Cambridge Assessment International Education

Cambridge O Level

CHEMISTRY **5070/12**

Paper 1 Multiple Choice **October/November 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.

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1 Helium gas and argon gas are mixed in a closed container at room temperature and pressure (r.t.p.).

What happens when the two gases are in the container?

A Argon and helium atoms become evenly mixed throughout the container even though they have different masses.

B Argon and helium atoms both move towards the bottom of the container. The argon atoms settle more quickly because they are larger and heavier.

C Argon and helium atoms both move towards the bottom of the container. The helium atoms settle more quickly because they are smaller and lighter.

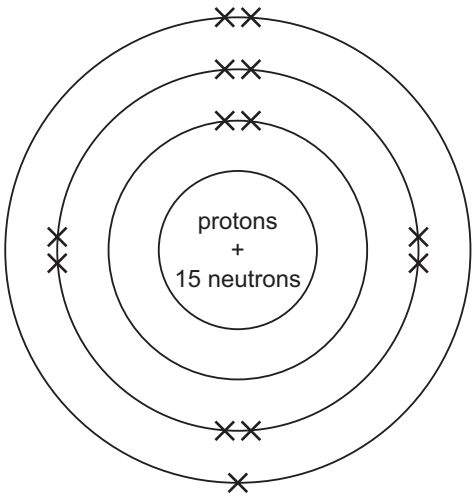
D Argon atoms move to the bottom of the container because they are heavier. Helium atoms move to the top of the container because they are lighter.

2 Substance X has a simple molecular structure and substance Y has a giant covalent structure.

Which row is correct?

	X could be	Y could be
A	an element only	an element only
B	an element only	an element or a compound
C	an element or a compound	an element only
D	an element or a compound	an element or a compound

3 The diagram shows an atom of element Z.

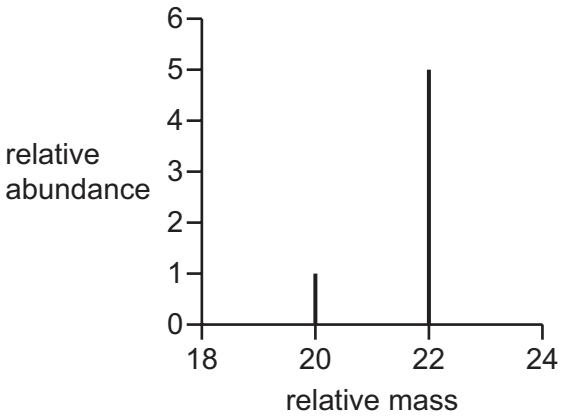


Which symbol for element Z is correct?

A $^{15}_{28}Z$ **B** $^{26}_{13}Z$ **C** $^{28}_{13}Z$ **D** $^{28}_{15}Z$

4 A sample of element Q contains two isotopes.

The diagram shows the relative abundances and relative masses of the two isotopes.



What is the relative atomic mass, A_r, of this sample of Q?

A 21.0 **B** 21.2 **C** 21.5 **D** 21.7

5 Which statement about electrical conductivity is correct?

A Covalent compounds, such as glucose, conduct when molten or dissolved in water.

B Dilute acids, such as sulfuric acid, conduct because all the ions are free to move.

C Ionic compounds, such as sodium chloride, conduct due to movement of electrons.

D Metals, such as copper, conduct due to movement of positive ions.

6 Which substance is **not** malleable and conducts electricity by the movement of electrons through a lattice of atoms?

A aqueous sodium chloride

B gold

C graphite

D solid sodium chloride

7 What is the relative molecular mass, M_r, of ethene?

A the average mass of the isotopes of C and H compared to $\frac{1}{12}$ of the mass of an atom of ^{12}C

B the atomic numbers of the isotopes of C and H compared to $\frac{1}{12}$ of the mass of an atom of ^{12}C

C twice the A_r of C plus four times the A_r of H

D twice the A_r of C plus six times the A_r of H

8 What is the relative molecular mass, M_r, of N_2O?

A 22 **B** 30 **C** 44 **D** 46

9 Which contains the greatest mass of oxygen?

A 0.2 mol of aluminium nitrate, $Al(NO_3)_3$

B 0.3 mol of potassium sulfate, K_2SO_4

C 0.4 mol of sodium nitrate, $NaNO_3$

D 0.5 mol of magnesium carbonate, $MgCO_3$

10 Compound Z contains carbon, hydrogen and oxygen only.

Compound Z contains 48.65% carbon and 8.11% hydrogen by mass.

