



Cambridge IGCSE™

CHEMISTRY

Paper 2 Multiple Choice (Extended)

0620/21

May/June 2025

45 minutes

You must answer on the multiple choice answer sheet.

You will need: Multiple choice answer sheet
Soft clean eraser
Soft pencil (type B or HB is recommended)

INSTRUCTIONS

- 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 multiple choice answer sheet.
- Follow the instructions on the multiple choice answer sheet.
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- Do **not** use correction fluid.
- Do **not** write on any bar codes.
- You may use a calculator.

INFORMATION

- The total mark for this paper is 40.
- Each correct answer will score one mark.
- Any rough working should be done on this question paper.
- The Periodic Table is printed in the question paper.

This document has **16** pages.



- 1 A gas is placed in a sealed container with a fixed volume.

The gas is heated.

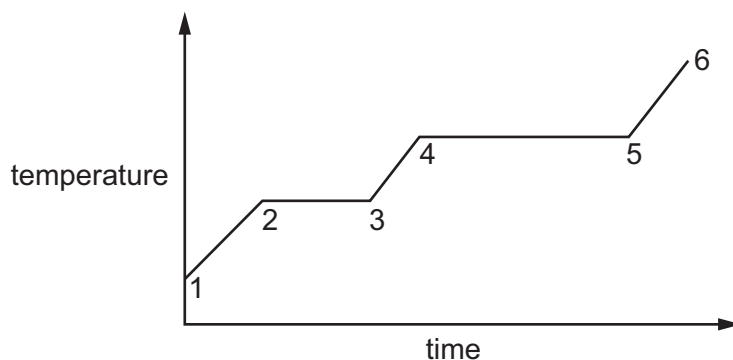
Which statements are correct?

- 1 The gas molecules move around faster.
- 2 The gas particles collide with the walls of the container more frequently.
- 3 The pressure in the container decreases.

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

- 2 A sample of ethanol is heated at a constant rate.

The heating curve for this sample is shown.



Which statement about the heating curve is correct?

- A** Ethanol changes its physical state between 3 and 4.
- B** Ethanol condenses between 2 and 3.
- C** Energy is absorbed between 3 and 4 but **not** absorbed between 4 and 5.
- D** More energy is absorbed between 4 and 5 than between 2 and 3.

- 3 Which atom has an equal number of protons, neutrons and electrons?

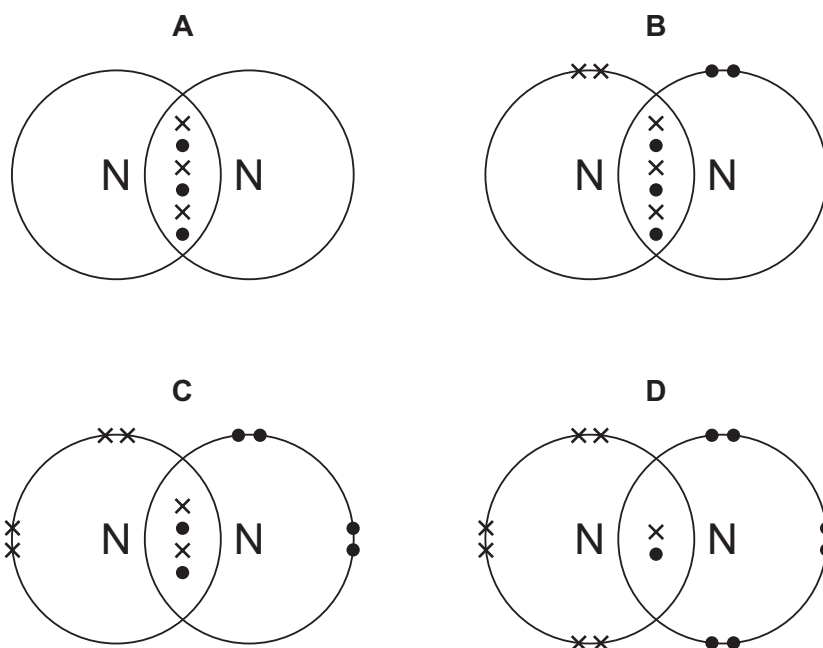
A ^{40}Ar **B** ^1H **C** ^{23}Na **D** ^{14}N

- 4 The only naturally occurring isotopes in a sample of europium are ^{151}Eu and ^{153}Eu . This sample of europium has a relative atomic mass, A_r , of 152.

What is the percentage of ^{151}Eu present in this sample to three significant figures?

A 0.987% **B** 50.0% **C** 76.0% **D** 98.7%

- 5 Which statement about potassium chloride is correct?
- A** It has a high melting point because it is a giant structure with strong covalent bonds.
- B** It conducts electricity when solid because of its oppositely charged ions.
- C** It conducts electricity when molten because its ions can move.
- D** It is insoluble in water because of its strong bonding.
- 6 Which dot-and-cross diagram shows the outer shell electron arrangement in a molecule of nitrogen?



- 7 Which statement about silicon(IV) oxide is correct?
- A** It contains silicon ions and oxide ions arranged in a giant lattice.
- B** It is used in electrical circuits because it can conduct electricity.
- C** Its bonds each contain one shared pair of electrons.
- D** Its atoms are arranged in the same way as the atoms in graphite.

8 Three organic molecules are described.

- The molecular formula of propanoic acid is $\text{CH}_3\text{CH}_2\text{COOH}$.
- The molecular formula of lactic acid is $\text{CH}_3\text{CH}(\text{OH})\text{COOH}$.
- A glucose molecule consists of 6 carbon atoms, 6 oxygen atoms and 12 hydrogen atoms only.

Which molecules have the same empirical formula?

- A** propanoic acid, lactic acid and glucose
B propanoic acid and lactic acid only
C propanoic acid and glucose only
D lactic acid and glucose only

9 Calcium carbonate reacts with dilute hydrochloric acid.

The equation for the reaction is shown.

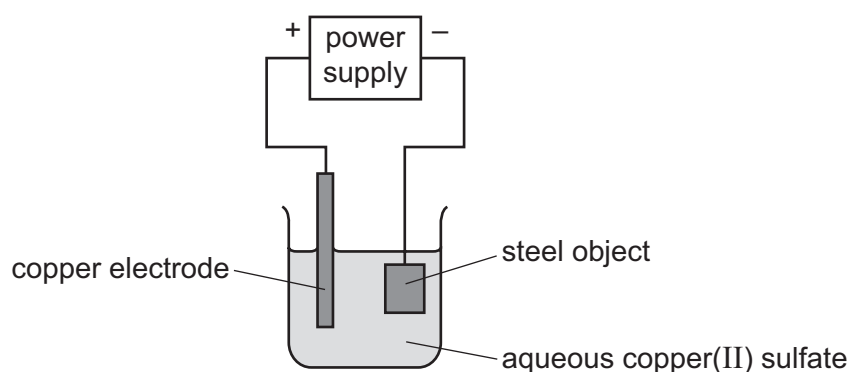


1.00 g of calcium carbonate is added to 50.0 cm^3 of 0.0500 mol/dm^3 hydrochloric acid.

Which volume of carbon dioxide is made in this reaction?

- A** 30 cm^3 **B** 60 cm^3 **C** 120 cm^3 **D** 240 cm^3

10 The diagram shows the electroplating of a steel object.



A student makes three statements.

- 1 The steel object turns a reddish-brown colour.
- 2 The aqueous copper(II) sulfate changes to a paler blue colour.
- 3 The copper electrode becomes thinner.

Which statements are correct?

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

- 11 Concentrated aqueous sodium chloride is electrolysed using inert electrodes.

Which equation shows the correct ionic half-equation for the reaction at the anode?

- A $\text{Cl}^- + \text{e}^- \rightarrow \text{Cl}$
- B $2\text{Cl}^- \rightarrow \text{Cl}_2 + 2\text{e}^-$
- C $\text{H}^+ \rightarrow \text{H} + \text{e}^-$
- D $2\text{H}^+ + 2\text{e}^- \rightarrow \text{H}_2$

- 12 Which equation represents the overall reaction in a hydrogen–oxygen fuel cell?

