

Candidate Name: _____

Class

Index No.

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FUHUA SECONDARY SCHOOL

Secondary Four Express

Preliminary Examination 2025

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CHEMISTRY

6092/01

Paper 1 Multiple Choice

03 September 2025
0800 – 0900
1 hour

Additional Material: Optical Mark Recognition (OMR)

READ THESE INSTRUCTIONS FIRST

Write in soft pencil.
Do not use staples, paper clips, glue or correction fluid.
Write your name, class, index number on the OMR and this question booklet.

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 OMR.

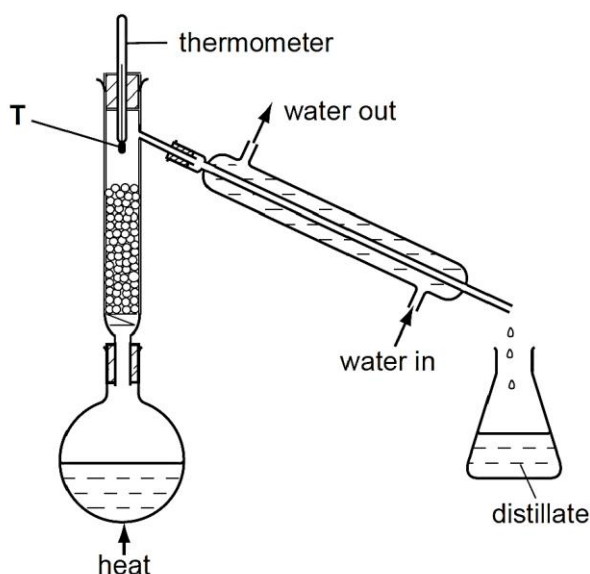
Each correct answer will score one mark. A mark will not be deducted for a wrong answer.
Any rough working should be done on this paper.
A copy of the Periodic Table is printed on page **13**.
The use of an approved scientific calculator is expected, where appropriate.

PARENT'S SIGNATURE	FOR EXAMINER'S USE	
		40

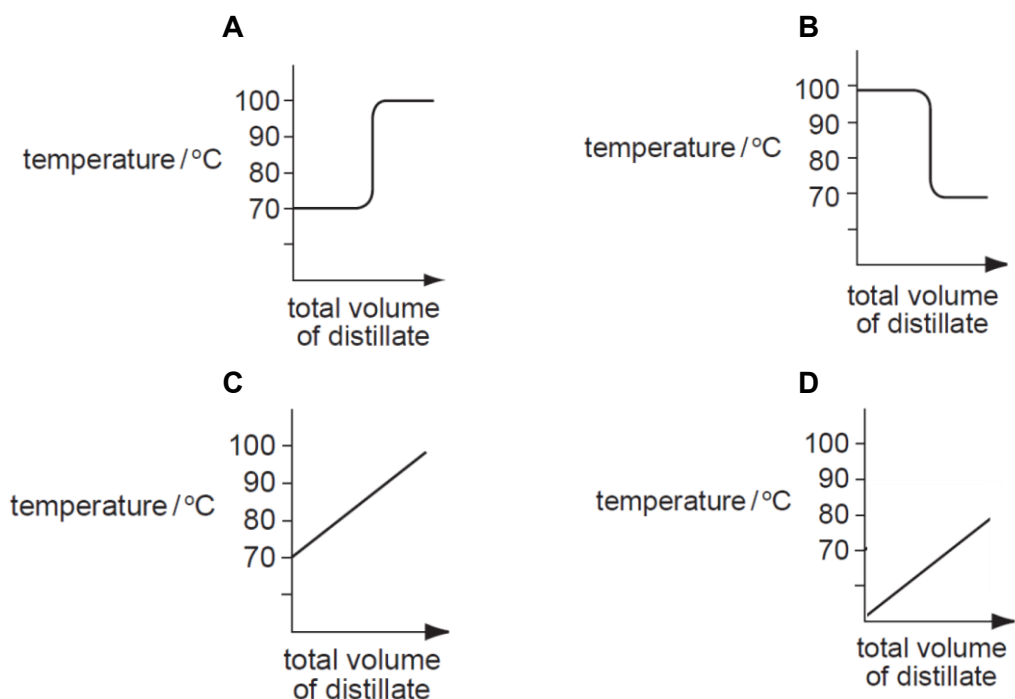
- 1 The melting points and boiling points of four substances are shown. Which substance exist as a monatomic gas at -200°C ?

