Cambridge Assessment International Education

Cambridge IGCSE™

CHEMISTRY **0620/21**

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

IB25 11_0620_21/3RP

1 A sealed balloon contains air.

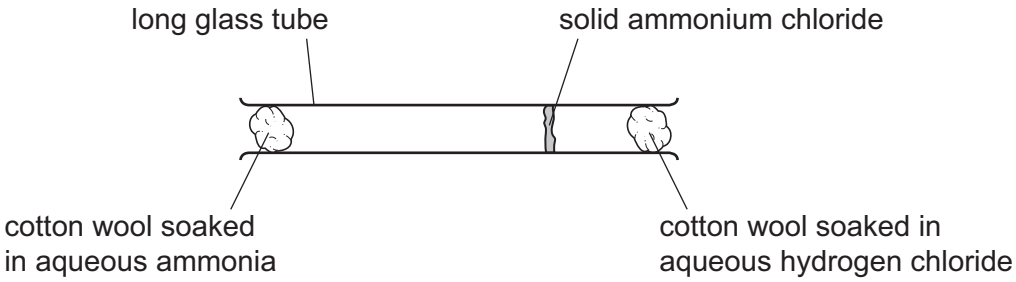
The temperature of the balloon is increased.

Which row describes how the pressure in the balloon and the kinetic energy of the particles in air change?

	pressure	kinetic energy of particles
A	decreases	decreases
B	increases	decreases
C	decreases	increases
D	increases	increases

2 Ammonia gas is reacted with hydrogen chloride gas using the apparatus shown.

Solid ammonium chloride is produced.



Which statement explains why the solid ammonium chloride is formed nearer to the hydrogen chloride?

A Aqueous ammonia is a base and aqueous hydrogen chloride is an acid.

B Ammonia molecules diffuse more slowly than hydrogen chloride molecules.

C Hydrogen chloride has a greater molecular mass than ammonia.

D Only ammonia molecules diffuse in all directions at the same time.

3 The table shows information about four different particles.

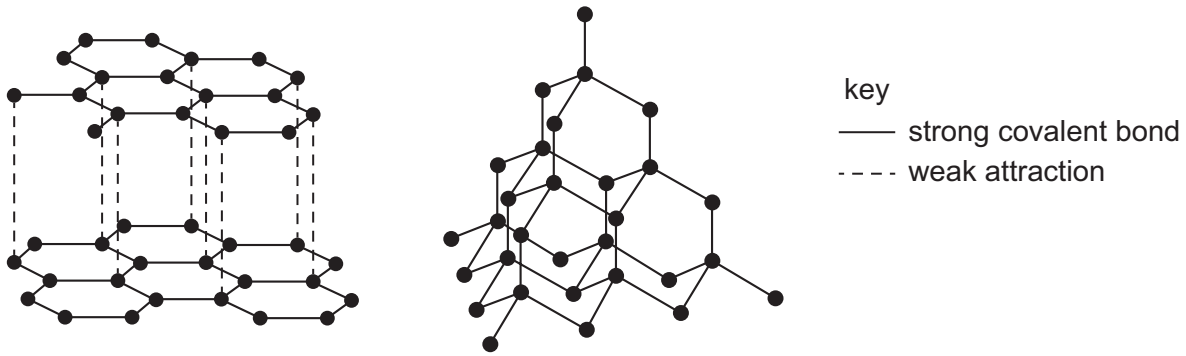
particle	nucleon number	number of protons	number of neutrons	number of electrons
Na	23	11	W	11
Na^+	23	11	12	X
O	16	8	Y	8
O^{2-}	16	8	8	Z

What are the values of W, X, Y and Z?

	W	X	Y	Z
A	11	10	10	8
B	11	11	8	10
C	12	10	8	10
D	12	11	10	8

4 Substances with giant covalent structures can be used as lubricants and as cutting tools for hard materials.

The diagrams show how the atoms are arranged in two giant covalent substances, P and Q.



P Q

Which statement is correct?

