Cambridge Assessment International Education

Cambridge IGCSE™

CHEMISTRY **0620/22**

Paper 2 Multiple Choice (Extended) **October/November 2024**

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.

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1 Oxygen melts at –219 °C and boils at –183 °C.

At which temperature is oxygen a liquid?

A –225 °C **B** –189 °C **C** –175 °C **D** 25 °C

2 The pressure of a sample of gas is decreased. The temperature is kept constant.

Which row describes the effects on the particles?

	movement of particles	collisions between particles
A	slower	occur less often
B	slower	occur with more force
C	no change in speed	occur less often
D	no change in speed	occur with more force

3 Rubidium has two isotopes, $^{85}_{37}Rb$ and $^{87}_{37}Rb$.

Which statement explains why both isotopes have the same chemical properties?

A They have the same number of protons.

B They have the same electronic configuration.

C They have different numbers of neutrons.

D They have different mass numbers.

4 Which pair of elements react to form a compound with a strong attraction between oppositely charged ions?

A carbon and bromine

B carbon and nitrogen

C sodium and oxygen

D sodium and potassium

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5 Four substances, P, Q, R and S, are described.

- P is diatomic.
- Q is a good conductor of electricity when solid and when molten.
- R is a silver solid with a very high melting point.
- S reacts with oxygen to form a brown gas.

Which substances are metals?

A P and Q **B** P and S **C** Q and R **D** R and S

6 Which diagram shows the covalent bonding in a molecule of carbon dioxide?

A O–C–O **B** O=C–O **C** O=C=O **D** O≡C≡O

7 The bonding, structure and melting point of sodium chloride and sulfur dichloride are shown.

compound	bonding	structure	melting point / °C
sodium chloride	ionic	giant lattice	801
sulfur dichloride	covalent	simple molecular	–121

Why does sulfur dichloride have a lower melting point than sodium chloride?

A The covalent bonds in sulfur dichloride are weaker than the attractive forces between molecules in sodium chloride.

B The covalent bonds in sulfur dichloride are weaker than the ionic bonds in sodium chloride.

C The attractive forces between molecules in sulfur dichloride are weaker than the attractive forces between molecules in sodium chloride.

D The attractive forces between molecules in sulfur dichloride are weaker than the ionic bonds in sodium chloride.

8 Diamond and graphite have giant covalent structures of carbon atoms.

Which statement describes graphite?

A It has a strong, rigid three-dimensional structure.

B It has four strong covalent bonds between each carbon atom.

C It has layers, which can slide over each other.

D It has no delocalised electrons so does **not** conduct electricity.

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9 Which row explains the malleability and electrical conductivity of a solid metal?

	malleability	electrical conductivity
A	Delocalised electrons can move freely through the structure.	Delocalised electrons can move freely through the structure.
B	Delocalised electrons can move freely through the structure.	Positive ions can move freely through the structure.
C	Rows of positive ions can slide over each other.	Delocalised electrons can move freely through the structure.
D	Rows of positive ions can slide over each other.	Positive ions can move freely through the structure.

10 The equation for the decomposition of ammonium carbonate, $(NH_4)_2CO_3$, is shown.

$$(NH_4)_2CO_3(s) \rightarrow 2NH_3(g) + CO_2(g) + H_2O(l)$$

[M_r: $(NH_4)_2CO_3$, 96]

The **total** volume of gas produced is 360 cm^3 at r.t.p.

Which mass of ammonium carbonate, $(NH_4)_2CO_3$, is decomposed?

A 0.24 g **B** 0.48 g **C** 0.96 g **D** 1.44 g

11 What is the empirical formula of a compound that contains 3.66 g of hydrogen, 37.8 g of phosphorus and 58.5 g of oxygen?

A $H_6P_2O_6$ **B** H_4PO_4 **C** H_3PO_3 **D** HPO

12 Aqueous copper(II) sulfate is electrolysed using graphite electrodes.

Which row identifies the product and observations at each electrode during the electrolysis?

	anode		cathode	
	product	observation	product	observation
A	oxygen	bubbles of gas	copper	electrode turns pink
B	copper	electrode turns pink	oxygen	bubbles of gas
C	none	electrode dissolves	copper	electrode turns pink
D	oxygen	bubbles of gas and electrode dissolves	hydrogen	bubbles of gas

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13 Molten sodium chloride is electrolysed using inert electrodes.