	substance	melting point / $^{\circ}\text{C}$	boiling point / $^{\circ}\text{C}$
A	argon	-189	-186
B	hydrogen	-259	-253
C	neon	-249	-246
D	nitrogen	-210	-196

- 2 The diagram shows a set-up used to separate hexane (boiling point, 70°C) and heptane (boiling point, 98°C).



Which graph would be obtained if the temperature at point **T** was plotted against the total volume of distillate collected?



- 3** A student wants to show that the rate of the reaction between a fixed mass of calcium carbonate and dilute hydrochloric acid doubles for every 10 °C rise in temperature. The student wants to measure the volume of carbon dioxide released to find the rate of reaction. The student has a measuring cylinder and a gas syringe. What other essential apparatus are required?

- A** Bunsen burner, burette, electronic balance, stopwatch
B Bunsen burner, electronic balance, stopwatch, thermometer
C Bunsen burner, pipette, stopwatch, thermometer
D burette, pipette, electronic balance, thermometer

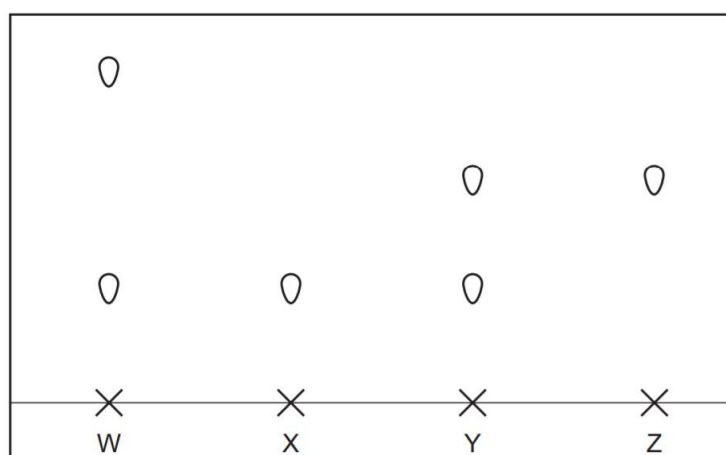
- 4** Some properties of substances X, Y and Z are given in the table below.

substance	percentage composition by mass	solid conducts electricity	changes on heating
X	constant	yes	solid burns in air to form an oxide solid decomposes solid melts
Y	constant	no	
Z	varies	yes	

Which classification of the substances is correct?

	element	mixture	compound
A	X	Z	Y
B	Y	Z	X
C	Z	Y	X
D	X	Y	Z

- 5** The diagram below shows the chromatogram of four substances, W, X, Y and Z.



Which statement is correct?

- A** W contains X and Y.
B X is more soluble than Z.
C Y contains three components.
D Z has a larger R_f value than X.

- 6 The atomic number of cerium, Ce, is 58. A Ce^{4+} ion has 140 nucleons. How many neutrons and electrons are there in one Ce^{4+} ion?

	neutrons	electrons
A	82	54
B	82	62
C	140	54
D	140	62

- 7 Diamond, graphite, iodine and silicon dioxide all contain covalent bonds. Which statement is correct?

- A** Diamond has atoms that are arranged in a tetrahedral structure.
- B** Graphite is used as a lubricant because each layer in its structure is held to the next layer by strong covalent bonds.
- C** Iodine changes from solid to gas upon gentle warming as its covalent bonds are weak.
- D** Both graphite and silicon dioxide can conduct electricity due to the presence of mobile electrons.