A Only P is used as a cutting tool and only Q is used as a lubricant.

B Only P is used as a lubricant and only Q is used as a cutting tool.

C P and Q are both used as cutting tools.

D P and Q are both used as lubricants.

5 Symbols representing four particles are shown.

$^{40}_{20}W$ $^{41}_{20}X^{2+}$ $^{37}_{18}Y$ $^{37}_{17}Z$

The letters are **not** the chemical symbols.

Which particles have the same number of neutrons?

A W and X^{2+} **B** W and Z **C** X^{2+} and Y **D** Y and Z

6 Which statement describes the formation of bonds in lithium bromide?

A A lithium atom donates one electron to a bromine atom.

B A bromine atom donates one electron to a lithium atom.

C A lithium atom shares a pair of electrons with a bromine atom.

D A bromine atom donates a pair of electrons to a lithium atom.

7 Which statement explains why solid magnesium is a good conductor of electricity?

A Magnesium has delocalised electrons that can move through the lattice.

B Magnesium has strong attractions between ions.

C Magnesium consists of a giant lattice of anions in a 'sea' of delocalised electrons.

D Magnesium consists of metal ions that move through the lattice.

8 The equation for the reaction between dilute ethanoic acid and aqueous lithium hydroxide is shown.

$$CH_3COOH + LiOH \rightarrow CH_3COOLi + H_2O$$

In an experiment, 20.0 cm^3 of 0.050 mol/dm^3 aqueous lithium hydroxide is exactly neutralised by 12.5 cm^3 of dilute ethanoic acid.

Which statement is correct?

A The amount of lithium hydroxide is equal to $0.050 \times \frac{1000}{20}$ mol.

B The amount of ethanoic acid reacted is 0.0010 mol.

C The concentration of the dilute ethanoic acid is 0.16 mol/dm^3.

D The volume of aqueous lithium hydroxide used is 0.20 dm^3.

9 The molecular formulae of four compounds are listed.

1 CH_4

2 C_2H_6

3 C_3H_8

4 C_3H_6

Which molecular formulae are also the empirical formulae for the compounds?

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

10 The equation for the reaction between copper(II) oxide, CuO, and ammonia is given.

$$3CuO + 2NH_3 \rightarrow 3Cu + 3H_2O + N_2$$

[M_r: CuO, 80; NH_3, 17; H_2O, 18; N_2, 28]

[A_r: Cu, 64]

Which statements about this reaction are correct?

1 80.0 g of copper(II) oxide reacts exactly with 17.0 g of ammonia.

2 4.0 g of copper(II) oxide reacts with excess ammonia to produce 3.2 g of copper.

3 The mass of water produced in this reaction is greater than the mass of nitrogen.

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

11 How many atoms are present in 1.00 mol of argon?

A 2.06×10^{23} **B** 3.02×10^{26} **C** 6.02×10^{23} **D** 6.32×10^{20}

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

Which statement is correct?

A Oxygen gas is produced at the positive electrode.

B The blue colour of the solution gradually fades.

C The concentration of copper ions in the solution stays the same.

D The mass of the negative electrode decreases.

13 Which row describes the reactions during the electrolysis of dilute aqueous sodium chloride?

	anode reaction	cathode reaction
A	$H_2 \rightarrow 2H^+ + 2e^-$	$2H_2O + O_2 + 4e^- \rightarrow 4OH^-$
B	$2H^+ + 2e^- \rightarrow H_2$	$4OH^- \rightarrow 2H_2O + O_2 + 4e^-$
C	$2H_2O + O_2 + 4e^- \rightarrow 4OH^-$	$H_2 \rightarrow 2H^+ + 2e^-$
D	$4OH^- \rightarrow 2H_2O + O_2 + 4e^-$	$2H^+ + 2e^- \rightarrow H_2$

14 Information about two reactions is given.

- The neutralisation reaction between citric acid and sodium hydrogencarbonate is endothermic.
- The displacement reaction between magnesium and carbon dioxide is exothermic.