- A $2\text{H}_2 + \text{O}_2 \rightarrow 2\text{H}_2\text{O}$
- B $2\text{H}_2\text{O} \rightarrow 2\text{H}_2 + \text{O}_2$
- C $\text{H}_2 + \text{O}_2 \rightarrow \text{H}_2\text{O}_2$
- D $\text{H}_2\text{O}_2 \rightarrow \text{H}_2 + \text{O}_2$

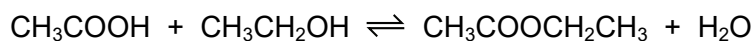
13 Water is added to anhydrous copper(II) sulfate in a test-tube.

The mixture becomes hot.

Which type of reaction and reaction pathway diagram apply to this reaction?

	type of reaction	reaction pathway diagram
A	endothermic	
B	endothermic	
C	exothermic	
D	exothermic	

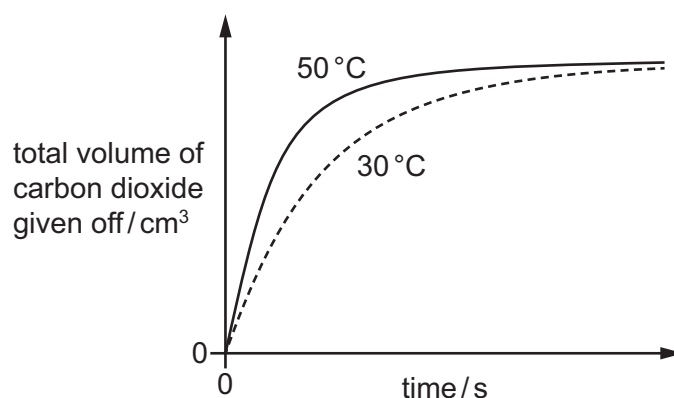
14 The equation represents the reaction between ethanoic acid and ethanol.



Which type of reaction does this show?

- A** addition
- B** neutralisation
- C** reduction
- D** reversible

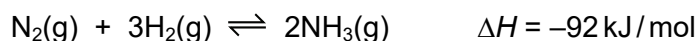
- 15 The graph shows the results of adding excess calcium carbonate to hydrochloric acid at 50 °C and at 30 °C. Only the temperature is changed.



Which row describes the reacting particles at 30 °C compared to those at 50 °C?

	frequency of collisions between particles	average kinetic energy of particles
A	higher	higher
B	higher	lower
C	lower	higher
D	lower	lower

- 16 Industrially, ammonia is made by the Haber process. The equation is shown.



The conditions used are 450 °C and 200 atm.

Which statements about the conditions are correct?

- 1 Temperatures below 450 °C give a lower rate of reaction.
- 2 Temperatures below 450 °C give a lower yield of ammonia.
- 3 Pressures above 200 atm give a lower yield of ammonia.
- 4 Pressures above 200 atm are too expensive to maintain.

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

17 Ethanol is warmed with acidified aqueous potassium manganate(VII).

Which row describes the type of reaction of the ethanol and the colour change observed in the reaction mixture?

	type of reaction	colour change
A	oxidation	colourless to purple
B	oxidation	purple to colourless
C	reduction	colourless to purple
D	reduction	purple to colourless

18 Two experiments involving acids R or S are done.

- 0.10 mol of acid R completely dissolves in 500 cm³ of water. 0.0048 mol of acid R is dissociated in the solution.
- 0.10 mol of acid S completely dissolves in 500 cm³ of water. 0.0179 mol of acid S is dissociated in the solution.

Which statement about acids R and S is correct?

- A** Acid R is a strong acid, and acid S is a weak acid.
- B** Acid R is a weak acid, and acid S is a strong acid.
- C** Acid R and acid S are both strong acids.
- D** Acid R and acid S are both weak acids.

19 Lead(II) sulfate is an insoluble salt.

Which process is **not** used to prepare a pure sample of this salt?

- A** crystallisation
- B** drying
- C** filtration
- D** precipitation

20 The formulae of two hydrated salts are shown.

- $\text{CuSO}_4 \cdot x\text{H}_2\text{O}$
- $\text{CoCl}_2 \cdot y\text{H}_2\text{O}$

What are the values of x and y ?

	x	y
A	5	5
B	5	6
C	6	5
D	6	6

21 The properties of the elements change from left to right across the Periodic Table.

Which statement describes how the properties change across Period 3?

- A** Elements change from gases to solids.
- B** Elements change from non-conductors to electrical conductors.
- C** Elements change from metal to non-metal.
- D** Elements have a decreasing number of electron shells.

22 Which property decreases down Group VII of the Periodic Table, from chlorine to iodine?

- A** atomic number
- B** density
- C** reactivity
- D** melting point

23 Some properties of elements are listed.

- 1 They have good electrical conductivity.
- 2 They have high melting points.
- 3 They are malleable.
- 4 They have ions with variable oxidation numbers.

Which properties are correct for **both** iron and lithium?

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

24 Two statements about noble gases are listed.

- 1 Noble gases are reactive, monatomic gases.
- 2 Noble gases all have a full outer shell of electrons.

Which statements about noble gases are correct?

- A Both statements are correct, and statement 2 explains statement 1.
- B Both statements are correct but statement 2 does **not** explain statement 1.
- C Statement 1 is correct but statement 2 is **not** correct.
- D Statement 2 is correct but statement 1 is **not** correct.

25 Which statement about the properties and uses of copper is correct?

- A It is used in electrical wiring, and it is ductile.
- B It is mixed with tin to make the alloy brass.
- C It is used in overhead electrical cables because it has a low density.
- D It is used in takeaway food containers because of its resistance to corrosion.

26 Three statements about solid Z are listed.

- It reacts with dilute hydrochloric acid to produce hydrogen.
- It reacts very slowly with cold water and quickly with steam.
- It is a good thermal conductor.

What is solid Z?

- A gold
- B magnesium
- C potassium
- D silver

27 Four metals J, K, L and M are added separately to aqueous solutions of their ions.

The results are shown.

	aqueous ions				
metal	J^{2+}	K^{2+}	L^{2+}	M^{2+}	
J	x	✓	✓	✓	key ✓ = reaction x = no reaction
K	x	x	x	✓	
L	x	✓	x	✓	
M	x	x	x	x	

Which statement about the metals is correct?

- A J has a greater tendency to form positive ions than K.
- B L has a greater tendency to form positive ions than J.
- C K has a greater tendency to form positive ions than L.
- D M has a greater tendency to form positive ions than K.

28 Which process is used in the extraction of iron from hematite?

- A electrolysis
- B precipitation
- C reduction
- D fractional distillation

29 Galvanising prevents iron from rusting.

Which statements about galvanising are correct?

- 1 Galvanising involves coating the iron with silver.
- 2 Galvanising prevents oxygen and water from coming into contact with the iron.
- 3 Galvanising works because the metal coating loses electrons more readily than iron.

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

30 Nitrogen, phosphorus and potassium are essential elements for improved plant growth.

Which mixture provides all **three** essential elements?

	mixture	formulae
A	ammonium phosphate + potassium chloride	$(\text{NH}_4)_3\text{PO}_4$ + KCl
B	ammonium phosphate + ammonium nitrate	$(\text{NH}_4)_3\text{PO}_4$ + NH_4NO_3
C	ammonium phosphate + ammonium chloride	$(\text{NH}_4)_3\text{PO}_4$ + NH_4Cl
D	ammonium nitrate + potassium chloride	NH_4NO_3 + KCl

31 Which statements help explain why an increasing amount of carbon dioxide or methane in the atmosphere causes global warming?

- 1 Carbon dioxide absorbs thermal energy from the Earth.
- 2 Methane does **not** absorb thermal energy from the Sun.
- 3 Carbon dioxide does **not** reflect thermal energy from the Sun to the Earth.
- 4 Methane reflects thermal energy from the Earth back to the Earth.

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

32 The exhaust gases from cars contain oxides of nitrogen.

How are these oxides of nitrogen formed?