- 8 The electronic configurations of three particles, X, Y and Z are shown.

particles	electronic configuration
X	2,1
Y	1
Z	2,8,7

Which statement is true about these three particles?

- A** X forms covalent bonds with Z.
 - B** X forms ionic bonds with Y.
 - C** Y can only form ionic bonds.
 - D** Y forms ionic bonds with Z.
- 9 Peeling onions often causes tearing of the eyes due to the release of a sulfide compound. Peeling them under running water reduces the problem. Which of the following statements are true about the sulfide compound?

- 1 It is volatile.
- 2 It is soluble in water.
- 3 It is an ionic compound with strong ionic bonds.
- 4 It is a covalent compound with weak covalent bonds.

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

10 Which molecule has the greatest number of bonded electrons?

- A** C₂H₄ **B** CO₂ **C** CH₃OH **D** HCO₂H

11 Hydrazine, N₂H₄, is a powerful reducing agent. When reacted with an aqueous solution containing silver ions, nitrogen is one of the products formed. Which ionic equation best represents this reaction?

- A** N₂H₄ + 2Ag⁺ → N₂ + 2AgH₂
B N₂H₄ + Ag⁺ → N₂ + 2H₂ + Ag
C N₂H₄ + Ag⁺ → N₂ + H⁺ + Ag
D N₂H₄ + 4Ag⁺ → N₂ + 4H⁺ + 4Ag

12 An element burns in air to form a compound which dissolves in dilute hydrochloric acid and aqueous sodium hydroxide.
What is the element?

- A** carbon **B** iron **C** aluminium **D** sulfur

13 The results of some experiments with sulfur dioxide are shown.

experiment	description	result
1	mix with dilute hydrochloric acid	does not react
2	mix with concentrated sodium hydroxide	a salt is formed
3	add Universal Indicator	Universal Indicator turns violet
4	add acidified aqueous potassium manganate(VII)	purple solution turns colourless

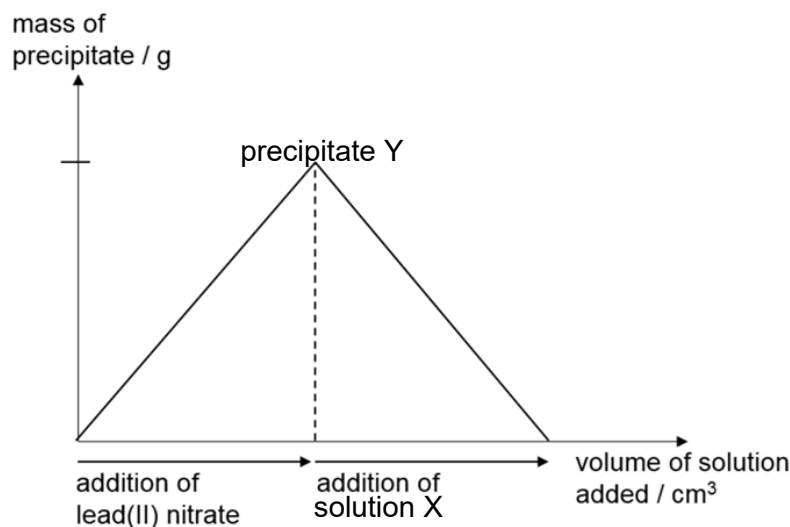
Which experiments show correct results?

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

14 Calcium chloride is made by adding powdered calcium carbonate to dilute hydrochloric acid. Which row identifies the reagent that should be added in excess and the purification method that is used to make a pure and dry sample of calcium chloride?

	excess reagent	purification method
A	calcium carbonate	filtration only
B	calcium carbonate	filtration and crystallisation
C	dilute hydrochloric acid	filtration only
D	dilute hydrochloric acid	filtration and crystallisation

- 15 The graph below shows the mass of precipitate Y formed when aqueous lead(II) nitrate and solution X are added successively to unknown solution M.



