Cambridge Assessment International Education

Cambridge O Level

CHEMISTRY **5070/12**

Paper 1 Multiple Choice **May/June 2024**

1 hour

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 physical changes are both exothermic?

A condensation and evaporation

B evaporation and melting

C freezing and condensation

D melting and freezing

2 What is tap water?

A a compound

B a mixture of compounds and elements

C a mixture of elements

D an element

3 In which pair of particles is:

- the sum of their charges equal to zero
- the sum of their masses almost the same as $\frac{1}{12}$ of the mass of an atom of ^{12}C?

A one electron and one neutron

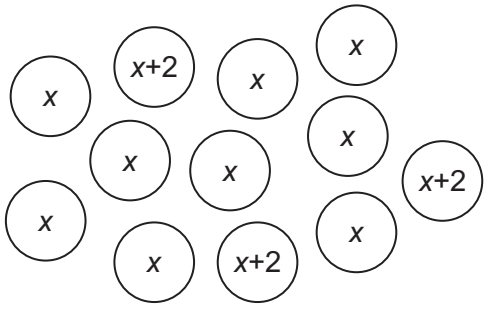
B one electron and one proton

C one neutron and one proton

D two neutrons

4 An element has two isotopes of relative isotopic masses x and $x+2$.

The diagram shows the composition of atoms in a sample of the element.



What is the relative atomic mass of the sample of the element?

A $x+0.5$ **B** $x+1.0$ **C** $x+1.5$ **D** $x+2.0$

5 Which molecule has only four electrons involved in covalent bonds?

A Cl_2 **B** CO_2 **C** H_2S **D** N_2

6 The melting points and boiling points of four compounds, W, X, Y and Z, are given in the table.

	melting point / °C	boiling point / °C
W	63	354
X	–7	59
Y	1728	2230
Z	–183	–89

The four compounds are silicon(IV) oxide, ethane, bromine and a carboxylic acid of formula $C_{16}H_{32}O_2$.

Which row identifies W, X, Y and Z?

	silicon(IV) oxide	ethane	bromine	carboxylic acid $C_{16}H_{32}O_2$
A	W	X	Z	Y
B	W	Y	Z	X
C	Y	Z	W	X
D	Y	Z	X	W

7 What is the formula of zinc oxide?

A Zn_2O **B** ZnO **C** Zn_2O_3 **D** ZnO_2

8 Which statement is correct?

A If the relative formula mass of hydrated sodium carbonate, $Na_2CO_3 \cdot xH_2O$, is 286, then x is 10.

B Phosphoric(V) acid, H_3PO_4, has a relative molecular mass of 50.

C The relative atomic mass of a sample of an element with isotopes of masses 20 and 22 can only be equal to 21.

D The relative atomic mass of an element is the average mass of atoms of isotopes of the element compared with the mass of a hydrogen atom.

9 In a volumetric experiment, 25.0 cm^3 of 0.100 mol/dm^3 sodium hydroxide reacts exactly with 20.0 cm^3 of dilute sulfuric acid.

$$2NaOH + H_2SO_4 \rightarrow Na_2SO_4 + 2H_2O$$

What is the concentration of the dilute sulfuric acid?

A 0.0625 mol/dm^3

B 0.0800 mol/dm^3

C 0.125 mol/dm^3

D 0.250 mol/dm^3

10 The equation for the reaction between ammonium chloride and calcium hydroxide is shown.

$$2NH_4Cl + Ca(OH)_2 \rightarrow 2NH_3 + CaCl_2 + 2H_2O$$

10.7 g of ammonium chloride and 14.8 g of calcium hydroxide are mixed and warmed.

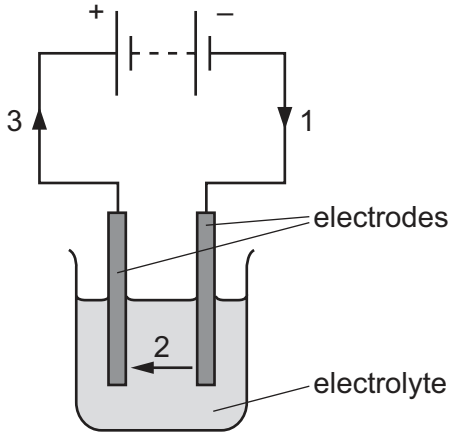
10.0 g of calcium chloride is obtained from the reaction.

What is the percentage yield of calcium chloride?

[M_r: NH_4Cl, 53.5; $Ca(OH)_2$, 74; $CaCl_2$, 111]

A 39.2% **B** 45.0% **C** 67.6% **D** 90.1%

11 The diagram shows a simple electrolytic cell.



Which arrows show the movement of electrons?