Which statements about the two reactions are correct?

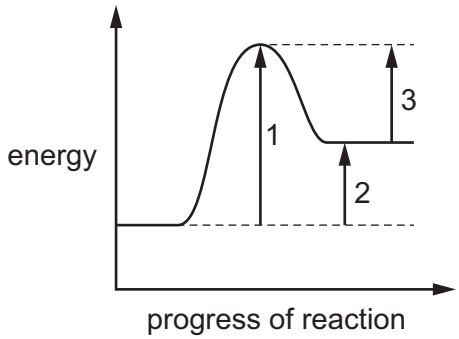
1 The energy of the products formed in the neutralisation reaction is greater than the energy of the reactants.

2 The energy of magnesium and carbon dioxide is greater than the energy of magnesium oxide and carbon.

3 In an exothermic reaction, the energy required to break the bonds is greater than the energy released when the new bonds are formed.

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

15 The reaction pathway diagram for a reaction is shown.



Which row identifies the activation energy, E_a, and the enthalpy change, ΔH, for this reaction?

	E_a	ΔH
A	1	2
B	1	3
C	2	3
D	3	1

16 Hydrogen peroxide solution decomposes very slowly at room temperature to produce oxygen gas. This gas forms a rising foam when liquid detergent is added.

Five test-tubes are half-filled with hydrogen peroxide solution. A drop of liquid detergent is added to each one.

Different metal oxides are added to four of the test-tubes and the height of the foam formed after one minute is measured. The results are shown.

metal oxide	height of foam / cm
no metal oxide added	0.1
aluminium oxide	0.1
calcium oxide	0.2
copper(II) oxide	2.3
manganese(IV) oxide	5.4

Which conclusion can be drawn from these results?

A Metal oxides do **not** affect the rate of this reaction.

B All metal oxides increase the rate of this reaction and act as catalysts.

C Manganese(IV) oxide is the best catalyst of the four metal oxides tested.

D Only transition element oxides increase the rate of this reaction.

17 Which equation represents one of the reactions in the Contact process?

A $2SO_2(g) + O_2(g) \rightleftharpoons 2SO_3(g)$

B $2SO_2(g) + O_2(g) \rightleftharpoons 2SO_3(aq)$

C $2SO_3(g) + O_2(g) \rightleftharpoons 2SO_4(aq)$

D $2SO_3(g) + O_2(g) \rightleftharpoons 2SO_4(g)$

18 The ionic equation for the redox reaction between acidified manganate(VII) ions and iodide ions is shown.

$$2MnO_4^-(aq) + 16H^+(aq) + 10I^-(aq) \rightarrow 2Mn^{2+}(aq) + 5I_2(aq) + 8H_2O(l)$$

Which row shows the changes in oxidation number for manganese and for iodine during this reaction?

	manganese		iodine	
	from	to	from	to
A	–2	+4	–1	0
B	–2	+4	–10	+5
C	+7	+2	–1	0
D	+7	+2	–10	+5

19 In the Haber process, nitrogen and hydrogen react to form ammonia.

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

The forward reaction is exothermic.

Which changes in pressure and temperature increase the yield of ammonia?

	change in pressure	change in temperature
A	decrease	decrease
B	decrease	increase
C	increase	decrease
D	increase	increase

20 Which statement describes a property of ethanoic acid?

A It does **not** produce carbon dioxide when added to sodium carbonate.

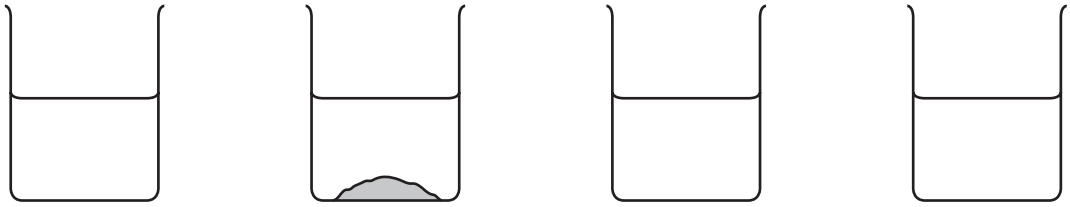
B It does **not** produce hydrogen when added to magnesium.