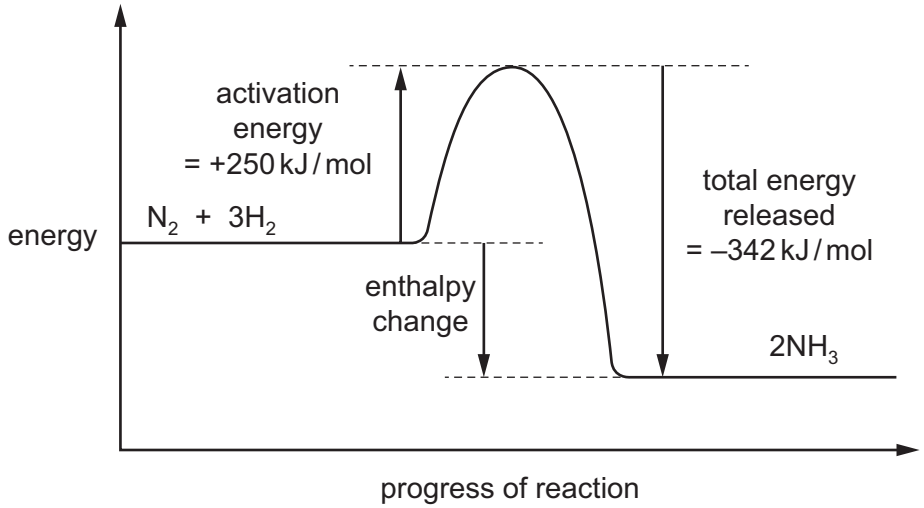
Which row shows the products formed at the cathode and anode?

	cathode	anode
A	chlorine	hydrogen
B	chlorine	sodium
C	hydrogen	chlorine
D	sodium	chlorine

14 The equation for the formation of ammonia is shown.

$$N_2 + 3H_2 \rightarrow 2NH_3$$

The reaction pathway diagram for the reaction is shown.



What is the enthalpy change for the reaction?

A –592 kJ / mol

B –92 kJ / mol

C +92 kJ / mol

D +592 kJ / mol

15 Sulfur dioxide is converted to sulfur trioxide in the Contact process.

The conditions used are 450 °C and 200 kPa with a vanadium(V) oxide catalyst.

Which row describes and explains the effect of changing conditions on the rate of reaction?

	change in conditions	effect on rate	explanation
A	no catalyst	lower	the activation energy is higher
B	higher pressure	higher	the particles have more kinetic energy
C	lower temperature	lower	the particles collide more frequently
D	lower pressure	higher	there are more particles per unit volume

16 Hydrogen gas reacts with iodine gas to form hydrogen iodide gas in an equilibrium reaction.

$$H_2(g) + I_2(g) \rightleftharpoons 2HI(g) \qquad \Delta H = +26.5\,kJ/mol$$

Which changes increase the yield of HI at equilibrium?

1 adding a catalyst

2 adding more hydrogen gas

3 increasing the pressure

4 increasing the temperature

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

17 The equation for the reaction of carbon with carbon dioxide is shown.

$$C + CO_2 \rightarrow 2CO$$

Which row identifies the carbon atom that is reduced and its change in oxidation number?

	atom that is reduced	change in oxidation number
A	carbon in CO_2	$+2 \rightarrow +4$
B	carbon in CO_2	$+4 \rightarrow +2$
C	elemental carbon, C	$0 \rightarrow +2$
D	elemental carbon, C	$+2 \rightarrow 0$

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18 Aqueous iron(II) sulfate is added to acidified potassium manganate(VII). The purple colour of the potassium manganate(VII) disappears.

Aqueous potassium iodide is added to acidified potassium dichromate(VI). A dark brown solution forms.