- A** Nitrogen and oxygen from the air react together at the high temperatures in the engine.
- B** Nitrogen and oxygen from the petrol react together in the car exhaust.
- C** Nitrogen from the petrol reacts with oxygen at the high temperatures in the engine.
- D** Nitrogen reacts with oxygen from the air in the catalytic converter.

33 The structural formula of methyl ethanoate is $\text{CH}_3\text{COOCH}_3$.

Which compounds are structural isomers of methyl ethanoate?

- 1 $\text{HCOOCH}_2\text{CH}_3$
- 2 $\text{CH}_3\text{CH}_2\text{COOH}$
- 3 $\text{HOCH}_2\text{CH}_2\text{CH}_2\text{OH}$

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

34 What is the **total** number of covalent bonds in one molecule of propane?

A 8 **B** 9 **C** 10 **D** 11

35 Industrially, ethanol is produced by fermentation or by the reaction of ethene with steam.

Which row is correct?

	fermentation	ethene + steam
A	uses a temperature of 100°C	uses a temperature of 350°C
B	needs the presence of yeast	does not need a catalyst
C	slow reaction	fast reaction
D	high yield of ethanol	low yield of ethanol

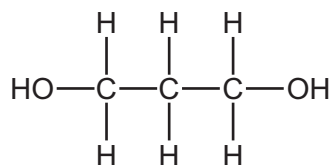
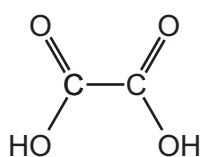
36 Some properties of an organic compound, J, are listed.

- It is a liquid at room temperature.
- It is soluble in water.
- A solution of J reacts with calcium carbonate to form carbon dioxide.
- A solution of J has a pH of 3.

In which homologous series does J belong?

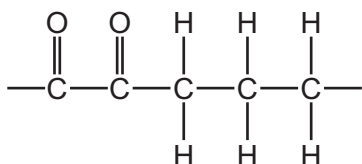
- A** alkane
- B** alkene
- C** alcohol
- D** carboxylic acid

37 The structures of two monomers that are used to make a condensation polymer are shown.

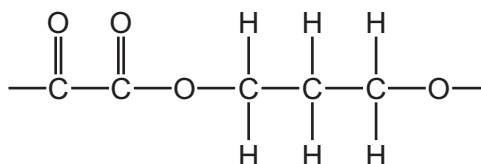


Which structure represents one repeat unit of the condensation polymer formed?

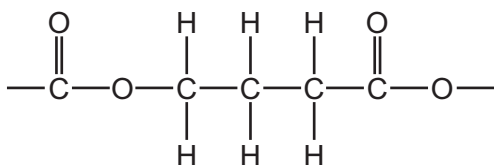
A



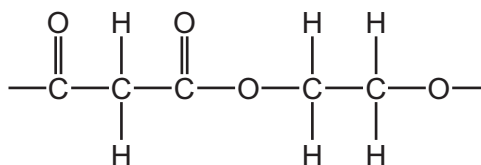
B



C



D

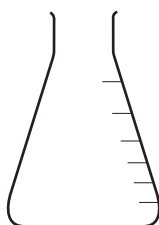


38 Which item of apparatus is used to measure 25.0 cm³ of aqueous sodium hydroxide?

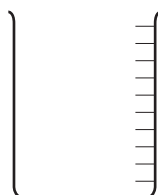
A



B



C



D

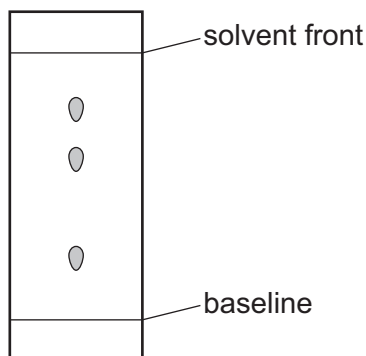


39 Which method is used to obtain copper(II) sulfate crystals from an aqueous solution of copper(II) sulfate?

- A** chromatography
- B** condensation
- C** evaporation
- D** filtration

40 A mixture of four different colourless amino acids is analysed by paper chromatography.

The final chromatogram is shown.



Why does the chromatogram only show three spots?

- A A locating agent is **not** used.
- B One of the amino acids is insoluble in the solvent.
- C The solvent front is too near the top of the paper.
- D Two of the amino acids have the same R_f value.

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The Periodic Table of Elements

Group																				
I	II											III	IV	V	VI	VII	VIII			
		1 H hydrogen 1																		
		Key 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		
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	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 —	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.).



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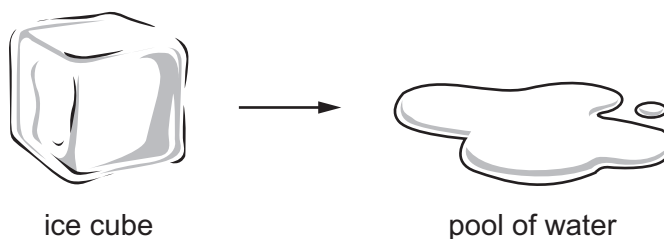
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- 1 An ice cube melts.

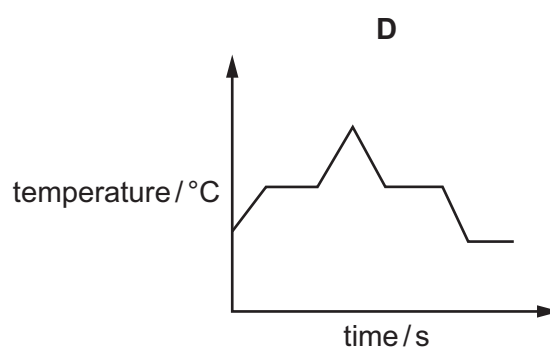
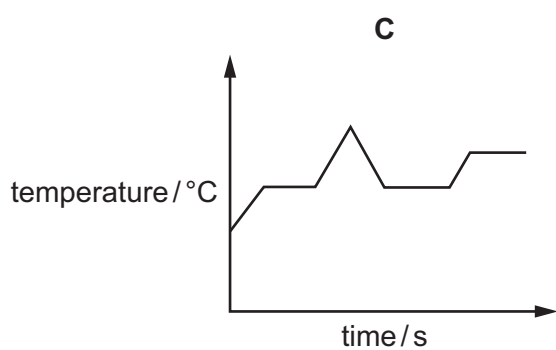
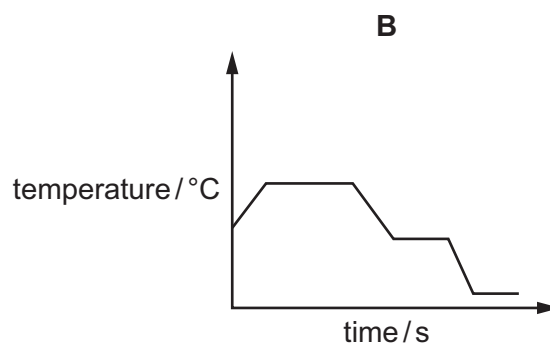
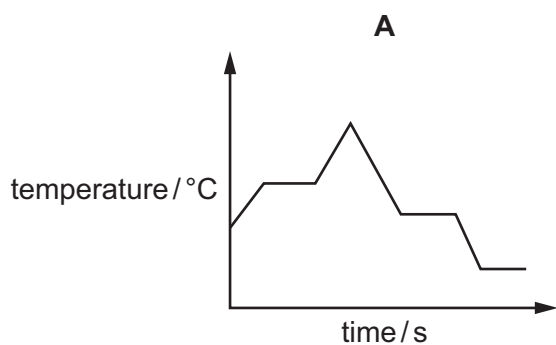


What happens to the molecules of water in the ice cube?

- A They evaporate.
 - B They dissolve.
 - C They gain energy.
 - D They lose energy.
- 2 A sample of a liquid, X, is heated to a temperature above its boiling point.

X is then cooled, so that it condenses and then freezes.

Which graph describes the change in temperature of X over time?



