Cambridge Assessment International Education

Cambridge IGCSE™

CHEMISTRY **0620/21**

Paper 2 Multiple Choice (Extended) **October/November 2022**

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.

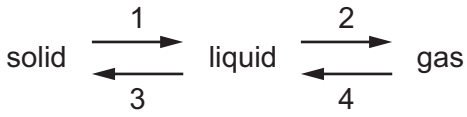
INFORMATION

- 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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[Turn over

1 The diagram shows the changes of state between a solid, a liquid and a gas.



In which changes of state is energy being given out?

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

2 A coloured dye is separated by chromatography.

One component of the dye moves a distance of 13 cm and has an R_f value of 0.86.

Which distance did the solvent front move?

A 6.6 cm **B** 11.9 cm **C** 15.1 cm **D** 21.6 cm

3 A mixture contains salt, sand and sulfur.

Salt dissolves in water but not in xylene.

Sulfur dissolves in xylene but not in water.

Sand does not dissolve in water or xylene.

What is the order of the processes used to separate the salt, the sand and the sulfur from the mixture?

A add water → filter → add xylene to the filtrate → filter

B add water → filter → add xylene to the residue → filter

C add xylene → filter → add water to the filtrate → filter

D add xylene → filter → add xylene to the residue → filter

4 Which statements about isotopes of the same element are correct?

1 They are atoms which have the same chemical properties because they have the same number of electrons in their outer shell.

2 They are atoms which have the same number of electrons and neutrons but different numbers of protons.

3 They are atoms which have the same number of electrons and protons but different numbers of neutrons.

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

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5 Which type of structure and bonding is present in an element that is malleable and conducts electricity?

A covalent molecular

B ionic lattice

C covalent macromolecular

D metallic lattice

6 Which statements about potassium bromide are correct?

1 It has a high melting point.

2 It dissolves in water.

3 It conducts electricity when solid.

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

7 Which substance has a similar structure to silicon(IV) oxide?

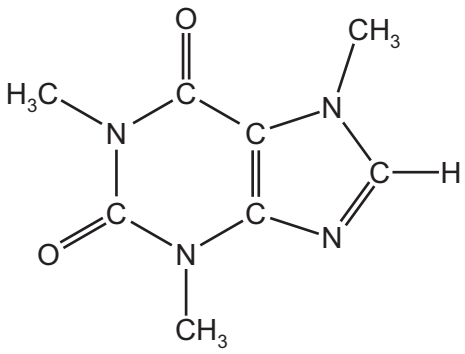
A carbon dioxide

B diamond

C graphite

D sodium oxide

8 Caffeine is a stimulant found in coffee.



caffeine

Which formula represents caffeine?

A $C_7H_{10}N_4O_2$ **B** $C_8H_{10}N_3O_2$ **C** $C_8H_{10}N_4O_2$ **D** $C_8H_{11}N_4O_2$

9 4.55 g of zinc is reacted with 50 cm^3 of 2.25 mol / dm^3 dilute hydrochloric acid.

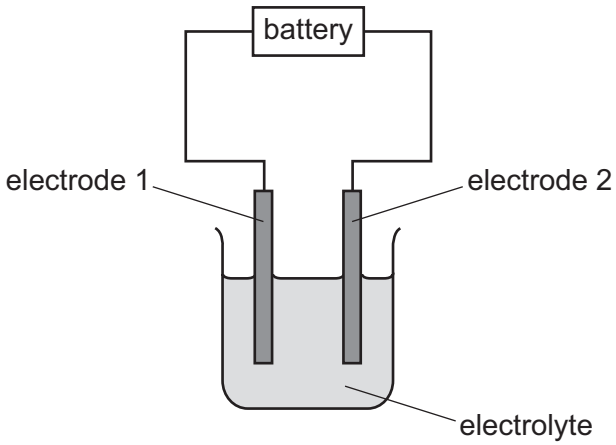
The equation for the reaction is shown.

$$Zn + 2HCl \rightarrow ZnCl_2 + H_2$$

Which volume of hydrogen gas, at room temperature and pressure, is produced in the reaction?