What is the possible identities of precipitate Y and solution X?

	precipitate Y	solution X
A	PbCl_2	NaOH
B	PbCO_3	HNO_3
C	$\text{Pb}(\text{NO}_3)_2$	HNO_3
D	PbSO_4	NaOH

- 16 Zinc oxide is produced by heating zinc carbonate.
What is the percentage yield of zinc oxide if 125 g of zinc carbonate produces 75 g of zinc oxide on heating?

A $\frac{75}{81} \times 100$
 B $\frac{125 \times 81}{75} \times 100$
 C $\frac{75}{125} \times 100$
 D $\frac{75}{81 \times 125} \times 100$

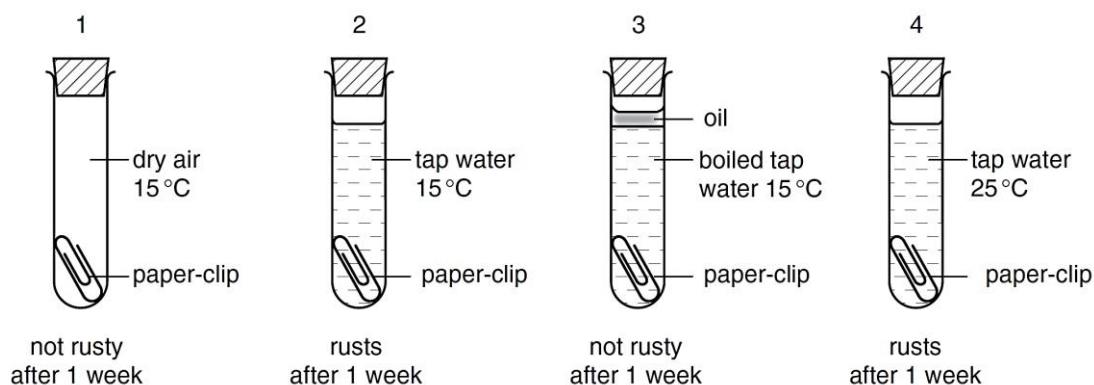
- 17 A fuel gas cylinder contains 6 g of ethane gas, C_2H_6 , under room temperature and pressure.
Which statement is **incorrect**?

- A** It contains 1.2 mol of hydrogen atoms.
B It contains 0.2 mol of ethane molecules.
C It contains 1.20×10^{23} ethane molecules.
D It occupies a volume of 0.25 dm^3 .

- 18 60 cm^3 of hydrogen are reacted with 30 cm^3 of oxygen to form water vapour.
What are the volumes of the gases remaining, at room temperature and pressure?

	hydrogen / cm^3	oxygen / cm^3	water vapour / cm^3
A	30	0	0
B	30	15	30
C	0	0	60
D	0	0	0

19 Four experiments of rusting are shown.



Which two experiments can be used to show that oxygen is needed for iron to rust?

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

20 A small piece of sodium is added to aqueous iron(II) sulfate. Which of the following is **not** observed during this reaction?

- A** A grey solid is formed.
B A white precipitate is formed.
C Bubbles of gas are formed.
D The pale green solution turns colourless.

21 Some reactions are stated below.

- 1 $\text{H}_2\text{SO}_4 + 2\text{NH}_3 \rightarrow (\text{NH}_4)_2\text{SO}_4$
- 2 $\text{H}_2\text{SO}_4 + \text{Zn} \rightarrow \text{ZnSO}_4 + \text{H}_2$
- 3 $\text{K}_2\text{Cr}_2\text{O}_7 + 2\text{KOH} \rightarrow 2\text{K}_2\text{CrO}_4 + \text{H}_2\text{O}$

How many of the reactions are redox reactions?