What is the empirical formula of Z?

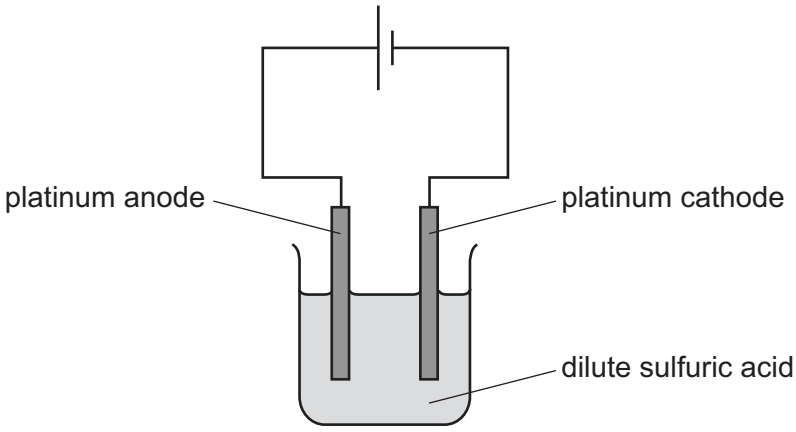
A C_2H_4O **B** $C_3H_6O_2$ **C** $C_4H_8O_3$ **D** $C_8H_{16}O_5$

11 Which fertiliser contains the highest percentage by mass of nitrogen?

[M_r: NH_4NO_3, 80; $(NH_4)_3PO_4$, 149; $(NH_4)_2SO_4$, 132; $(NH_2)_2CO$, 60]

A NH_4NO_3 **B** $(NH_4)_3PO_4$ **C** $(NH_4)_2SO_4$ **D** $(NH_2)_2CO$

12 An electrolytic cell is shown.



Which statement is correct?

A Electrons move from the cathode to the anode in the external circuit.

B Hydrogen ions gain electrons at the anode.

C In the electrolyte, positive ions move to the cathode and negative ions move to the anode.

D The hydroxide ions in the electrolyte move to the cathode.

13 An aqueous mixture of copper(II) nitrate and silver nitrate is electrolysed with pure copper electrodes.

Which ionic half-equation describes the change occurring at the anode?

A $Cu \rightarrow Cu^{2+} + 2e^-$

B $Cu^{2+} + 2e^- \rightarrow Cu$

C $Ag \rightarrow Ag^+ + e^-$

D $Ag^+ + e^- \rightarrow Ag$

14 What is a disadvantage of using a hydrogen-oxygen fuel cell to power a car?

A Gasoline / petrol is a non-renewable resource.

B The hydrogen tank may split in an accident, leading to an explosion.

C The product of the reaction between oxygen and hydrogen is toxic.

D The oxygen is obtained from air.

15 When chemical reaction X takes place, thermal energy is given out.

Which row is correct for this reaction?

	type of reaction	explanation
A	endothermic	More energy is required to break the bonds than the energy released when the bonds are formed.
B	endothermic	Less energy is required to break the bonds than the energy released when the bonds are formed.
C	exothermic	More energy is required to break the bonds than the energy released when the bonds are formed.
D	exothermic	Less energy is required to break the bonds than the energy released when the bonds are formed.

16 Which statement about a physical change is correct?

A A physical change is impossible to reverse.

B In a physical change, the appearance of a substance may change.

C New substances are formed in a physical change.

D There is no energy released or taken in during a physical change.