A 1.35 dm^3 **B** 1.67 dm^3 **C** 2.70 dm^3 **D** 3.34 dm^3

10 In the electrolysis diagram, oxidation is occurring at electrode 1 and reduction at electrode 2.



Which row shows the directions of movement of the electrons in the external circuit and of the positive ions in the electrolyte?

	direction of movement of electrons in external circuit	direction of movement of positive ions in electrolyte
A	1 → 2	1 → 2
B	1 → 2	2 → 1
C	2 → 1	1 → 2
D	2 → 1	2 → 1

11 When an acid is added to an alkali, the temperature of the reaction mixture rises.

Which words describe this reaction?

A decomposition and endothermic

B decomposition and exothermic

C neutralisation and endothermic

D neutralisation and exothermic

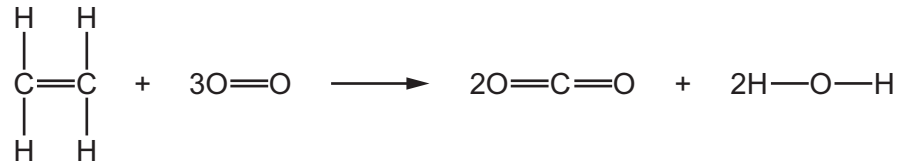
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12 Some properties of four fuels are shown.

Which fuel is a gas at room temperature and makes two products when it burns in a plentiful supply of air?

	fuel	formula	melting point / °C	boiling point / °C
A	hydrogen	H_2	–259	–253
B	methane	CH_4	–182	–164
C	octane	C_8H_{18}	–57	126
D	wax	$C_{31}H_{64}$	60	400

13 Ethene can undergo complete combustion, as shown.



Some bond energies are given in the table.

bond	bond energy in kJ / mol
C=C	612
C–H	412
O–H	463
O=O	496

The energy change of the reaction is –1408 kJ / mol.

What is the bond energy of the C=O bond in CO_2?

A 454 kJ / mol **B** 673 kJ / mol **C** 826 kJ / mol **D** 1619 kJ / mol

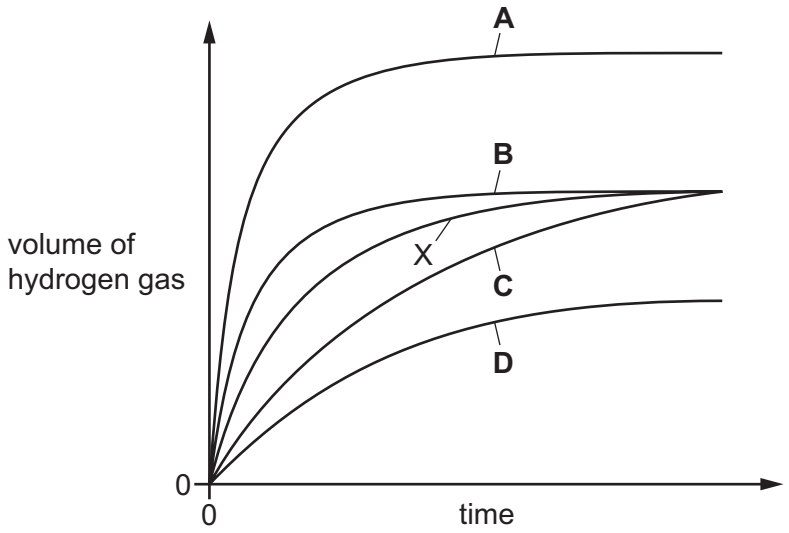
14 A student adds excess zinc to dilute hydrochloric acid at 25 °C.

The hydrogen gas produced is collected and measured at room temperature and pressure.