- 3 Which row gives the number of protons, electrons and neutrons in an atom of zinc?

	protons	electrons	neutrons
A	30	30	35
B	30	35	35
C	35	30	30
D	35	35	30

- 4 Which particles have the electronic configuration 2,8,8?

- 1 an argon atom, Ar
- 2 an aluminium ion, Al^{3+}
- 3 a sodium ion, Na^+
- 4 a chloride ion, Cl^-

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

- 5 A sample of element Q has two isotopes.

Their relative masses and abundances are shown.

relative mass of isotope	abundance /%
238	66
244	34

What is the relative atomic mass of this sample of Q to three significant figures?

- A** 240 **B** 241 **C** 242 **D** 243

- 6 Which statement about silicon(IV) oxide, SiO_2 , is correct?

- A** It conducts electricity because it contains delocalised electrons.
- B** It has a giant covalent structure with each silicon atom bonded to four oxygen atoms.
- C** It is a simple covalent molecule.
- D** Its structure is similar to that of graphite.

- 7 When 65 g of zinc reacts with 32 g of sulfur, 97 g of zinc sulfide is produced.

When 65 g of zinc reacts with 40 g of sulfur, the mass of zinc sulfide produced is still 97 g.

Which statement explains this observation?

- A Some of the zinc sulfide evaporates.
- B The reaction rate is slow.
- C The reaction stops before it is complete.
- D Zinc is the limiting reactant.

- 8 Aluminium reacts with iron(III) oxide to form aluminium oxide and iron.

Which chemical equation for the reaction between aluminium and iron(III) oxide is correct?

- A $Al + FeO \rightarrow AlO + Fe$
- B $2Al + Fe_2O \rightarrow Al_2O + 2Fe$
- C $Al + Fe_2O_3 \rightarrow Al_2O_3 + Fe$
- D $2Al + Fe_2O_3 \rightarrow Al_2O_3 + 2Fe$

- 9 The concentration of a solution of aqueous sodium hydroxide is 0.50 mol/dm^3 .

Which mass of sodium hydroxide is used to make 500 cm^3 of this solution?

- A 10 g B 20 g C 40 g D 160 g

- 10 Molten zinc oxide is electrolysed using inert electrodes.

Which row identifies the product at each electrode?

	anode	cathode
A	zinc	oxygen
B	hydrogen	oxygen
C	oxygen	zinc
D	oxygen	hydrogen

11 Dilute aqueous sodium chloride is electrolysed using platinum electrodes.

What is the half-equation for the reaction at the cathode?

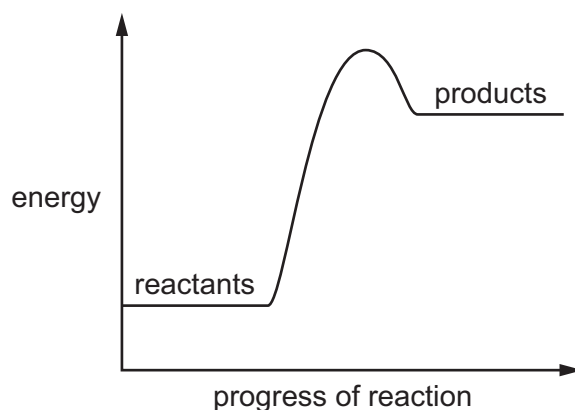
- A** $2\text{H}^+ + 2\text{e}^- \rightarrow \text{H}_2$
- B** $\text{Na}^+ + \text{e}^- \rightarrow \text{Na}$
- C** $2\text{Cl}^- \rightarrow \text{Cl}_2 + 2\text{e}^-$
- D** $4\text{OH}^- \rightarrow 2\text{H}_2\text{O} + \text{O}_2 + 4\text{e}^-$

12 Hydrogen–oxygen fuel cells can be used to power vehicles.

Which statement about hydrogen–oxygen fuel cells is correct?

- A** The equation for the overall reaction is $\text{H}_2 + \text{O}_2 \rightarrow \text{H}_2\text{O}_2$.
- B** The only chemical products are water and carbon dioxide.
- C** Chemical energy in the fuel is converted into electrical energy.
- D** The hydrogen used in hydrogen–oxygen fuel cells is a fossil fuel.

13 A reaction pathway diagram is shown.



Which row identifies the type of reaction and how the temperature of the surroundings changes during the reaction?

	type of reaction	temperature of the surroundings
A	endothermic	decreases
B	endothermic	increases
C	exothermic	decreases
D	exothermic	increases

- 14 The average bond energy for the C–H bond is 413 kJ/mol.

What is the enthalpy change when 1.0 mol of methane molecules is formed from carbon and hydrogen atoms?

- A –1652 kJ B –413 kJ C +413 kJ D +1652 kJ

- 15 Which statement describes the effect of adding a catalyst to a chemical reaction?

- A The activation energy, E_a , of the reaction is increased.
 B The enthalpy change, ΔH , of the reaction stays unchanged.
 C The frequency of collisions between the particles is decreased.
 D The kinetic energy of the particles is increased.

- 16 Which row describes the conditions used in the manufacture of sulfuric acid by the Contact process?

	catalyst	pressure	temperature
A	iron	high	high
B	iron	low	low
C	vanadium(V) oxide	high	low
D	vanadium(V) oxide	low	high

- 17 Which equations show the underlined species acting as a reducing agent?

- 1 Fe₂O₃ + 3CO → 2Fe + 3CO₂
 2 Fe + CuSO₄ → FeSO₄ + Cu
 3 5Fe²⁺ + MnO₄[–] + 8H⁺ → 5Fe³⁺ + Mn²⁺ + 4H₂O
 4 Fe(OH)₂ + H₂SO₄ → FeSO₄ + 2H₂O

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

- 18 A farmer incorrectly adds two substances to the soil at the same time.

They react together to form a gas which turns damp red litmus paper blue.

What are the two substances?

- A a basic oxide and a potassium salt
 B a basic oxide and an ammonium salt
 C an acidic oxide and a potassium salt
 D an acidic oxide and an ammonium salt

- 19 Which row shows the equations for the dissociation of hydrochloric acid and of ethanoic acid in aqueous solution?

	hydrochloric acid	ethanoic acid
A	$\text{HCl}(\text{aq}) \rightarrow \text{H}^+(\text{aq}) + \text{Cl}^-(\text{aq})$	$\text{CH}_3\text{COOH}(\text{aq}) \rightleftharpoons \text{H}^+(\text{aq}) + \text{CH}_3\text{COO}^-(\text{aq})$
B	$\text{HCl}(\text{aq}) \rightleftharpoons \text{H}^+(\text{aq}) + \text{Cl}^-(\text{aq})$	$\text{CH}_3\text{COOH}(\text{aq}) \rightleftharpoons \text{H}^+(\text{aq}) + \text{CH}_3\text{COO}^-(\text{aq})$
C	$\text{HCl}(\text{aq}) \rightarrow \text{H}^+(\text{aq}) + \text{Cl}^-(\text{aq})$	$\text{CH}_3\text{COOH}(\text{aq}) \rightarrow \text{H}^+(\text{aq}) + \text{CH}_3\text{COO}^-(\text{aq})$
D	$\text{HCl}(\text{aq}) \rightleftharpoons \text{H}^+(\text{aq}) + \text{Cl}^-(\text{aq})$	$\text{CH}_3\text{COOH}(\text{aq}) \rightarrow \text{H}^+(\text{aq}) + \text{CH}_3\text{COO}^-(\text{aq})$

- 20 Which three oxides are **all** acidic?

- A** CaO, NO₂, SO₂
B CaO, CO₂, Na₂O
C CO₂, NO₂, SO₂
D CO₂, Na₂O, SO₂

- 21 The table shows some properties of noble gases.

noble gas	density in g/dm ³	boiling point in °C
helium	0.2	−269
neon	0.9	−246
argon	1.8	−186
krypton		
xenon	5.9	−108

Which row predicts the density and the boiling point of krypton?

	density in g/dm ³	boiling point in °C
A	1.4	−75
B	2.4	−195
C	3.8	−153
D	8.5	−213

22 Sodium is a Group I metal.

What is a physical property of sodium?