C It only donates some of its protons when added to excess aqueous sodium hydroxide.

D It only partially dissociates when added to water.

21 A student adds different solid salts to an excess of water. The student stirs the mixtures to determine the solubilities of the salts.

The results are shown.



What could the four different salts be?

	W	X	Y	Z
A	calcium sulfate	lead(II) chloride	ammonium nitrate	potassium sulfate
B	ammonium nitrate	sodium carbonate	calcium sulfate	lead(II) chloride
C	sodium carbonate	calcium sulfate	potassium sulfate	ammonium nitrate
D	lead(II) chloride	ammonium nitrate	sodium carbonate	calcium sulfate

22 Four metal oxides are listed.

1 Al_2O_3

2 CaO

3 CuO

4 ZnO

Which metal oxides are amphoteric?

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

23 The ions formed when element X and element Y react together are shown.

- Element X forms X^- ions.
- Element Y forms Y^{2+} ions.

Which row identifies the position of X and of Y in the Periodic Table?

	X	Y
A	Group I	Group VI
B	Group VII	Group II
C	Group VII	Group VI
D	Group I	Group II

24 Which properties decrease down the group of alkali metals?

1 melting point
2 density
3 reactivity

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

25 Some halide ions are displaced from aqueous potassium halides by halogens.

In which mixtures are the halide ions displaced?

1 potassium bromide and chlorine
2 potassium bromide and iodine
3 potassium iodide and chlorine
4 potassium chloride and iodine

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

26 What is the correct order of reactivity of the following metals, from least reactive to most reactive?

A calcium → magnesium → zinc → copper

B copper → zinc → magnesium → calcium

C copper → zinc → calcium → magnesium

D zinc → copper → magnesium → calcium

27 The equation for the reaction between aluminium and iron(III) oxide is shown.

$$2Al + Fe_2O_3 \rightarrow Al_2O_3 + 2Fe$$

Which statement about this reaction is correct?

A The aluminium acts as an oxidising agent.

B It shows that iron is more reactive than aluminium.

C The oxidation number of the aluminium decreases during the reaction.

D It shows that aluminium has a greater tendency to form ions than iron.

28 Which row identifies methods used to prevent iron from rusting?

	greasing	painting	washing with distilled water
A	✓	✗	✓
B	✗	✓	✓
C	✓	✓	✗
D	✓	✓	✓

key

✓ = yes

✗ = no

29 Which statement about the extraction of aluminium by electrolysis is correct?

A Aluminium oxide is dissolved in molten cryolite to increase its melting point.

B At the cathode, oxygen ions lose electrons to form oxygen gas.

C The carbon in the graphite anode reacts with oxygen gas forming carbon dioxide.

D The reaction at the anode is $Al^{3+} + 3e^- \rightarrow Al$.

30 Catalytic converters are used to remove oxides of nitrogen from exhaust gases.

The equation represents one of the reactions that occur in a catalytic converter.

$$2NO + 2CO \rightarrow N_2 + 2CO_2$$

What is a disadvantage of using a catalytic converter to remove oxides of nitrogen?

A CO is an essential reactant in photosynthesis.

B CO_2 is a greenhouse gas.

C N_2 is acidic.

D N_2 is toxic.

31 Some gases are present in clean, dry air, while other gases are **only** present in polluted air.

Which row is correct?

	a gas present in clean, dry air	a gas **only** present in polluted air
A	argon	carbon dioxide
B	argon	nitrogen dioxide
C	sulfur dioxide	carbon dioxide
D	sulfur dioxide	nitrogen dioxide

32 Petroleum is separated by fractional distillation.

Which statement about the fractions produced is correct?

A Bottled gas for heating and cooking is obtained from the naphtha fraction.