- A** 0 **B** 1 **C** 2 **D** 3

22 Which noble gas has the highest concentration in dry air?

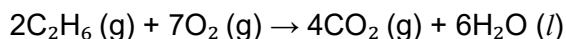
- A** argon
B krypton
C helium
D neon

23 Which pair of gases will cause the most damage to limestone buildings?

- A** carbon monoxide and nitrogen monoxide
B chlorofluorocarbons and ozone
C methane and sulfur dioxide
D nitrogen dioxide and sulfur dioxide

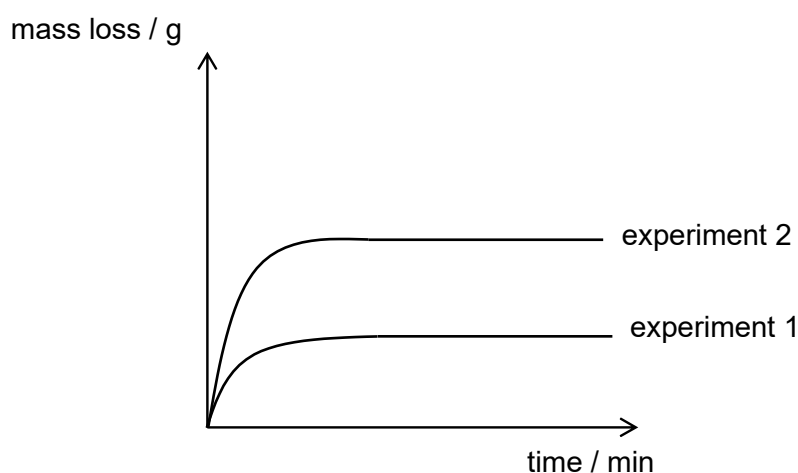
- 24** Which property shows a general decrease when going down any group in the Periodic Table?
- A** the reactivity of the elements
 - B** the oxidising ability of the elements
 - C** the number of electrons in the valence shell
 - D** the tendency of the elements to form positive ions
- 25** Which pair of elements, when reacted together, would give the most violent reaction?
- A** caesium and fluorine
 - B** lithium and iodine
 - C** potassium and bromine
 - D** sodium and chlorine
- 26** Magnesium reacts with acid. Which solution would give the fastest initial rate of reaction?
- A** 40 g of hydrochloric acid in 500 cm³ of water
 - B** 20 g of hydrochloric acid in 1000 cm³ of water
 - C** 40 g of sulfuric acid in 500 cm³ of water
 - D** 20 g of sulfuric acid in 1000 cm³ of water
- 27** In the electrolysis of molten sodium chloride, 46 g of sodium is formed at the cathode. How many moles of chlorine gas are formed at the anode?
- A** 0.0 mol **B** 0.5 mol **C** 1.0 mol **D** 2.0 mol
- 28** The effects of a change in conditions on a chemical reaction are listed.
- 1 The total number of collisions per minute increased.
 - 2 The average energy of the particles increased.
 - 3 The activation energy increased.
- Which of the above effects are result of an increase in temperature?
- A** 1 only
 - B** 2 only
 - C** 1 and 2
 - D** 1, 2 and 3

- 29 The enthalpy change for the reaction shown in this equation is -1560 kJ .



What is the heat change when 1 mole of ethane is burned?

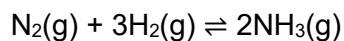
- A 780 kJ of heat is absorbed
 B 780 kJ of heat is released
 C 1560 kJ of heat is absorbed
 D 1560 kJ of heat is released
- 30 Dilute hydrochloric acid was added to some marble chips in a conical flask and the total mass of the flask and its contents is weighed at regular intervals. Both reactants are used up at the end of the reaction. The graph labelled experiment 1 was obtained.