- A non-conductor of electricity
- B high melting point
- C high density
- D malleable

23 Tennessine (atomic number 117) is a manufactured element that is below astatine in Group VII of the Periodic Table.

What is the expected state of tennessine at room temperature and pressure?

- A a diatomic gas
- B a liquid
- C a monatomic gas
- D a solid

24 When chlorine is bubbled into aqueous sodium bromide, a displacement reaction occurs.

Which description of this reaction is correct?

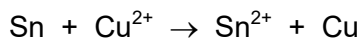
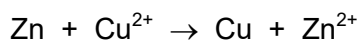
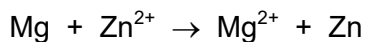
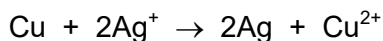
- A Chloride displaces bromide.
- B Chlorine displaces bromine.
- C Chloride displaces bromine.
- D Chlorine displaces bromide.

25 Brass is an alloy of copper.

Which statement about brass or copper is correct?

- A Brass does **not** conduct electricity because it is a compound.
- B Copper conducts electricity because its atoms are free to move.
- C Brass is harder than copper because its layers of atoms **cannot** easily slide over each other.
- D Copper is stronger than brass because it is a pure metal.

26 The ionic equations for some reactions between metals and aqueous metal ions are shown.



Which further information can be used to place copper, magnesium, silver, tin and zinc in order of their reactivity?

- A Zinc reacts with Sn^{2+} ions.
- B Copper does **not** react with Sn^{2+} ions.
- C Magnesium reacts with Cu^{2+} ions.
- D Magnesium reacts with Ag^+ ions.

27 Zinc is used to galvanise iron to prevent it from rusting.

Which statements are correct?

- 1 Galvanising is an example of a barrier method.
- 2 If the zinc is scratched, the iron will rust very quickly.
- 3 Galvanising is an example of sacrificial protection.
- 4 Zinc is more reactive than iron and so accepts electrons more readily.

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

28 Which equation represents a reaction that occurs in a blast furnace during the extraction of iron from hematite?

- A $\text{Ca} + \text{CO}_2 \rightarrow \text{CaO} + \text{CO}$
- B $\text{Fe}_2\text{O}_3 + 3\text{Ca} \rightarrow 2\text{Fe} + 3\text{CaO}$
- C $\text{Ca}(\text{OH})_2 \rightarrow \text{CaO} + \text{H}_2\text{O}$
- D $\text{Fe}_2\text{O}_3 + 3\text{CO} \rightarrow 2\text{Fe} + 3\text{CO}_2$

29 Water is added separately to anhydrous copper(II) sulfate and to anhydrous cobalt(II) chloride.

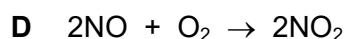
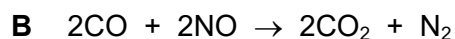
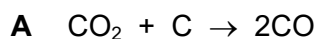
Which row shows the colour changes?

	anhydrous copper(II) sulfate	anhydrous cobalt(II) chloride
A	blue to white	blue to pink
B	blue to white	pink to blue
C	white to blue	blue to pink
D	white to blue	pink to blue

30 Gases which cause acid rain form in car engines.

These gases can be removed using a catalytic converter.

Which equation represents the removal of one of these gases using a catalytic converter?



31 Which statements about carbon dioxide are correct?

- 1 Carbon dioxide absorbs thermal energy from the Earth.
- 2 Carbon dioxide increases the thermal energy loss to space.
- 3 The level of carbon dioxide in the atmosphere has increased due to the burning of fossil fuels.
- 4 Carbon dioxide is the only gas that causes global warming.

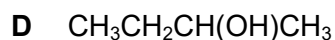
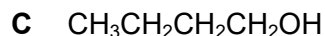
A 1 and 2

B 1 and 3

C 2 and 3

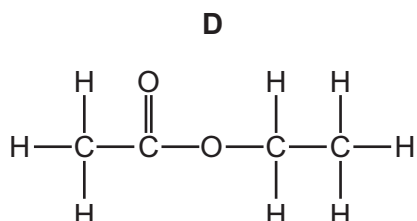
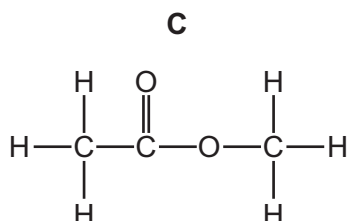
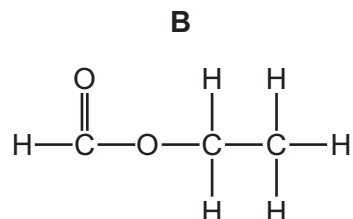
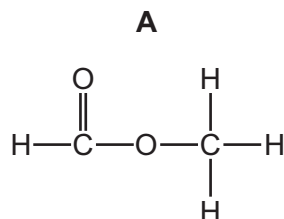
D 2 and 4

32 What is the structural formula of butan-2-ol?



- 33** Methanol reacts with ethanoic acid to form an ester.

What is the displayed formula for this ester?



- 34** Petroleum can be separated into useful fractions by fractional distillation.

Which row shows a correct use of the named fraction?

	fraction	use
A	bitumen	lubricant
B	naphtha	fuel for home heating
C	kerosene	jet fuel
D	refinery gas	making chemicals

- 35** Ethane reacts with chlorine in the presence of ultraviolet light.

Which products are formed?

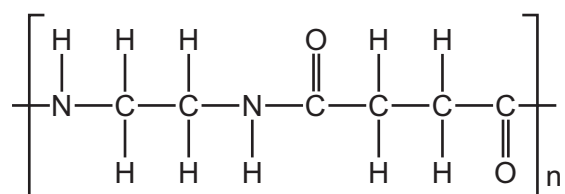
- A** $\text{ClCH}_2\text{CH}_2\text{Cl}$ and H_2
B $2\text{CH}_3\text{Cl}$ and H_2
C $\text{C}_2\text{H}_5\text{Cl}$ and HCl
D $\text{CH}_2=\text{CH}_2$ and 2HCl

- 36** Ethanol can be made by the fermentation of aqueous glucose and by the catalytic addition of steam to ethene.

What are two advantages of making ethanol by the catalytic addition of steam to ethene rather than by the fermentation of aqueous glucose?

- A** faster reaction and renewable raw materials
- B** purer product and faster reaction
- C** renewable raw materials and continuous process
- D** uses more energy and forms a purer product

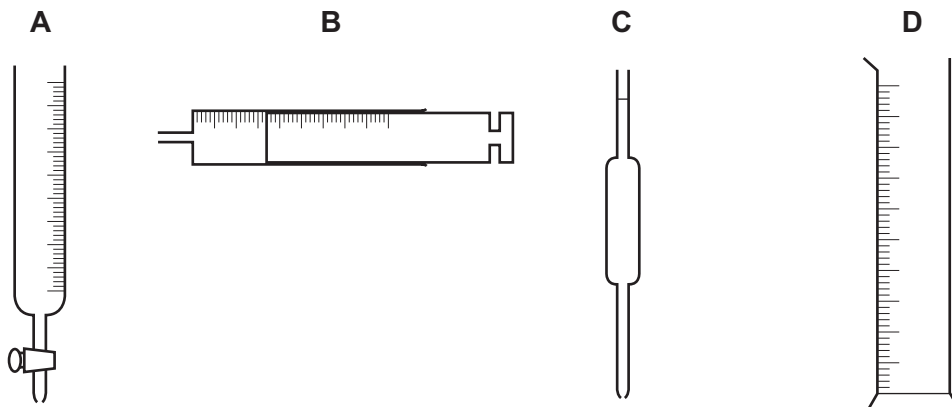
- 37** The structure of a polymer repeat unit is shown.



