as shown below.



The initial mass of the trophy was 50.00 g. When sufficiently coated with a thin layer of copper metal, the mass of the trophy was now 53.00 g.

What was the total number of moles of electrons which flowed through the circuit?

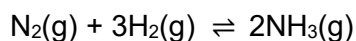
- A** 0.0234 mol
B 0.0479 mol
C 0.0938 mol
D 0.188 mol

[Turn over

- 26 Which statement describes what happens when hydrogen and oxygen are used in a fuel cell?

A Electricity is generated directly.
B Electricity is used to produce water.
C Hydrogen is burned to form steam.
D Hydrogen reacts to form a hydrocarbon fuel.

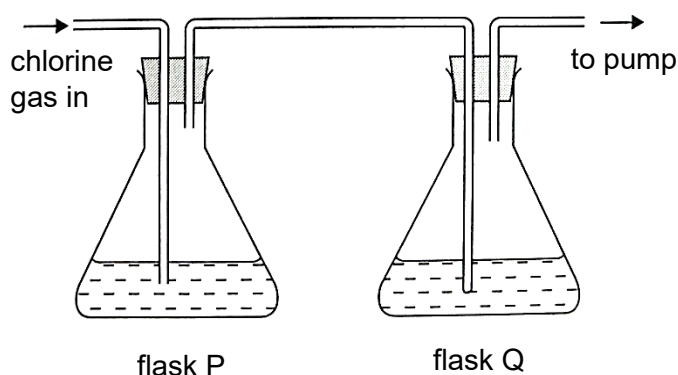
- 27 Nitrogen and hydrogen react in a closed vessel.



How do the speeds of the forward and reverse reactions change, if the pressure in the vessel is increased but the temperature is kept constant?

	speed of forward reaction	speed of reverse reaction
A	increases	increases
B	does not change	does not change
C	decreases	increases
D	decreases	does not change

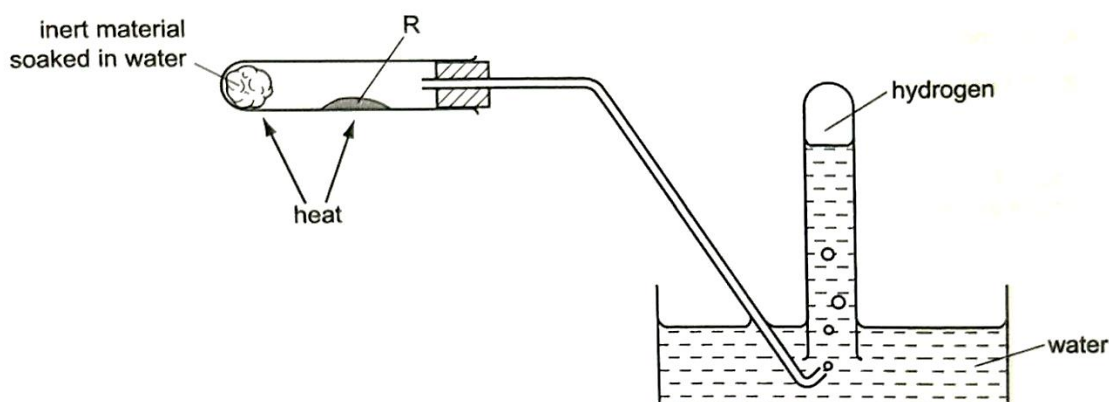
- 28 Chlorine gas was passed through the experimental setup below. After a few minutes coloured substances were observed in flasks P and Q.



Which were the solutions contained in flasks P and Q?

	flask P	flask Q
A	NaF	NaI
B	NaF	NaBr
C	NaBr	NaI
D	NaI	NaBr

- 29 The diagram shows an experiment to produce and collect hydrogen.



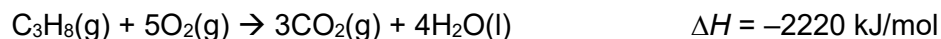
What is R?

- | | |
|---------------------------|-------------------------|
| A copper(II) oxide | B lead |
| C iron | D lead(II) oxide |
- 30 When heated, solid X gives off a gas. When this gas is bubbled through limewater, a white precipitate is formed.

The residue after heating solid X reacts with dilute acid and also with aqueous alkali.

What is X?

- | | |
|-------------------------------|------------------------------|
| A copper(II) carbonate | B magnesium carbonate |
| C sodium carbonate | D zinc carbonate |
- 31 Propane undergoes complete combustion. The balanced chemical equation and enthalpy change are shown below.

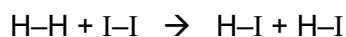


What is the enthalpy change when 60 dm³ of propane is burnt?

- | |
|-------------------------------------|
| A -5550 kJ |
| B -5946 kJ |
| C -6660 kJ |
| D -1.33 x 10 ⁵ kJ |

[Turn over

- 32** The formation of hydrogen iodide from hydrogen and iodine is an endothermic reaction.



What may be deduced from this information?

- A** The number of bonds broken is greater than the number of bonds formed.
 - B** The formation of H-I bonds absorbs energy.
 - C** The products possess less energy than the reactants.
 - D** The total energy change in bond formation is less than that in bond breaking.
- 33** When crude oil is fractionally distilled, which compounds leave from the top of the fractionating column?
- A** the compounds that are least flammable
 - B** the compounds that are the most viscous
 - C** the compounds with the highest relative molecular mass
 - D** the compounds with the lowest boiling points
- 34** Two alkane molecules are isomers.