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

12 Which changes are observed during the electrolysis of aqueous copper(II) sulfate using copper electrodes?

1 A pink solid is deposited on the negative electrode.

2 Bubbles form on the positive electrode.

3 The colour of the solution does not change.

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

13 Which row describes a hydrogen-oxygen fuel cell?

	chemical product	comparison of fuel cell with petrol engine
A	hydrogen and oxygen	hydrogen has a lower energy content by mass than petrol
B	hydrogen and oxygen	a renewable fuel may be used in a fuel cell, a petrol engine uses a non-renewable fuel
C	water only	hydrogen has a lower energy content by mass than petrol
D	water only	a renewable fuel may be used in a fuel cell, a petrol engine uses a non-renewable fuel

14 Which statements about endothermic reactions are correct?

1 Energy is absorbed from the surroundings.

2 Energy is released to the surroundings.

3 The temperature of the reaction mixture falls.

4 The temperature of the reaction mixture rises.

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

15 Hydrogen and chlorine react to form hydrogen chloride.

$$H_2 + Cl_2 \rightarrow 2HCl$$

Bond energy data is given in the table.

bond	bond energy in kJ / mol
H–H	436
Cl–Cl	242
H–Cl	431

What is the enthalpy change, ΔH, for this reaction?

A –247 kJ / mol

B –184 kJ / mol

C +184 kJ / mol

D +247 kJ / mol

16 Which statement is correct?

A Both physical changes and chemical changes produce new substances.

B Chemical changes are irreversible.

C During a chemical change, atoms rearrange themselves to form new chemical bonds.

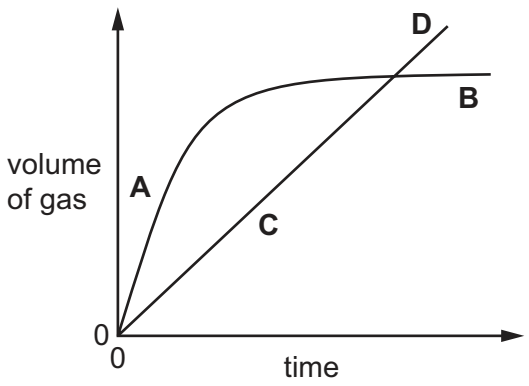
D The only way to reverse a physical change is with a chemical reaction.

17 Two reactions each produce a gaseous product.

The reactions are performed separately using the same conditions of temperature and pressure.

The volume of gas formed in each experiment is measured over time and the results are plotted in the graph shown.

At which point is the rate of production of gas the greatest?



18 The reaction between calcium oxide and carbon dioxide is reversible and the forward reaction is exothermic.

$$CaO(s) + CO_2(g) \rightleftharpoons CaCO_3(s)$$

A mixture of calcium oxide and carbon dioxide is placed in a heated flask and the reaction reaches equilibrium.

Which statement about this equilibrium is correct?

A Less calcium carbonate is produced if the pressure in the flask increases.

B More calcium carbonate is produced when the temperature is increased.

C The flask must be sealed if equilibrium is to be reached.

D When equilibrium is reached, the reaction stops.

19 In the Haber process, hydrogen and nitrogen react to form ammonia in the presence of a catalyst.

Which reactant is obtained by fractional distillation and what is the catalyst used in the Haber process?

	obtained by fractional distillation	catalyst
A	hydrogen	nickel
B	hydrogen	iron
C	nitrogen	nickel
D	nitrogen	iron

20 Chlorine reacts with aqueous sodium bromide to form aqueous sodium chloride and bromine.

Which statement about this reaction is correct?

A Bromide ions are oxidised because they lose electrons.

B Chlorine atoms are oxidised because they gain electrons.

C Sodium ions are oxidised because they lose electrons.

D This reaction does **not** involve oxidation or reduction.

[Turn over

21 One mole of compound X gives two moles of ions in aqueous solution. X reacts with ammonium carbonate to give an acidic gas.

What is compound X?

A calcium hydroxide

B ethanoic acid

C nitric acid

D sodium hydroxide

22 Which statement about weak acids is correct?

A Some molecules are **not** dissociated.

B Weak acids do **not** react with carbonates.

C Weak acids always form more dilute solutions than strong acids.

D Weak acids always have lower pH values than strong acids.

23 Which compound is the least soluble in water?

A calcium chloride

B lead nitrate

C magnesium carbonate

D potassium sulfate

24 Which statement about water of crystallisation is correct?

A The ratio of $CoCl_2 : H_2O$ in hydrated cobalt(II) chloride is 6 : 1.