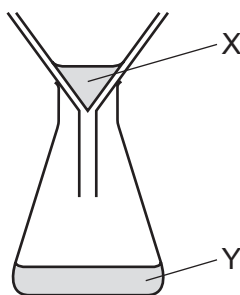
Which pair of monomers is used to make this polymer?

	monomer 1	monomer 2
A	$\begin{array}{cccc} \text{H} & \text{H} & \text{H} & \text{H} \\ & & & \\ \text{N}- & \text{C}- & \text{C}- & \text{N} \\ & & & \\ \text{H} & \text{H} & \text{H} & \text{H} \end{array}$	$\begin{array}{ccccc} & \text{H}-\text{O} & & \text{O}-\text{H} & \\ & & & & \\ & \text{C} & - & \text{C} & \\ & & & & \\ & \text{O} & & \text{O} & \end{array}$
B	$\begin{array}{cccc} \text{H} & \text{H} & \text{H} & \text{H} \\ & & & \\ \text{N}- & \text{C}- & \text{C}- & \text{N} \\ & & & \\ \text{H} & \text{H} & \text{H} & \text{H} \end{array}$	$\begin{array}{ccccccc} \text{H}-\text{O} & & \text{H} & & \text{H} & & \text{O}-\text{H} \\ & & & & & & \\ \text{C} & - & \text{C} & - & \text{C} & - & \text{C} \\ & & & & & & \\ \text{O} & & \text{H} & & \text{H} & & \text{O} \end{array}$
C	$\begin{array}{ccccccc} \text{H} & \text{H} & \text{H} & \text{H} & \text{H} & & \text{H} \\ & & & & & & \\ \text{N}- & \text{C}- & \text{C}- & \text{C}- & \text{C}- & & \text{N} \\ & & & & & & \\ \text{H} & \text{H} & \text{H} & \text{H} & \text{H} & & \text{H} \end{array}$	$\begin{array}{ccccc} \text{H}-\text{O} & & & & \text{O}-\text{H} \\ & & & & \\ \text{C} & - & \text{C} & & \\ & & & & \\ \text{O} & & \text{O} & & \end{array}$
D	$\begin{array}{ccccccc} \text{H} & \text{H} & \text{H} & \text{H} & \text{H} & & \text{H} \\ & & & & & & \\ \text{N}- & \text{C}- & \text{C}- & \text{C}- & \text{C}- & & \text{N} \\ & & & & & & \\ \text{H} & \text{H} & \text{H} & \text{H} & \text{H} & & \text{H} \end{array}$	$\begin{array}{ccccccc} \text{H}-\text{O} & & \text{H} & & \text{H} & & \text{O}-\text{H} \\ & & & & & & \\ \text{C} & - & \text{C} & - & \text{C} & - & \text{C} \\ & & & & & & \\ \text{O} & & \text{H} & & \text{H} & & \text{O} \end{array}$

38 Which item of apparatus is used to measure exactly 26.3 cm^3 of a liquid?



39 A mixture containing an aqueous salt and an insoluble salt is filtered.



Which row describes X and Y?

	X	Y
A	solute	pure water
B	solute	filtrate
C	residue	pure water
D	residue	filtrate

40 Pure ethanol has a melting point of -114°C and a boiling point of 78°C .

What are the melting and boiling points of a sample of ethanol with glucose dissolved in it?

	melting point/ $^\circ\text{C}$	boiling point/ $^\circ\text{C}$
A	-116	77
B	-116	79
C	-112	77
D	-112	79

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The Periodic Table of Elements

Group																	
I	II	1 H hydrogen 1										III	IV	V	VI	VII	VIII
3 Li lithium 7	4 Be beryllium 9	Key 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										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 oganeson —

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.).



Cambridge IGCSE™

CHEMISTRY

Paper 2 Multiple Choice (Extended)

0620/23

May/June 2025

45 minutes

You must answer on the multiple choice answer sheet.

You will need: Multiple choice answer sheet
Soft clean eraser
Soft pencil (type B or HB is recommended)

INSTRUCTIONS

- 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 multiple choice answer sheet.
- Follow the instructions on the multiple choice answer sheet.
- Write in soft pencil.
- Write your name, centre number and candidate number on the multiple choice answer sheet in the spaces provided unless this has been done for you.
- Do **not** use correction fluid.
- Do **not** write on any bar codes.
- You may use a calculator.

INFORMATION

- The total mark for this paper is 40.
- Each correct answer will score one mark.
- Any rough working should be done on this question paper.
- The Periodic Table is printed in the question paper.

This document has **16** pages. Any blank pages are indicated.

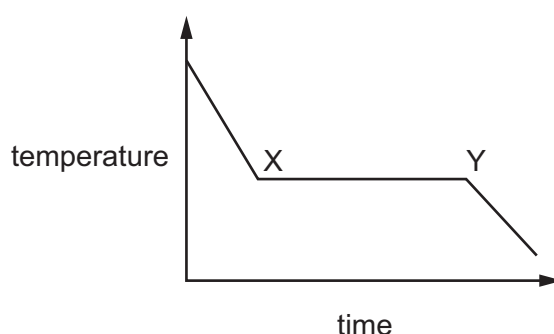


- 1 Which two changes, when applied **at the same time** to a fixed amount of gas, cause the greatest increase in volume of the gas?

	change in pressure	change in temperature
A	decrease by 10%	decrease by 10%
B	increase by 10%	decrease by 10%
C	decrease by 20%	increase by 10%
D	increase by 20%	increase by 10%

- 2 Solid G is heated until it melts. It is then left to cool to room temperature.

The graph shows the cooling curve for G.



Four statements about the cooling curve between X and Y are listed.

- 1 The speed of the molecules of G decreases.
- 2 The molecules of G become less closely packed.
- 3 Thermal energy is released by the molecules of G to the surroundings.
- 4 G changes from solid to liquid.

Which statements are correct?

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

- 3 Which atom has twice as many neutrons as protons?

- A** ${}^1_1\text{H}$ **B** ${}^2_1\text{H}$ **C** ${}^3_1\text{H}$ **D** ${}^4_2\text{He}$

- 4 What is the nucleon number of an atom?

- A** the number of electrons, neutrons and protons in the nucleus
B the number of neutrons and protons in the nucleus
C the number of neutrons in the nucleus
D the number of protons in the nucleus

- 5** The diagram shows the positions of elements P and Q in the Periodic Table.

A simplified periodic table with 18 columns and 4 rows. The first two columns are on the left, and the last six columns are on the right, with a gap in between. The element 'P' is in the second row, second column of the left block. The element 'Q' is in the second row, fourth column of the right block. There is an empty box above the gap between the two blocks.

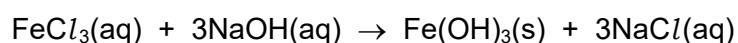
What is the formula of the compound that is formed between P and Q?

- A** PQ **B** P₂Q **C** PQ₂ **D** P₂Q₇

- 6** Which statement about ionic compounds is correct?

- A** Giant lattices are formed when ionic compounds crystallise from solution.
- B** In all ionic compounds, the metal ions have fewer electrons than the non-metal ions.
- C** In a giant lattice, ions of the same charge are closer together than ions of opposite charge.
- D** When ionic compounds melt, strong intermolecular forces are broken.

- 7 The equation for the reaction between iron(III) chloride and sodium hydroxide is shown.



What is the ionic equation for this reaction?

- A** $\text{Fe}^{3+}(\text{aq}) + 3\text{OH}^{-}(\text{aq}) \rightarrow \text{Fe}^{3+}(\text{s}) + 3\text{OH}^{-}(\text{s})$
- B** $\text{Fe}^{3+}(\text{aq}) + 3\text{OH}^{-}(\text{aq}) \rightarrow \text{Fe}(\text{OH})_3(\text{s})$
- C** $3\text{Na}^{+}(\text{aq}) + 3\text{Cl}^{-}(\text{aq}) \rightarrow 3\text{Na}^{+}(\text{aq}) + 3\text{Cl}^{-}(\text{aq})$
- D** $3\text{Na}^{+}(\text{aq}) + 3\text{Cl}^{-}(\text{aq}) \rightarrow 3\text{NaCl}(\text{aq})$

- 8** A compound is analysed and found to contain 85.7% carbon and 14.3% hydrogen only.