The results are plotted and labelled as curve X on the graph.

The experiment is repeated at 50 °C with all other conditions remaining the same.

Which graph shows the results at 50 °C?



15 Dinitrogen tetroxide, N_2O_4, is converted into nitrogen dioxide, NO_2, in a reversible reaction.

$$N_2O_4(g) \rightleftharpoons 2NO_2(g)$$

The forward reaction is endothermic.

Which conditions give the highest equilibrium yield of nitrogen dioxide?

	pressure / atmospheres	temperature
A	2	high
B	2	low
C	50	high
D	50	low

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16 When magnesium is heated with zinc oxide a reaction occurs.

The equation is shown.

$$Mg + ZnO \rightarrow MgO + Zn$$

Which substance is oxidised?

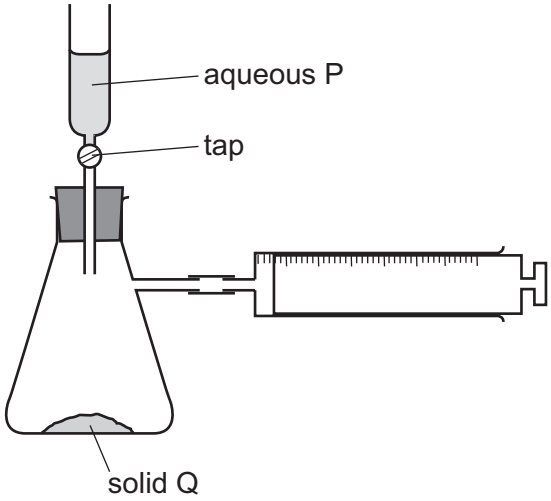
A magnesium

B magnesium oxide

C zinc

D zinc oxide

17 The diagram shows an experiment.



A small volume of aqueous P is poured on to solid Q and the tap of the funnel closed.

Which pairs of substances cause the syringe to fill with gas?

	HNO_3 and Mg	HCl and Cu	H_2SO_4 and Na_2CO_3
A	✓	✓	✓
B	✓	✓	✗
C	✓	✗	✓
D	✗	✓	✓

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[Turn over

18 Ethanoic acid reacts with water to produce an acidic solution.

Which row describes the roles of ethanoic acid and water in this reaction?

	ethanoic acid	water
A	accepts a proton	donates a proton
B	accepts an electron	donates an electron
C	donates a proton	accepts a proton
D	donates an electron	accepts an electron

19 Aqueous ammonium sulfate is made by reacting aqueous ammonia with dilute sulfuric acid.

How is solid ammonium sulfate obtained from the resulting solution?

A crystallisation

B distillation

C filtration

D solvent extraction

20 Carbon forms two oxides: carbon monoxide, CO, and carbon dioxide, CO_2.

Which row describes these two oxides?

	CO	CO_2
A	acidic	acidic
B	acidic	neutral
C	neutral	acidic
D	neutral	neutral

21 Group II elements show the same trends as Group I elements.

Which statement about elements in Group II is correct?

A The melting point of barium is higher than the melting point of calcium.

B Barium is more reactive than beryllium.

C Strontium would not react with oxygen.

D Magnesium is more dense than barium.

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22 Some information about properties of Group I elements is shown.

element	melting point / °C	density in g / cm^3
lithium	181	0.53
sodium	98	0.97
potassium	X	
rubidium	Y	Z

What are the values for X, Y and Z?

	X	Y	Z
A	63	252	0.26
B	63	39	0.26
C	39	63	1.53
D	63	39	1.53

23 Which statements describe properties of transition elements?

1 They form coloured compounds.

2 They have variable oxidation states.

3 They have low densities.

4 They are volatile.

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

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

A Aluminium is extracted from its ore, cryolite.

B Aluminium is formed at the positive electrode.

C Bauxite is used to lower the temperature of the extraction process.