Which row identifies the role of the iron(II) sulfate and the potassium dichromate(VI) in these reactions?

	iron(II) sulfate	potassium dichromate(VI)
A	oxidising agent	oxidising agent
B	oxidising agent	reducing agent
C	reducing agent	reducing agent
D	reducing agent	oxidising agent

19 Which row shows the difference between a weak acid and a strong acid?

	weak acid	strong acid
A	fully dissociated	partially dissociated
B	concentrated	dilute
C	dilute	concentrated
D	partially dissociated	fully dissociated

20 Which substance turns methyl orange red?

A aqueous ammonia

B dilute hydrochloric acid

C aqueous sodium hydroxide

D distilled water

21 Which row describes zinc oxide and calcium oxide?

	zinc oxide	calcium oxide
A	basic	acidic
B	acidic	basic
C	amphoteric	acidic
D	amphoteric	basic

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22 Which row shows the properties of a transition element?

	catalyst	colour of oxide	electrical conductivity
A	yes	red	good
B	yes	green	poor
C	no	yellow	good
D	no	white	poor

23 Fluorine is the element at the top of Group VII of the Periodic Table.

Which statement describes fluorine?

A It is inert.

B It is monatomic.

C It is non-metallic.

D It is a solid at room temperature.

24 When aluminium is placed in dilute hydrochloric acid, there is no reaction.

When zinc is placed in dilute hydrochloric acid, bubbles of gas are immediately given off.

Which statement correctly explains these observations?

A Aluminium is coated with a layer of aluminium oxide.

B Aluminium is more reactive than hydrogen.

C Aluminium is less reactive than zinc.

D Zinc is less reactive than hydrogen.

25 Which statements about the use of sacrificial protection to prevent iron from rusting are correct?

1 A more reactive metal than iron is used as a sacrificial protector because it undergoes reduction before iron.

2 Zinc is used as a sacrificial protector because it gains electrons more readily than iron.

3 Copper is **not** used as a sacrificial protector because it is less reactive than iron.

4 Magnesium is used as a sacrificial protector because it loses electrons more readily than iron.

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

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26 Aluminium is extracted from its ore by electrolysis.

What is the role of cryolite in this process?

A to lower the operating temperature

B to lower the boiling point of bauxite

C to raise the melting point of bauxite

D to act as a catalyst

27 Which row identifies two greenhouse gases and three processes by which they contribute to global warming?

	two greenhouse gases	three processes
A	carbon dioxide and methane	absorption, creation and reflection of thermal energy
B	carbon dioxide and oxygen	absorption, creation and reflection of thermal energy
C	carbon dioxide and methane	absorption, emission and reflection of thermal energy
D	methane and oxygen	absorption, emission and reflection of thermal energy

28 Which mixture contains all of the elements in a typical NPK fertiliser?

A ammonium nitrate and calcium phosphate

B ammonium phosphate and potassium chloride

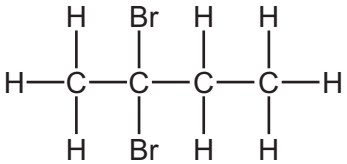
C potassium nitrate and ammonium chloride

D potassium carbonate and ammonium nitrate

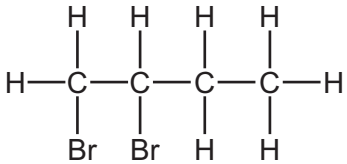
29 Bromine reacts with but-2-ene.

What is the displayed formula of the product of this reaction?

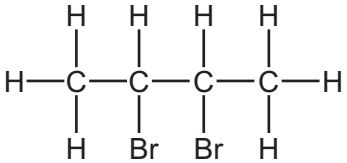
A



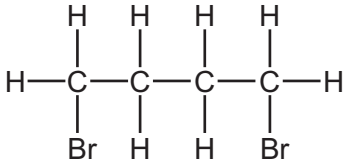
B



C



D



30 Which statement is correct?

A Bitumen is used as a fuel for ships.

B Coal, natural gas and oxygen are all fuels.

C Hydrogen is the main constituent of natural gas.

D Petroleum is separated into useful substances by fractional distillation.

31 Which statement explains why ethanoic acid is saturated?

A The molecule dissociates completely in water.

B There is a carbon–oxygen double bond in the molecule.

C The carbon–carbon bond in the molecule is a single bond.

D All the carbon–hydrogen bonds in the molecule are single bonds.