What is its empirical formula?

- A** CH **B** CH₂ **C** C₂H₄ **D** C₆H

- 9 Aqueous barium hydroxide, $\text{Ba}(\text{OH})_2$, reacts with dilute nitric acid, HNO_3 . The products are aqueous barium nitrate, $\text{Ba}(\text{NO}_3)_2$, and water.

In a titration, 15.2 cm^3 of 0.75 mol/dm^3 aqueous barium hydroxide is required to neutralise 20.0 cm^3 of dilute nitric acid.

What is the concentration of the nitric acid?

- A 0.29 mol/dm^3
 B 0.57 mol/dm^3
 C 1.14 mol/dm^3
 D 2.03 mol/dm^3
- 10 Which particles are responsible for the transfer of charge in the external circuit during the electrolysis of molten lead(II) bromide?
- A anions
 B atoms
 C cations
 D electrons
- 11 Two statements about hydrogen are listed.

- 1 Hydrogen is used as a fuel.
 2 When hydrogen burns in the air to form water, thermal energy is produced.

Which conclusion about these statements is correct?

- A Both statements are correct, and statement 2 explains statement 1.
 B Both statements are correct, but statement 2 does **not** explain statement 1.
 C Statement 1 is correct, but statement 2 is **not** correct.
 D Statement 2 is correct, but statement 1 is **not** correct.
- 12 Concentrated aqueous copper(II) chloride is electrolysed using carbon electrodes.

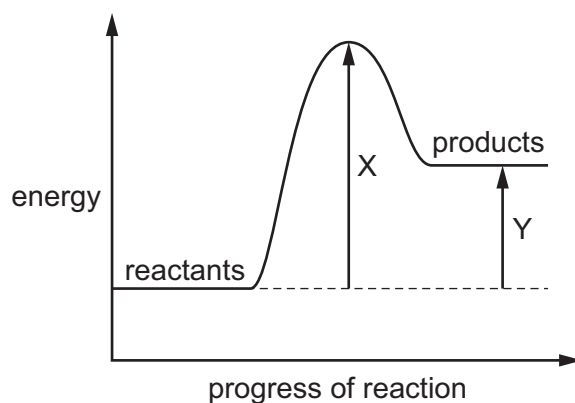
What is formed at each electrode?

	negative electrode	positive electrode
A	chlorine	copper
B	copper	chlorine
C	copper	oxygen
D	oxygen	copper

13 Which row describes an exothermic reaction?

	sign of enthalpy change, ΔH	temperature of the surroundings
A	positive	decreases
B	positive	increases
C	negative	decreases
D	negative	increases

14 A reaction pathway diagram is shown.



Which row shows the correct labels for X and Y and the type of reaction taking place?

	X	Y	type of reaction
A	enthalpy change	activation energy	exothermic
B	activation energy	enthalpy change	endothermic
C	activation energy	enthalpy change	exothermic
D	enthalpy change	activation energy	endothermic

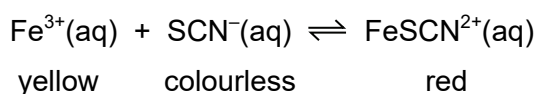
15 The rate of reaction between magnesium and dilute hydrochloric acid is increased by increasing the concentration of the acid.

How does this affect the reacting particles?

	collision rate of particles	proportion of particles with sufficient energy to react
A	increases	increases
B	increases	stays the same
C	stays the same	increases
D	stays the same	stays the same

- 16** The reaction between aqueous iron(III) ions, Fe^{3+} , and aqueous thiocyanate ions, SCN^- , is reversible.

The equation for the reaction is shown.

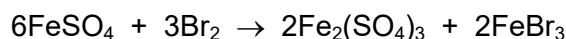


At equilibrium, the concentrations of Fe^{3+} ions, SCN^- ions, and FeSCN^{2+} ions are identical, and the mixture appears orange.

When a few drops of aqueous thiocyanate ions are added to the mixture, a new equilibrium forms.

How does the colour of the mixture change?

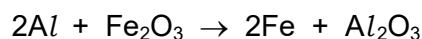
- A** It becomes colourless.
- B** It becomes a lighter orange.
- C** It becomes more yellow.
- D** It becomes more red.
- 17** The equation for the reaction between iron(II) sulfate and bromine is shown.



Which row identifies the oxidising agent and the reducing agent?

	oxidising agent	reducing agent
A	Br_2	FeSO_4
B	FeSO_4	Br_2
C	FeBr_3	$\text{Fe}_2(\text{SO}_4)_3$
D	$\text{Fe}_2(\text{SO}_4)_3$	FeBr_3

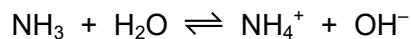
- 18** The equation represents a redox reaction.



What is the change in the oxidation number of iron in this reaction?

- A** from +2 to +3
- B** from +2 to 0
- C** from +3 to +2
- D** from +3 to 0

- 19 Aqueous ammonia forms an equilibrium with water.



In this equilibrium, which particle acts as an acid and which particle acts as a base?

	acid	base
A	NH_3	H_2O
B	NH_3	OH^-
C	H_2O	NH_3
D	H_2O	NH_4^+

- 20 Which row identifies an acidic oxide, a basic oxide and an amphoteric oxide?

	acidic	basic	amphoteric
A	ZnO	SO_2	Al_2O_3
B	SO_2	Al_2O_3	Na_2O
C	ZnO	Al_2O_3	SO_2
D	SO_2	Na_2O	Al_2O_3

- 21 A Group I metal (lithium or potassium) is reacted with a Group VII element (chlorine or iodine).

Which compound is formed when the Group I metal of highest density reacts with the Group VII element of lowest density?

- A** potassium chloride
- B** lithium chloride
- C** potassium iodide
- D** lithium iodide

- 22 Element X is in the same group of the Periodic Table as silicon.

An atom of element X has more protons than a silicon atom.

Which element could be X?

- A** aluminium
- B** carbon
- C** germanium
- D** phosphorus

23 Which statement about the elements in Group VIII is correct?

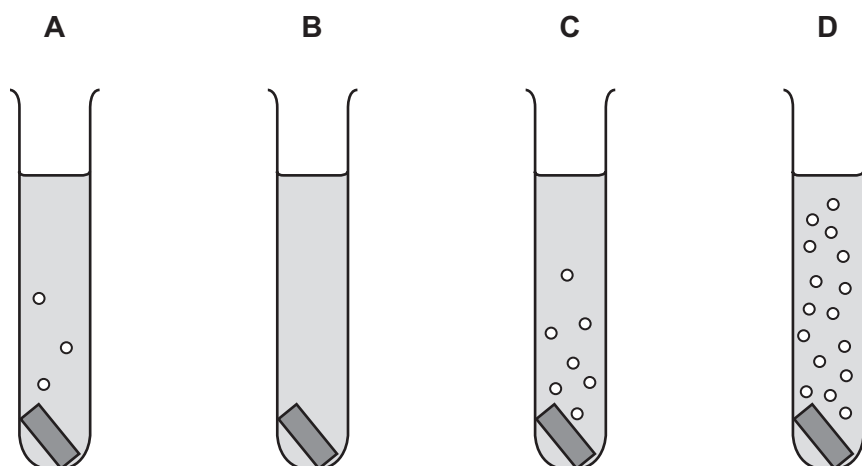
- A** They all form diatomic molecules.
- B** They all have eight electrons in their outer electron shells.
- C** They all react with oxygen to form oxides.
- D** They all are gases at room temperature.

24 Which element is a transition element?

	melting point in °C	density at r.t.p. in g/cm ³	colour of oxide at r.t.p.
A	98	1.0	white
B	328	11.3	yellow
C	651	1.7	white
D	1907	7.2	green

25 Four test-tubes contain dilute hydrochloric acid. Each test-tube has one piece of a different metal added to it. The metals are copper, iron, magnesium and zinc.

Which test-tube contains iron and dilute hydrochloric acid?



26 Brass is a mixture of copper and zinc.

Which statement describes and explains the relative strength of brass compared to copper?

