

Cambridge IGCSE[™]

CHEMISTRY

Paper 2 Multiple Choice (Extended)

February/March 2021 45 minutes

0620/22

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 20 pages. Any blank pages are indicated.

1 Which row about a change of state is correct?

	change of state	energy change	process
Α	solid \rightarrow liquid	heat given out	melting
В	gas $ ightarrow$ liquid	heat taken in	evaporation
С	solid \rightarrow gas	heat taken in	sublimation
D	liquid \rightarrow solid	heat given out	condensing

2 Gases are separated from liquid air by fractional distillation.

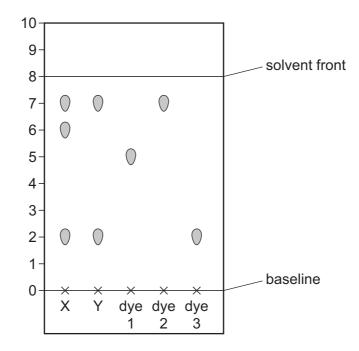
The boiling points of four gases are shown.

Which gas is both monoatomic and a liquid at -200 °C?

	gas	boiling point/°C
Α	argon	-186
в	helium	-269
С	neon	-246
D	nitrogen	-196

Three pure dyes, 1, 2 and 3, are also tested.

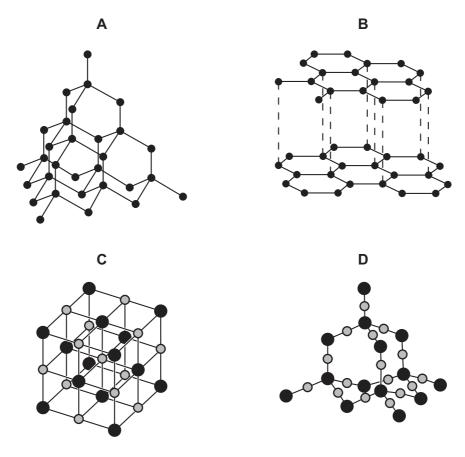
The chromatogram is shown.



Which statements are correct?

- 1 X and Y both contain two or more dyes.
- 2 Dyes 2 and 3 are present in both X and Y.
- 3 The $R_{\rm f}$ of dye 1 is 0.625.
- A 1 and 2 only B 1 and 3 only C 1, 2 and 3 D 2 and 3 only
- 4 Which statement about the atoms of all the isotopes of carbon is correct?
 - **A** They are all radioactive.
 - **B** They have the same mass.
 - **C** They have the same number of neutrons.
 - **D** They have the same number of electrons in the outer shell.

5 Which diagram represents the structure of silicon(IV) oxide?



6 Lithium and fluorine react to form lithium fluoride.

A student writes three statements about the reaction.

- 1 Lithium atoms lose an electron when they react.
- 2 Each fluoride ion has one more electron than a fluorine atom.
- 3 Lithium fluoride is a mixture of elements.

Which statements are correct?

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

7 How many electrons are used to form covalent bonds in a molecule of methanol, CH₃OH?

A 5 **B** 6 **C** 8 **D** 10

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8 Magnesium oxide has a high melting point.

Carbon dioxide has a low melting point.

Which row identifies the attractive forces that are broken when these compounds are melted?

	magnesium oxide	carbon dioxide
Α	strong attractions between molecules	weak attractions between atoms
в	strong attractions between molecules	weak attractions between molecules
С	strong attractions between ions	weak attractions between atoms
D	strong attractions between ions	weak attractions between molecules

9 The ionic half-equation for the formation of oxygen during the electrolysis of aluminium oxide is shown.

$$xO^{2-} \rightarrow O_2 + ye^-$$

What are the values of *x* and *y*?

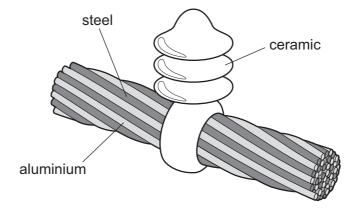
	x	У
Α	1	2
В	1	4
С	2	2
D	2	4

10 A compound has the formula XF_2 and has a relative mass of 70.

What is element X?