32 Which statement about compounds in the same homologous series is correct?

A They have the same chemical properties because they have the same number of carbon atoms.

B They have the same physical properties because they have the same number of carbon atoms.

C They have different chemical properties because they have different numbers of carbon atoms.

D They have different physical properties because they have different numbers of carbon atoms.

33 Which row shows the properties of methane?

	soluble in water	state at room temperature	gives a positive test with aqueous bromine
A	no	gas	no
B	no	gas	yes
C	yes	liquid	no
D	yes	liquid	yes

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34 The table shows two methods used to make ethanol.

method	type of process	conditions			source of raw material
		temperature / °C	pressure / atm	catalyst	
fermentation	batch	35	1	yeast	sugar cane
adding steam to ethene	continuous	300	60	acid	petroleum

Which statement gives an advantage of preparing ethanol by fermentation rather than by adding steam to ethene?

A Fermentation takes several days to complete.

B Little energy is used in the fermentation process.

C The fermentation of glucose from sugar cane produces pure ethanol.

D Fermentation uses a non-renewable raw material.

35 Which equation represents an addition reaction?

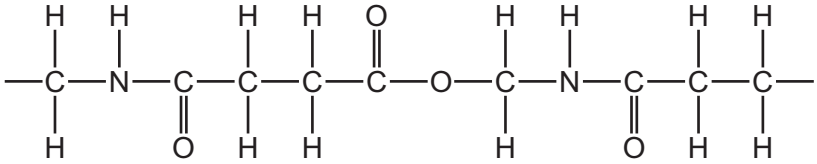
A $CH_3CHO + HCN \rightarrow CH_3CH(OH)CN$

B $C_6H_6 + Br_2 \rightarrow C_6H_5Br + HBr$

C $NH_4Br \rightarrow NH_3 + HBr$

D $C_{14}H_{30} \rightarrow C_2H_4 + C_8H_{18} + C_4H_8$

36 The structure of part of a polymer is shown.

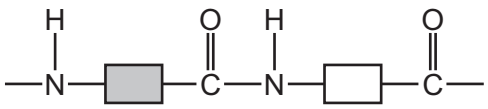


How many amide and ester linkages are included in the structure shown?

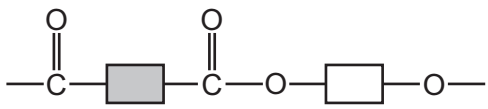
	amide linkages	ester linkages
A	1	0
B	1	1
C	2	1
D	2	2

37 Which structure represents part of a protein?

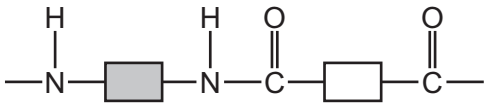
A



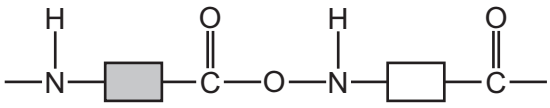
B



C



D



38 Which piece of apparatus can only measure a single fixed volume?

A a 250 cm^3 beaker

B a 50 cm^3 burette

C a 100 cm^3 measuring cylinder

D a 25 cm^3 volumetric pipette

39 Pure solid copper(II) nitrate can be obtained from a mixture of copper(II) nitrate and copper powder.

Three stages in the method are listed.

X add water and stir

Y crystallise

Z filter

After the three stages, the copper(II) nitrate is washed and dried.

What is the correct order of stages X, Y and Z to obtain pure solid copper(II) nitrate from the mixture?

A $X \rightarrow Y \rightarrow Z$ **B** $X \rightarrow Z \rightarrow Y$ **C** $Y \rightarrow X \rightarrow Z$ **D** $Z \rightarrow X \rightarrow Y$

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40 Which row describes a test and the observation for aqueous sulfate ions?

	test	observation
A	add dilute nitric acid	a gas is produced which turns limewater cloudy
B	add dilute nitric acid and aqueous barium nitrate	white precipitate forms
C	add dilute nitric acid and aqueous potassium manganate(VII)	solution decolourises
D	add dilute nitric acid and aqueous silver nitrate	white precipitate forms

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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.).