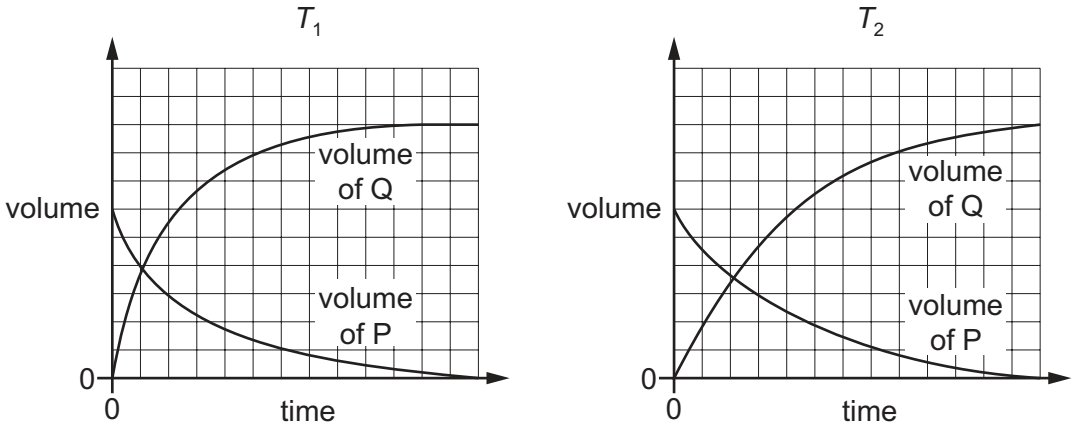
[Turn over

17 Gas P decomposes to form gas Q.

$$xP \rightarrow yQ$$

Two experiments are done to investigate the rate of reaction. The conditions are the same except that two different temperatures, T_1 and T_2, are used.

The results are plotted on graphs, drawn to the same scale.



Which row is correct?

	x	y	temperature
A	2	3	T_1 is higher than T_2
B	2	3	T_2 is higher than T_1
C	3	2	T_1 is higher than T_2
D	3	2	T_2 is higher than T_1

18 Samples of nitrogen and hydrogen are reacted and allowed to reach equilibrium. The equation is shown.

$$N_2 + 3H_2 \rightleftharpoons 2NH_3 \qquad \Delta H = -92\,\text{kJ/mol}$$

The temperature is increased and a new equilibrium is established.

Which statement about the new equilibrium is correct?

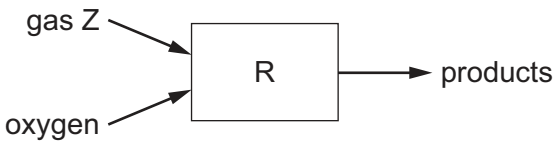
A The amount of product increases.

B The amount of product decreases.

C The rate of the forward reaction is greater than the rate of the reverse reaction.

D The rate of the forward reaction is less than the rate of the reverse reaction.

19 In the diagram, R represents one of the reactions in the Contact process.



Which statement is correct?

A Gas Z is SO_2.

B In R, an iron catalyst speeds up the reaction.

C In R, the pressure is approximately 200 atm.

D In R, the temperature is approximately 45 °C.

20 Peroxodisulfate ions, $S_2O_8^{2-}$, react with iron(II) ions, Fe^{2+}.

$$S_2O_8^{2-} + 2Fe^{2+} \rightarrow 2SO_4^{2-} + 2Fe^{3+}$$

The **only** elements that are either oxidised or reduced in this reaction are sulfur and iron.

Which row is correct?

	the element that is reduced	behaviour of $S_2O_8^{2-}$ ions
A	iron	oxidising agent
B	iron	reducing agent
C	sulfur	oxidising agent
D	sulfur	reducing agent

21 Which solid reacts with dilute hydrochloric acid to produce a gas?

A carbon

B copper

C magnesium oxide

D sodium carbonate

22 Which 1 mol / dm^3 aqueous solution has the highest pH?

A hydrochloric acid

B sodium chloride

C sodium hydroxide

D sulfuric acid

[Turn over

23 Oxide Q reacts with separate samples of dilute hydrochloric acid and aqueous potassium hydroxide.

Both reactions produce a salt and water.

Which statement is correct?

A Q is an acidic oxide.

B Q is an amphoteric oxide.

C Q is a basic oxide.

D Q is a non-metal oxide.

24 The table shows four methods used to prepare pure salts.

Which row shows a method of making a pure sample of each named salt?

	acid + carbonate	acid + metal	precipitation	titration
A	copper(II) sulfate	magnesium sulfate	silver chloride	sodium chloride
B	sodium sulfate	copper(II) sulfate	sodium chloride	silver chloride
C	potassium chloride	sodium chloride	copper(II) sulfate	magnesium sulfate
D	potassium sulfate	sodium chloride	silver chloride	copper(II) sulfate

25 Which property determines the order of the elements in the Periodic Table?

A the masses of their atoms

B the number of electrons in the outer shell

C the number of neutrons in the nucleus

D the number of protons in the nucleus

26 Which statement explains why helium and neon are unreactive?

A They are both gases at room temperature and pressure.

B They both have eight electrons in their outer shell.