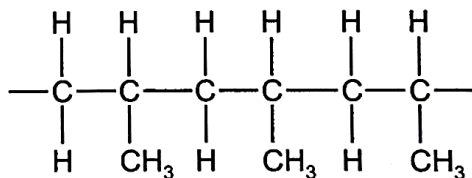
Which properties will be the same for both molecules?

- 1 empirical formula
 - 2 general formula
 - 3 molecular formula
 - 4 structural formula
- A** 1, 2 and 3 only
 - B** 1, 2, 3 and 4
 - C** 2 only
 - D** 2 and 3 only

35 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

36 The diagram shows the structure of a polymer X.

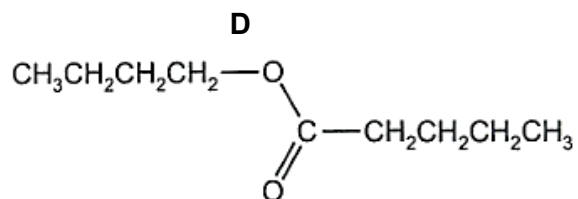
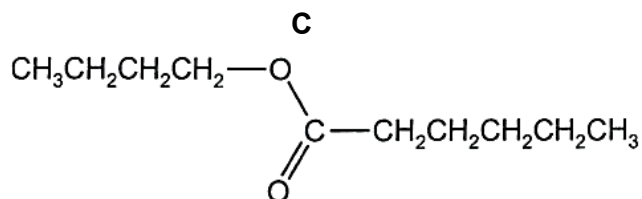
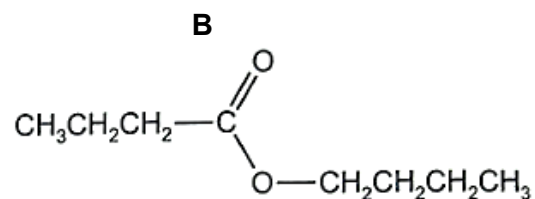
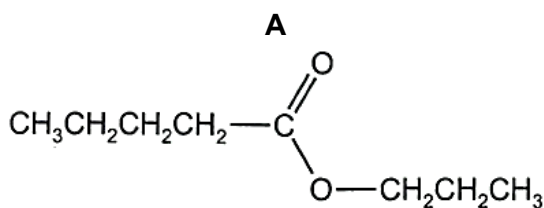


Which reactant does not react with the monomer of the polymer, X?

- A bromine
- B hydrogen
- C sodium
- D steam

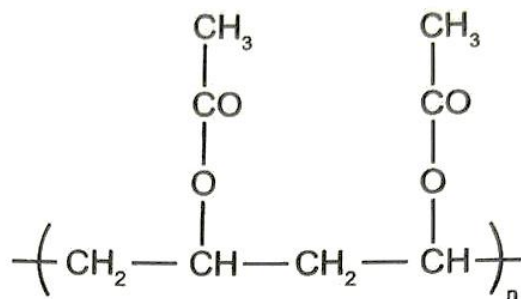
37 Pentanoic acid has the formula $\text{CH}_3\text{CH}_2\text{CH}_2\text{CH}_2\text{CO}_2\text{H}$.

Which formula represents butyl pentanoate?



[Turn over

- 38 The diagram shows the formula of a polymer.



Which of the following could be used to make this polymer?

- A $\text{CH}_3 - \text{CO} - \text{O} - \text{CH} = \text{CH}_2$
 B CH_3COOH and $\text{HO} - \text{CH}_2 - \text{CH}_2 - \text{OH}$
 C $\text{CH}_3 - \text{CO} - \text{CH} = \text{CH}_2$
 D $\text{CH}_3\text{COOCH}_3$ and $\text{HO} - \text{CH}_2 - \text{CH}_2 - \text{OH}$
- 39 To reduce atmospheric pollution, the waste gases from a coal-burning power station are passed through powdered calcium carbonate.

Which waste gas is removed by powdered calcium carbonate?

- A carbon monoxide, CO
 B carbon dioxide, CO_2
 C sulfur dioxide, SO_2
 D nitric oxide, NO
- 40 The carbon cycle ensures a balance in the amount of carbon dioxide present in the atmosphere.

Which of the following correctly shows how the balance is attained?

	release of carbon dioxide	absorption of carbon dioxide
A	respiration, photosynthesis	ocean uptake, burning of fossil fuels
B	respiration, burning of fossil fuels	ocean uptake, photosynthesis
C	ocean uptake, burning of fossil fuels	respiration, photosynthesis
D	ocean uptake, photosynthesis	respiration, burning of fossil fuels

End of Paper

The Periodic Table of Elements

Periodic Table of Elements																							
Group												13	14	15	16	17	18						
1	2	Key proton (atomic) number atomic symbol name relative atomic mass						1 H hydrogen 1								2 He helium 4							
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 —	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
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 –

actinoids

The volume of one mole of any gas is 24 dm³ at room temperature and pressure (r.t.p.).The Avogadro constant, $L = 6.02 \times 10^{23} \text{ mol}^{-1}$

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