If the experiment is repeated, what changes will be necessary to obtain the graph for experiment 2?

	marble chips	dilute hydrochloric acid
A	grind to powder	no change
B	no change	same volume, higher concentration
C	use more	same volume, same concentration
D	use more	larger volume, same concentration

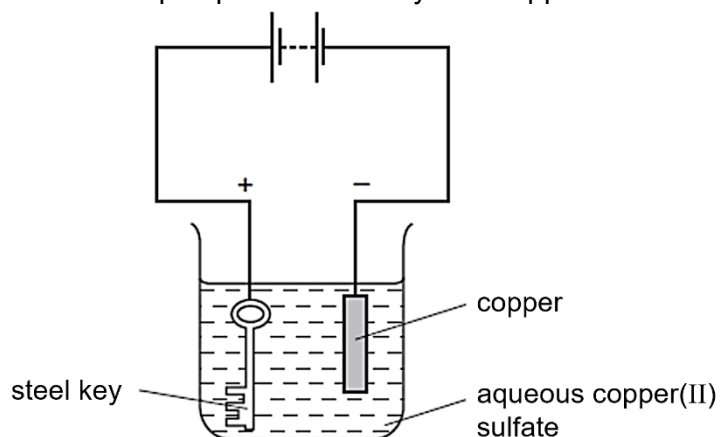
- 31 In Haber process, nitrogen and hydrogen react as shown.



How do the speed and the final yield of the reaction change, if the pressure in the vessel is increased but the temperature is kept constant?

	speed of forward reaction	final yield of reaction
A	increase	no change
B	increase	increase
C	no change	no change
D	no change	increase

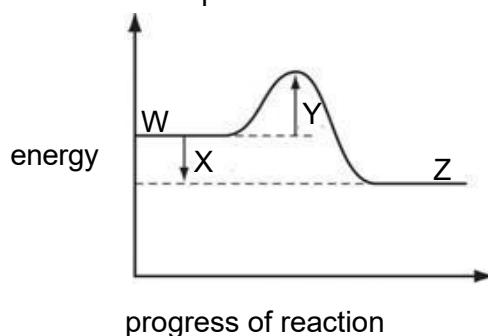
- 32 The apparatus shown is set up to plate a steel key with copper.



Which of the following explains the observation that will be made on the electrolyte?

- A Water is electrolysed leading to volume of water decreasing.
- B Concentration of Cu^{2+} decreases leading to the fading of CuSO_4 colour.
- C Concentration of Cu^{2+} increases leading to the darkening of CuSO_4 colour.
- D Concentration of Cu^{2+} remains unchanged leading to no change in colour intensity of CuSO_4 .

- 33 The energy profile diagram for the Haber process is shown below.



Which statement is correct?

- A The reverse reaction is exothermic.
 - B The enthalpy change of the forward reaction is equal to $(W - Z)$.
 - C The activation energies of the forward and reverse reactions are equal to Y.
 - D The activation energy of the reverse reaction is greater than that of the forward reaction.
- 34 Which of the following is true of a homologous series?

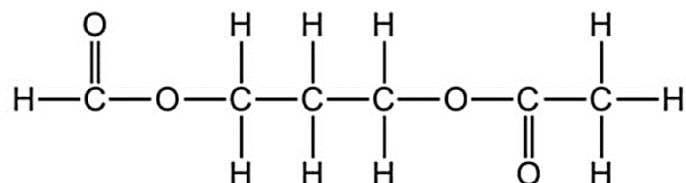
- A Each member differs from the previous one by one carbon and four hydrogen atoms.
- B The viscosity increases as the carbon chain of the members increases.
- C The members have the same empirical formula.
- D The members have the same structural formula.

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

- A** Both are liquids at room temperature.
- B** Both occur naturally.
- C** Margarine has higher melting point than vegetable oil.
- D** Vegetable oil has fewer carbon-carbon double bonds than margarine.

36 Hydrolysis using an alkali will result in the ester linkage being broken and the carboxyl functional group reacting with the base to form a salt.

The diester below can be hydrolysed by heating with aqueous sodium hydroxide.



What would be the products of the reaction?