- A** Brass is stronger than copper because the layers of atoms in brass **cannot** easily slide over each other.
- B** Brass is stronger than copper because the intermolecular forces are greater in brass than in copper.
- C** Brass is weaker than copper because the layers of atoms slide more easily over each other in brass than in copper.
- D** Brass is weaker than copper because the intermolecular forces are weaker in brass than in copper.

27 A sample of calcium carbonate is heated strongly, and substances U and V are formed.

Substance U is a white solid. Substance V is a colourless gas.

What are substances U and V?

	U	V
A	calcium chloride	oxygen
B	calcium hydroxide	carbon dioxide
C	calcium oxide	carbon dioxide
D	calcium sulfate	oxygen

28 A sample of water taken from a river contains harmful microbes.

What is a source of harmful microbes in the river water?

- A** sewage
- B** fertilisers
- C** detergents
- D** plastics

- 29** Anhydrous copper(II) sulfate and anhydrous cobalt(II) chloride change colour when water is added to them.

Which row shows the correct colour changes?

	copper(II) sulfate	cobalt(II) chloride
A	blue to white	blue to pink
B	blue to white	pink to blue
C	white to blue	blue to pink
D	white to blue	pink to blue

- 30** Which gas contributes to increased global warming?

- A** argon
- B** carbon dioxide
- C** nitrogen
- D** oxygen

- 31** Which statement describes how greenhouse gases increase global warming?

- A** Greenhouse gases absorb thermal energy from the Sun, reducing the Earth's temperature.
- B** Greenhouse gases reflect thermal energy back into space, cooling the Earth's surface.
- C** Greenhouse gases absorb and re-emit thermal energy radiated from the Earth's surface.
- D** Greenhouse gases release thermal energy from the Earth into space.

- 32** Nitrogen monoxide is produced in a car engine when petrol is burned.

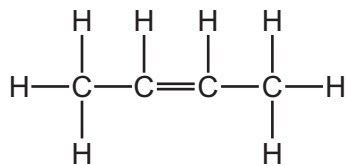
The gases from the car engine are passed through a catalytic converter.

In the catalytic converter, the nitrogen monoxide, NO, reacts with carbon monoxide, CO, to form nitrogen and carbon dioxide.

Which statement is **not** correct?

- A** Carbon monoxide is oxidised in the catalytic converter.
- B** Carbon monoxide is produced by the complete combustion of petrol.
- C** Nitrogen monoxide is formed by the reaction of nitrogen and oxygen.
- D** Nitrogen monoxide is reduced in the catalytic converter.

33 The displayed formula of but-2-ene is shown.



Which displayed formulae represent structural isomers of but-2-ene?

$ \begin{array}{ccccccc} & \text{H} & & \text{H} & & \text{H} & & \text{H} \\ & & & & & & & \\ \text{H} & - \text{C} & = & \text{C} & - & \text{C} & - & \text{C} & - \text{H} \\ & & & & & & & \\ & & & & & \text{H} & & \text{H} \end{array} $	$ \begin{array}{ccccccc} & \text{H} & & \text{H} & & \text{H} & & \\ & & & & & & & \\ \text{H} & - \text{C} & - & \text{C} & - & \text{C} & - & \text{H} \\ & & & & & & & \\ & \text{H} & & & & \text{H} & & \\ & & & \text{H} - \text{C} - \text{H} & & & & \\ & & & & & & & \\ & & & \text{H} & & & & \end{array} $	$ \begin{array}{ccccccc} & & & \text{H} & & & & \\ & & & & & & & \\ \text{H} & & \text{H} & - \text{C} & - & \text{H} & & \\ & & & & & & & \\ & & & \text{C} & = & \text{C} & & \\ & & & & & & & \\ \text{H} & & \text{H} & - \text{C} & - & \text{H} & & \\ & & & & & & & \\ & & & \text{H} & & & & \end{array} $
1	2	3

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

34 Which row describes two characteristics of members of the same homologous series?

	characteristic 1	characteristic 2
A	same functional group	trend in physical properties
B	same physical properties	same functional group
C	same general formula	different chemical properties
D	differing from one member to the next by a CH ₃ unit	similar chemical properties

35 Compound W is a hydrocarbon that contains single bonds only.

Which homologous series contains W?

- A** alkenes
B alkanes
C carboxylic acids
D alcohols

36 Methane forms chloromethane in a photochemical reaction using ultraviolet light.

Which statement about this reaction is correct?

- A** Methane is mixed with hydrogen chloride gas, and ultraviolet light prevents a combustion reaction.
- B** Methane is mixed with hydrogen chloride gas, and ultraviolet light provides the activation energy for the reaction.
- C** Methane is mixed with chlorine gas, and ultraviolet light prevents a combustion reaction.
- D** Methane is mixed with chlorine gas, and ultraviolet light provides the activation energy for the reaction.

37 Which statement about polymers is correct?

- A** Nylon contains the $\begin{array}{c} \text{O} \\ \parallel \\ \text{---C---N---} \\ | \\ \text{H} \end{array}$ linkage.
- B** Nylon is a polyester.
- C** Propane can be polymerised by addition polymerisation.
- D** The linkage in PET contains a carbon–carbon double bond.

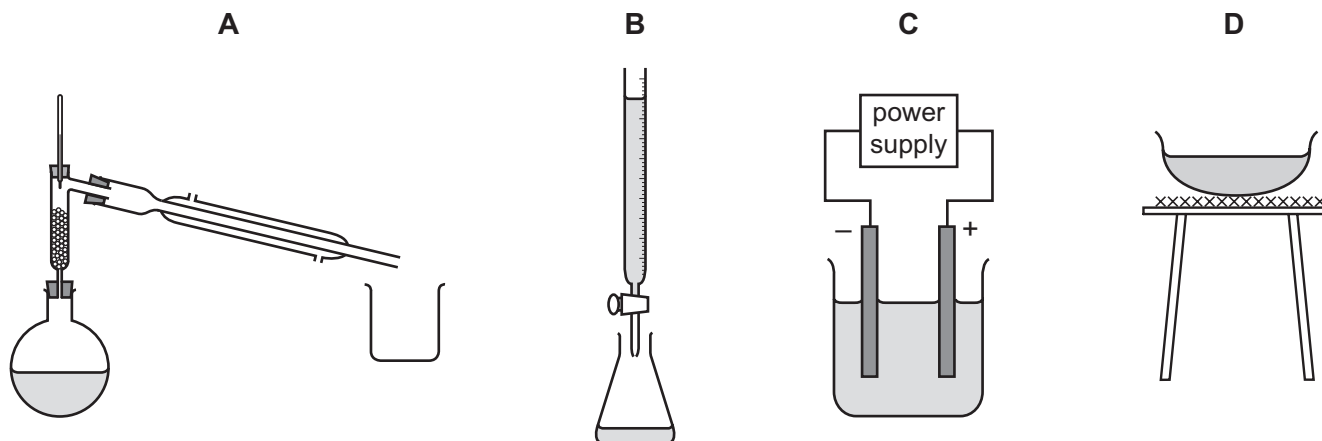
38 The steps used to separate a mixture of a soluble solid and an insoluble solid are listed.

- A solution is made by adding the mixture to a suitable 1..... .
- The mixture is stirred and then poured through a filter funnel lined with filter paper.
- The insoluble solid is collected on the filter paper as the 2..... .

Which words complete gaps 1 and 2?

	1	2
A	solute	filtrate
B	solute	residue
C	solvent	filtrate
D	solvent	residue

39 Which items of apparatus are used to separate a mixture of liquids with different boiling points?



40 In paper chromatography, what is the equation for the R_f value?

- A $R_f = \frac{\text{distance travelled by solvent}}{\text{distance travelled by substance}}$
- B $R_f = \frac{\text{distance travelled by locating agent}}{\text{distance travelled by substance}}$
- C $R_f = \frac{\text{distance travelled by substance}}{\text{distance travelled by locating agent}}$
- D $R_f = \frac{\text{distance travelled by substance}}{\text{distance travelled by solvent}}$

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