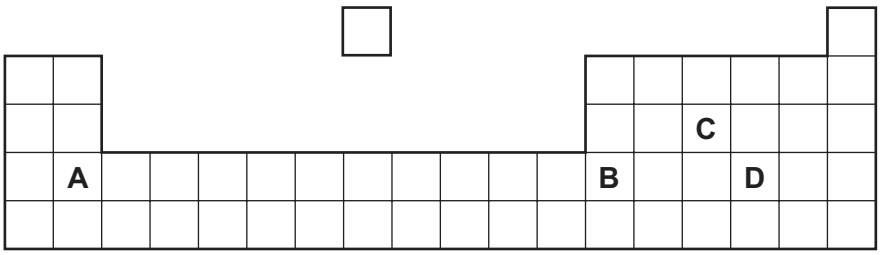
B The ratio of $CuSO_4 : H_2O$ in hydrated copper(II) sulfate is 1 : 5.

C When a saturated solution is heated, the water that evaporates is called the water of crystallisation.

D When white copper(II) sulfate is heated, blue crystals are formed.

25 The diagram shows a section of the Periodic Table.

Which element is a metal that has exactly three outer shell electrons?



26 The table compares two properties of lithium and potassium.

Which row is correct?

	greater density	greater tendency to form a positive ion
A	lithium	lithium
B	lithium	potassium
C	potassium	lithium
D	potassium	potassium

27 Which properties are correct for the element copper?

	melting point / °C	malleability
A	83	low
B	83	high
C	1083	low
D	1083	high

28 Which statement is correct?

A Copper is unreactive because of an oxide layer.

B Gold and silver are used to make jewellery because they corrode very slowly.

C Magnesium can be displaced from aqueous solutions of its ions by adding aluminium.

D Zinc gains electrons more readily than magnesium gains electrons.

29 Which reaction takes place in the blast furnace?

A $FeCr_2O_4 + 4C \rightarrow Fe + 2Cr + 4CO$

B $3Fe + 4H_2O \rightarrow Fe_3O_4 + 4H_2$

C $SiO_2 + CaO \rightarrow CaSiO_3$

D $SiO_2 + 2NaOH \rightarrow Na_2SiO_3 + H_2O$

[Turn over

30 The presence of water can be confirmed by the use of either anhydrous cobalt(II) chloride or anhydrous copper(II) sulfate.

Which observation is correct if water is present?

A Anhydrous cobalt(II) chloride turns from blue to white.

B Anhydrous cobalt(II) chloride turns from pink to blue.

C Anhydrous copper(II) sulfate turns from blue to pink.

D Anhydrous copper(II) sulfate turns from white to blue.

31 Ammonium phosphate, $(NH_4)_3PO_4$, may be used as a fertiliser.

What is the percentage by mass of elements that improve plant growth in ammonium phosphate?

A 9 **B** 21 **C** 28 **D** 49

32 Which statement is correct?

A An unsaturated hydrocarbon is one in which more solute can dissolve.

B Members of a homologous series each differ from the next by a $–CH_2–$ unit.

C Structural isomers have the same displayed formula but different structural formulae.

D The general formula of the carboxylic acid homologous series is $C_nH_{2n}COOH$.

33 What is the name of the ester $C_3H_7COOC_2H_5$?

A butyl ethanoate

B ethyl butanoate

C ethyl propanoate

D propyl ethanoate

34 Petroleum is separated into useful products by fractional distillation.

Which of these fractions has the lowest boiling point?

A bitumen

B fuel oil

C gasoline / petrol

D kerosene / paraffin

35 Which equation represents a substitution reaction?

A $C_3H_8 + Cl_2 \rightarrow C_3H_7Cl + HCl$

B $C_2H_5OH + 3O_2 \rightarrow 2CO_2 + 3H_2O$

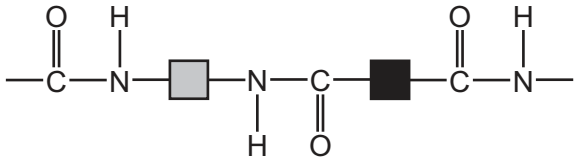
C $C_2H_4 + Br_2 \rightarrow C_2H_4Br_2$

D $C_6H_{12}O_6 \rightarrow 2CO_2 + 2C_2H_5OH$

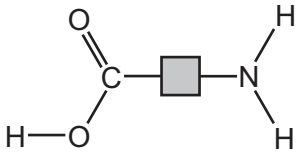
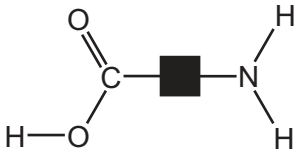
36 Which row shows the minimum number of moles of oxygen needed for the complete combustion of 1 mole of the named alcohol?