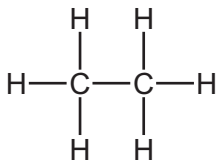
B Diesel oil is used as a fuel for jet aircraft.

C Substances used to make polishes are obtained from the lubricating fraction.

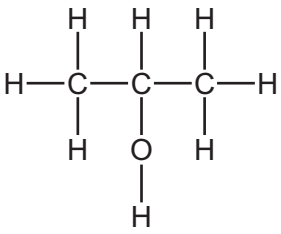
D The kerosene fraction contains many useful waxes.

33 Which structure represents a compound in the alcohol homologous series?

A



B



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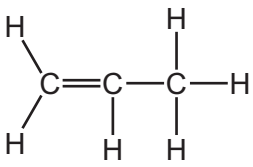
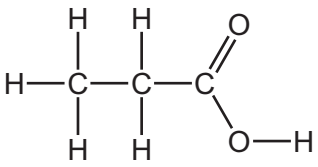


D



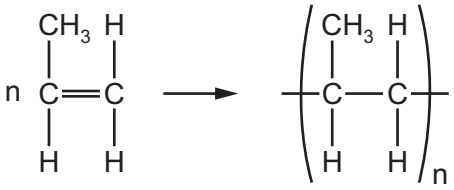
34 Ethane reacts with chlorine.

Which row identifies the type of reaction and the formulae of the products formed?

	reaction	products
A	addition	CH_3CH_2Cl + H_2
B	addition	CH_3CH_2Cl + HCl
C	substitution	CH_3CH_2Cl + HCl
D	substitution	CH_3CH_2Cl + H_2

35 Which equation represents the formation of poly(propene) from propene?

A



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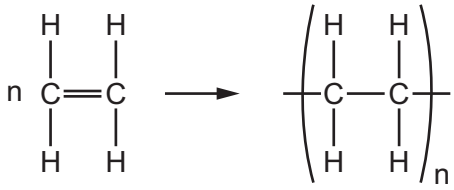
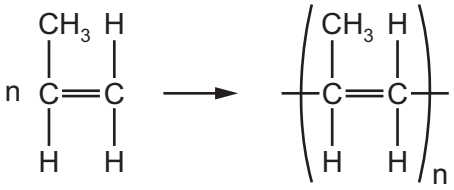
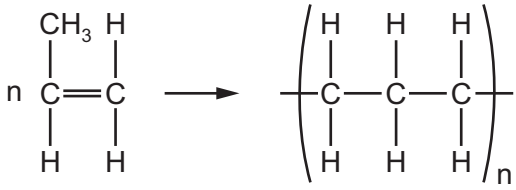


C



D



36 Ethene reacts with hydrogen in an addition reaction to form ethane.

Which catalyst is used for this reaction?

A iron

B nickel

C vanadium(V) oxide

D yeast

37 What is produced by the bacterial oxidation of ethanol?

A ethene

B sodium ethanoate

C ethyl ethanoate

D vinegar

38 Which statement about addition polymers or condensation polymers is correct?

A Addition polymers only contain carbon and hydrogen atoms.

B One of the monomers used to make a polyester is a diamine.

C Addition polymers contain carbon–carbon double bonds in the main chain.

D Water is an additional product in the formation of a protein from amino acids.

39 The results of flame tests on three metal salts, X, Y and Z, are shown.

metal salt	flame test colour
X	yellow
Y	lilac
Z	blue-green

Which row identifies the cations present in X, Y and Z?

	X	Y	Z
A	potassium	sodium	calcium
B	potassium	sodium	copper
C	sodium	potassium	calcium
D	sodium	potassium	copper

40 Ethanol can be made by fermentation of sugar, using yeast.

This produces a mixture of ethanol and water.

How is ethanol separated from this mixture?

A distilling the mixture using a fractionating column

B filtering the mixture

C heating to evaporate most of the water, and allowing the ethanol to crystallise

D heating to evaporate the water

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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.).