- A gallium
- B germanium
- C sulfur
- D ytterbium

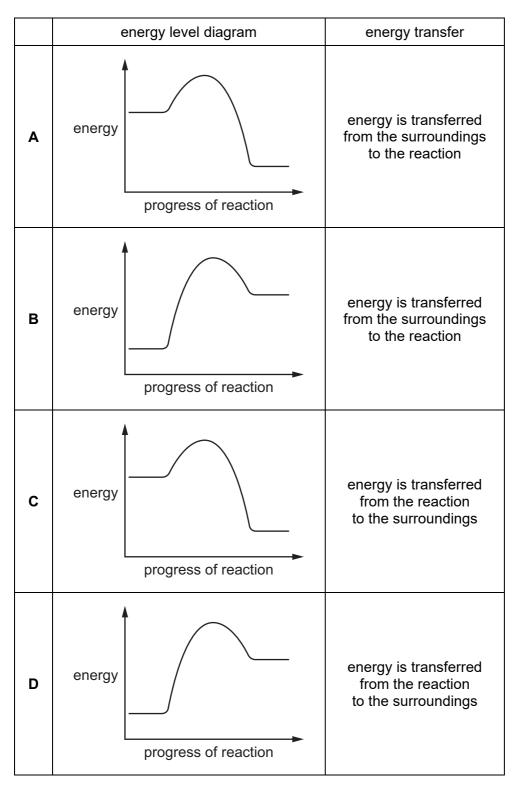
11 The diagram shows a section of an overhead power cable.



Which statement explains why a particular substance is used?

- A Aluminium has a low density and is a good conductor of electricity.
- **B** Ceramic is a good conductor of electricity.
- **C** Steel can rust in damp air.
- **D** Steel is more dense than aluminium.
- **12** During the electrolysis of dilute sulfuric acid, hydrogen is collected at the cathode.

What is the ionic half-equation for this reaction?



7

13 Which row describes an endothermic reaction?

14 The equation for the complete combustion of methane is shown.

$$CH_4(g) + 2O_2(g) \rightarrow CO_2(g) + 2H_2O(g)$$

The bond energies are shown in the table.

bond	bond energy in kJ/mol
C–H	+410
C=O	+805
O–H	+460
O=0	+496

What is the energy change for the reaction?

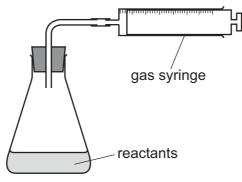
A -818 kJ/mol B -359 kJ/mol C -323 kJ/mol D +102 kJ/mol

15 Hydrogen fuel cells can be used to power cars.

Which statements about a fuel cell are correct?

- 1 The balanced equation for the reaction is $H_2 + O_2 \rightarrow H_2O$.
- 2 The fuel cell generates electricity.
- 3 In the fuel cell hydrogen is reduced.
- 4 The reactants are gases at room temperature.
- **A** 1 and 2 **B** 1 and 3 **C** 2 and 4 **D** 3 and 4

16 The apparatus shown is used to measure the rate of a reaction.



Which equation represents a reaction where the rate can be measured using this apparatus?

- **A** Mg(s) + 2HC $l(aq) \rightarrow MgCl_2(aq) + H_2(g)$
- **B** HCl(aq) + NaOH(aq) \rightarrow NaCl(aq) + H₂O(I)
- $\label{eq:constraint} \mbox{C} \quad \mbox{Fe}(s) \ + \ \mbox{CuSO}_4(aq) \ \rightarrow \ \mbox{Cu}(s) \ + \ \mbox{FeSO}_4(aq)$
- $\textbf{D} \quad 2Na(s) \ + \ Br_2(I) \ \rightarrow \ 2NaBr(s)$
- **17** P is a hydrated metal salt with a blue colour. When P is heated, water is given off, leaving solid Q.