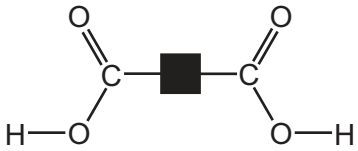
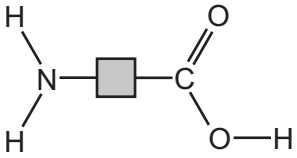
	alcohol	moles of oxygen
A	butan-1-ol	6
B	butan-2-ol	12
C	propan-1-ol	3
D	propan-2-ol	6

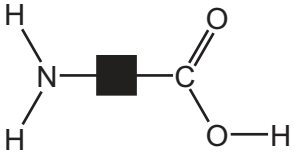
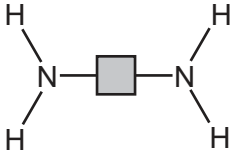
37 The diagram shows the partial structure of a polymer.

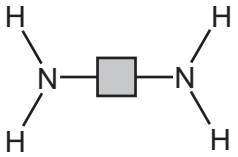
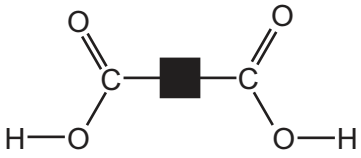


Which pair of reagents is used to form this polymer?

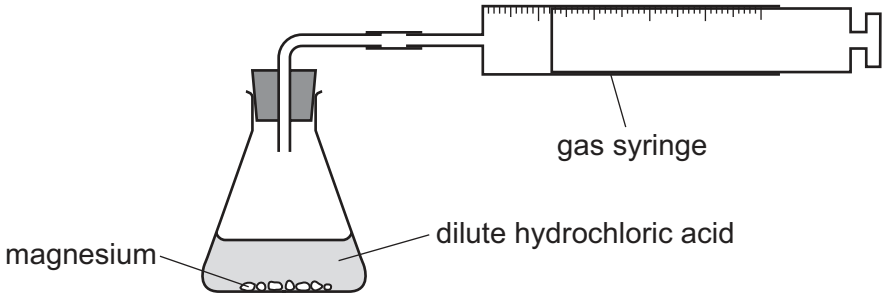
A  and 

B  and 

C  and 

D  and 

38 A student measures the rate at which a fixed mass of magnesium reacts with a fixed volume of dilute hydrochloric acid.



Which additional pieces of apparatus are required for this experiment?

A a balance, a measuring cylinder and a stop-watch only

B a balance, a measuring cylinder and a thermometer only

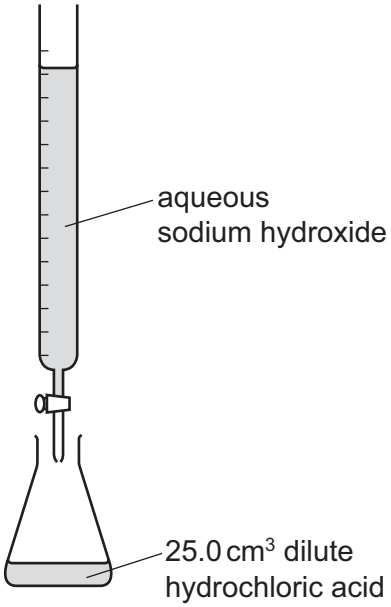
C a balance, a stop-watch and a thermometer only

D a measuring cylinder, a stop-watch and a thermometer only

39 Two titrations of dilute hydrochloric acid with aqueous sodium hydroxide are done using two different indicators, methyl orange and thymolphthalein. The equation for the reaction is shown.

$$HCl(aq) + NaOH(aq) \rightarrow NaCl(aq) + H_2O(l)$$

Using a volumetric pipette, 25.0 cm^3 dilute hydrochloric acid is added to a conical flask with a few drops of indicator. Aqueous sodium hydroxide is added from a burette to the dilute hydrochloric acid until the end-point is reached.



The end-point of the titration with each indicator occurs when 23.6 cm^3 of aqueous sodium hydroxide is added.

Which statements about this experiment are correct?

1 The methyl orange changes colour from red to yellow.

2 The thymolphthalein changes colour from blue to colourless.

3 The dilute hydrochloric acid is less concentrated than the aqueous sodium hydroxide.

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

40 What is used to separate a solid mixture of copper powder and sodium chloride to obtain pure, solid samples of each compound?

1 a suitable solvent

2 distillation

3 crystallisation

4 filtration

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

BLANK PAGE

The Periodic Table of Elements

Group																	
I	II											III	IV	V	VI	VII	VIII
							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 –

Key

atomic number
atomic symbol
name
relative atomic mass

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 dm^3 at room temperature and pressure (r.t.p.).