D Graphite is used for both the positive and negative electrodes.

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25 Copper(II) nitrate and zinc carbonate are heated strongly in separate test-tubes.

Which row identifies the gases produced?

	copper(II) nitrate	zinc carbonate
A	oxygen and nitrogen dioxide	carbon dioxide only
B	oxygen and nitrogen dioxide	carbon dioxide and oxygen
C	nitrogen dioxide only	carbon dioxide and oxygen
D	nitrogen dioxide only	carbon dioxide only

26 Iron from a blast furnace can be converted to steel.

Which statements about steel are correct?

1 Steel contains more carbon than the iron obtained from the blast furnace.

2 Steel is produced by blowing oxygen through the iron.

3 Calcium oxide is added to molten iron to remove basic oxides.

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

27 Which metal is used to galvanise steel?

A copper

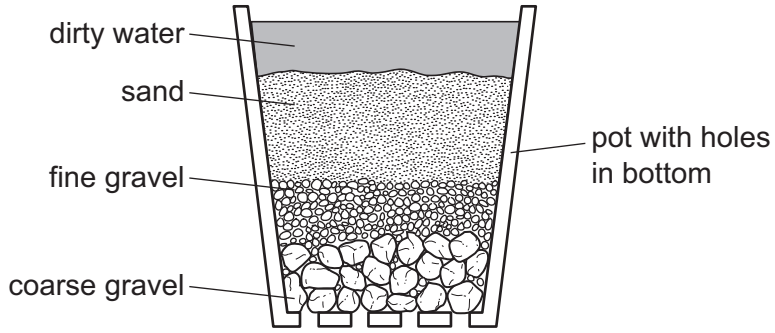
B lead

C tin

D zinc

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28 The diagram shows a stage in the purification of dirty water.



Which process does this apparatus show?

A chlorination

B condensation

C distillation

D filtration

29 Which substance in polluted air damages stonework and kills trees?

A carbon dioxide

B carbon monoxide

C lead compounds

D sulfur dioxide

30 Which row explains why a high temperature and an iron catalyst are used in the manufacture of ammonia by the Haber process?

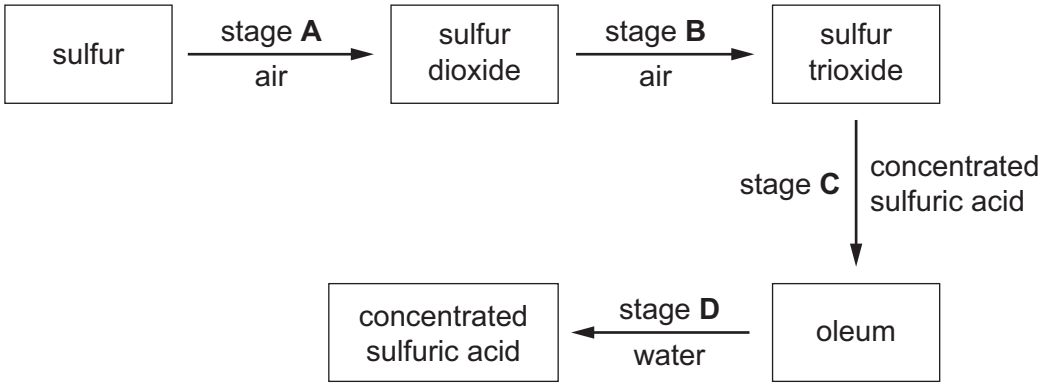
	high temperature	iron catalyst
A	increases the rate of the reaction	increases the equilibrium yield of ammonia
B	increases the rate of the reaction	increases the rate of the reaction
C	increases the equilibrium yield of ammonia	increases the equilibrium yield of ammonia
D	increases the equilibrium yield of ammonia	increases the rate of the reaction

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[Turn over

31 The scheme shows four stages in the conversion of sulfur to sulfuric acid.

In which stage is a catalyst used?