- A**
- $$\begin{array}{ccc} \text{H}-\text{C}=\text{O} & \begin{array}{ccc} \text{H} & \text{H} & \text{H} \\ | & | & | \\ \text{HO}-\text{C} & -\text{C} & -\text{C}-\text{OH} \\ | & | & | \\ \text{H} & \text{H} & \text{H} \end{array} & \begin{array}{ccc} \text{O} & \text{H} \\ || & | \\ \text{HO}-\text{C} & -\text{C}-\text{H} \\ & | \\ & \text{H} \end{array} \end{array}$$
- B**
- $$\begin{array}{ccc} \text{H}-\text{C}=\text{O} & \begin{array}{ccc} \text{H} & \text{H} & \text{H} \\ | & | & | \\ \text{NaO}-\text{C} & -\text{C} & -\text{C}-\text{ONa} \\ | & | & | \\ \text{H} & \text{H} & \text{H} \end{array} & \begin{array}{ccc} \text{O} & \text{H} \\ || & | \\ \text{HO}-\text{C} & -\text{C}-\text{H} \\ & | \\ & \text{H} \end{array} \end{array}$$
- C**
- $$\begin{array}{ccc} \text{H}-\text{C}=\text{O} & \begin{array}{ccc} \text{H} & \text{H} & \text{H} \\ | & | & | \\ \text{HO}-\text{C} & -\text{C} & -\text{C}-\text{OH} \\ | & | & | \\ \text{H} & \text{H} & \text{H} \end{array} & \begin{array}{ccc} \text{O} & \text{H} \\ || & | \\ \text{NaO}-\text{C} & -\text{C}-\text{H} \\ & | \\ & \text{H} \end{array} \end{array}$$
- D**
- $$\begin{array}{ccc} \text{H}-\text{C}=\text{O} & \begin{array}{ccc} \text{H} & \text{H} & \text{H} \\ | & | & | \\ \text{NaO}-\text{C} & -\text{C} & -\text{C}-\text{ONa} \\ | & | & | \\ \text{H} & \text{H} & \text{H} \end{array} & \begin{array}{ccc} \text{O} & \text{H} \\ || & | \\ \text{NaO}-\text{C} & -\text{C}-\text{H} \\ & | \\ & \text{H} \end{array} \end{array}$$

37 How many of the following reactions involve the formation of water?

- 1 ethanol and ethanoic acid
- 2 glucose and yeast
- 3 ethene and oxygen
- 4 ethane and chlorine

A 1 B 2 C 3 D 4

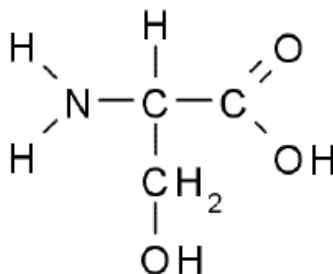
38 You are provided with the following list of chemicals.

- 1 aqueous bromine
- 2 aqueous sodium carbonate
- 3 litmus solution
- 4 propanol

How many of these chemicals can be used to distinguish between propene and propanoic acid at room temperature?

A 0 B 2 C 3 D 4

39 The structure of serine is shown below.



Which statement about serine is **false**?

- A It produces carbon dioxide when reacted with sodium carbonate.
- B It burns in air to produce carbon dioxide, water and oxides of nitrogen.
- C It can undergo condensation polymerisation with other molecules of serine.
- D It causes acidified potassium manganate(VII) to turn from colourless to purple.

40 In the electrolysis of an aqueous solution of vanadium chloride, 76.5 g of vanadium, V ($A_r = 51$), is deposited at the cathode by 4.5 moles of electrons. What is the charge on the vanadium ion?

A 1+ B 2+ C 3+ D 6+

The Periodic Table of Elements

Group																							
1	2	1 H hydrogen 1												13	14	15	16	17	18				
		Key																					
		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 200	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, $L = 6.02 \times 10^{23} \text{ mol}^{-1}$.