C They both have equal numbers of protons and electrons in their atoms.

D They both have all their occupied electron shells completely filled.

27 Substance X conducts electricity in the solid state. Substance X is malleable.

Which statement is correct?

A X conducts electricity by the movement of electrons between layers of negative ions.

B X conducts electricity by the movement of positive ions through a giant lattice.

C X has a giant lattice of positive ions in a 'sea' of delocalised electrons.

D X has layers of atoms with delocalised electrons between the layers.

28 Aluminium and copper are good conductors of electricity.

Why is aluminium used in overhead electrical cables instead of copper?

A Aluminium is above copper in the reactivity series.

B Aluminium is less dense than copper.

C Copper does not have an oxide coating.

D Copper reacts with water.

29 The oxide of Z is reduced by heating with carbon.

What is Z?

A aluminium

B calcium

C magnesium

D zinc

30 A metal ore contains an oxide, MO.

Metal M forms coloured compounds.

When a piece of iron is placed into a solution containing aqueous M^{2+} ions, M is displaced.

Which row is correct?

	density of M	possible method of extraction of M from MO
A	high	electrolysis only
B	high	electrolysis or heating with carbon
C	high	heating with carbon only
D	low	heating with carbon only

31 Iron can be extracted from the ore hematite.

What is the maximum mass of iron that is produced from 500 kg of hematite?

[A_r: O, 16; Fe, 56]

A 160 kg **B** 240 kg **C** 350 kg **D** 420 kg

32 Which row describes an advantage and a disadvantage of fertilisers?

	advantage	disadvantage
A	deoxygenation of water	damage to aquatic life
B	deoxygenation of water	addition of nitrogen to the air
C	improved plant growth	damage to aquatic life
D	improved plant growth	addition of nitrogen to the air

33 Which row about the adverse effects of air pollutants is correct?

	methane	oxides of nitrogen	particulates
A	increased global warming	respiratory problems	cancer
B	cancer	acid rain	increased global warming
C	increased global warming	cancer	respiratory problems
D	respiratory problems	increased global warming	acid rain

34 How many different unbranched esters have the molecular formula $C_4H_8O_2$?

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

35 Petroleum is separated in a fractionating column.

Which statements are correct?

1 The compounds at the top of the column are more volatile and have lower boiling points.

2 The compounds at the bottom of the column are more viscous.

3 The chain length of the molecules at the bottom of the column are shorter than those at the top.

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

36 Which statement about hydrocarbons is correct?

A Alkenes are unsaturated which means that they are less soluble in water than alkanes.

B Alkenes contain a higher percentage by mass of carbon than alkanes.

C Cracking large alkanes produces only smaller alkanes and hydrogen.

D The presence of a double bond in an alkene means that 1 mol of alkene will react with exactly 80.0 g of bromine.

37 Two statements are shown.

1 When ethanol is made from glucose by fermentation, each glucose molecule produces two molecules of ethanol.

2 When ethanoic acid is made from ethanol, the ethanol acts as a reducing agent.

Which description of these statements is correct?

A Statements 1 and 2 are both true.

B Statement 1 is true. Statement 2 is false.

C Statement 1 is false. Statement 2 is true.

D Statements 1 and 2 are both false.

38 In a titration, a 25.0 cm^3 sample of 0.100 mol/dm^3 sodium hydroxide is exactly neutralised by 16.2 cm^3 of dilute sulfuric acid.

The equation for the reaction is shown.

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

What is the concentration of the dilute sulfuric acid?

A 0.0648 mol/dm^3

B 0.0772 mol/dm^3

C 0.154 mol/dm^3

D 0.309 mol/dm^3

39 Three liquids, X, Y and Z, are tested and the results are shown.

test	X	Y	Z
add anhydrous cobalt(II) chloride	blue to pink	no change	blue to pink
measure boiling point	100 °C	78 °C	103 °C

What may be deduced about X, Y and Z from this information?

	X is	Y is	Z is
A	impure water	not water	pure water
B	impure water	pure water	impure water
C	pure water	impure water	not water
D	pure water	not water	impure water

40 Compound Q is soluble in water.

A solution of Q gives a white precipitate when dilute sulfuric acid is added.

When Q is warmed with aqueous sodium hydroxide and aluminium foil, a gas is produced which turns damp red litmus paper blue.

What is Q?

A ammonium chloride

B ammonium nitrate

C barium chloride

D barium nitrate

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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.).