32 Which element has an oxide that is used as a food preservative?

A helium

B hydrogen

C iron

D sulfur

33 Which substance gives off carbon dioxide on heating?

A lime

B limestone

C limewater

D slaked lime

34 Which formula represents ethanol?

A CH_3CH_3 **B** CH_2CH_2 **C** CH_3CH_2OH **D** CH_3COOH

35 Which statement about structural isomers is correct?

A They have the same structure but different reactivity.

B They have the same general formula but a different number of carbon atoms in their molecules.

C They have the same structure but different relative molecular masses.

D They have different structures but the same numbers of each type of atom.

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36 Which formula is the same in methanol, ethanol and propanol?

A empirical formula

B general formula

C molecular formula

D structural formula

37 Ethene reacts with water under suitable conditions.

Which statement about this reaction is correct?

A The product of this reaction has an M_r of 46.

B The reaction produces two different products.

C The reaction occurs when ethene gas is bubbled into cold water in the presence of an acid catalyst.

D The reaction is a redox reaction.

38 Ethanoic acid is made by reacting ethanol with acidified potassium manganate(VII).

Which type of reaction occurs when ethanol reacts with acidified potassium manganate(VII)?

A displacement

B fermentation

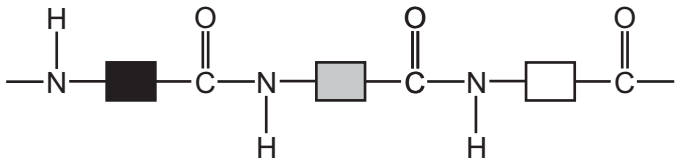
C oxidation

D neutralisation

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39 Which structure represents *Terylene*?

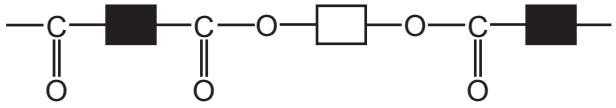
A



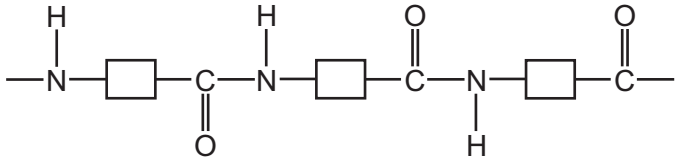
B



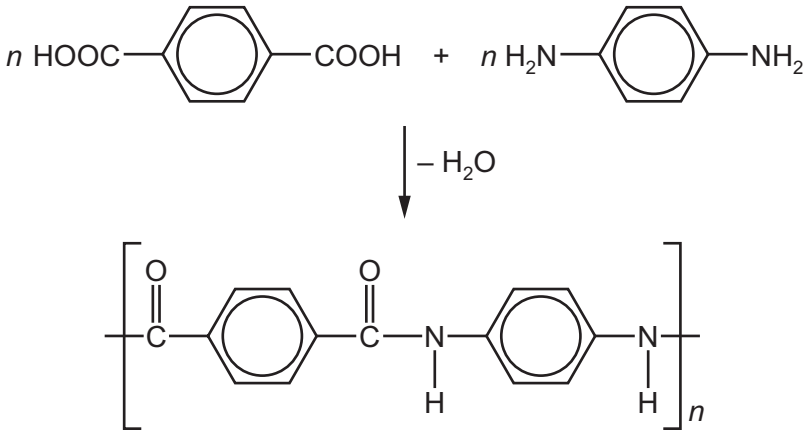
C



D



40 The equation shows the formation of a polymer called *Kevlar*.



Which row describes *Kevlar*?

	how the polymer is formed	type of polymer
A	addition polymerisation	polyamide
B	addition polymerisation	polyester
C	condensation polymerisation	polyamide
D	condensation polymerisation	polyester

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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 –		114 Fl flerovium –		116 Lv livermorium –		

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.).