R is a hydrated metal salt with a pink colour. When R is heated, water is given off, leaving solid S.

Which row gives the name of P and the colour of S?

	name of P	colour of S
Α	hydrated cobalt(II) chloride	blue
в	hydrated cobalt(II) chloride	white
С	hydrated copper(II) sulfate	blue
D	hydrated copper(II) sulfate	white

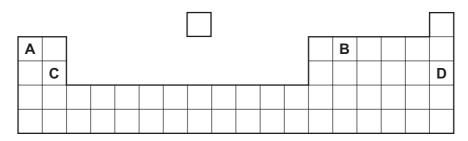
18 Magnesium reacts with copper(II) oxide to give magnesium oxide and copper.

Which substance is the oxidising agent in this reaction?

- A copper
- **B** copper(II) oxide
- C magnesium
- D magnesium oxide

19 Part of the Periodic Table is shown.

Which element forms an acidic oxide?



20 When aqueous sodium hydroxide is added to a solution of a metal ion, a grey-green precipitate forms, which dissolves in excess to form a dark green solution.

What is the identity of the metal ion?

- **A** chromium(III)
- **B** iron(II)
- **C** iron(III)
- **D** copper(II)
- 21 Which statements about strong acids are correct?
 - 1 They have a high concentration of OH^- ions.
 - 2 They have a pH value of 1.
 - 3 They completely ionise in water.
 - 4 They turn red litmus blue.

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

22 Metal X reacts with non-metal Y to form an ionic compound with the formula X_2Y .

Which statements are correct?

- 1 X is in Group I of the Periodic Table.
- 2 X is in Group II of the Periodic Table.
- 3 Y is in Group VI of the Periodic Table.
- 4 Y is in Group VII of the Periodic Table.
- A 1 and 3 B 1 and 4 C 2 and 3 D 2 and 4

element	density g/cm ³	boiling point /°C
carbon	2.2	4827
silicon		
germanium	5.3	2830
tin	5.8	2270
lead	11.3	1755

11

23 The table gives some properties of Group IV elements.

Which row describes the properties of silicon?

	density g/cm³	boiling point /°C
Α	2.3	3 265
в	3.1	1 997
С	6.2	2920
D	24.6	11682

24 The metal beryllium does not react with cold water.

It reacts with hydrochloric acid but cannot be extracted from its ore by using carbon.

Where is beryllium placed in the reactivity series?

- 25 Why is cryolite used in the extraction of aluminium from bauxite?
 - **A** as a catalyst for the process
 - **B** as a solvent for aluminium oxide
 - **C** it stops the carbon anodes burning away
 - D it reduces aluminium ions in aluminium oxide

- 26 Which statements about the uses of metals are correct?
 - 1 Iron is used to make aircraft because iron has a low density.
 - 2 Copper is used to make electric cables because copper is a good conductor of electricity.
 - 3 Aluminium is used to make brass because aluminium is strong and hard.
 - 4 Iron is mixed with additives to make an alloy used in chemical plant.

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

27 Which row describes the reactions of magnesium hydroxide and magnesium oxide?

	effect of heat on hydroxide	effect of heating oxide with carbon
Α	forms magnesium oxide	magnesium and carbon dioxide formed
в	forms magnesium oxide	no reaction
С	no reaction	magnesium and carbon dioxide formed
D	no reaction	no reaction

28 The properties of an element are listed.

Its melting point is 3414 °C.

Some of its compounds are catalysts.

It has variable oxidation states.

Where is the element found in the Periodic Table?

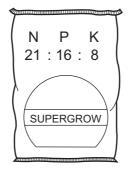
- A alkali metals
- B halogens
- C noble gases
- D transition elements
- **29** Petrol burns in a car engine to produce waste gases which leave through the car exhaust.

One of these waste gases is an oxide of nitrogen.

Which statement describes how this oxide of nitrogen is formed?

- A Carbon dioxide reacts with nitrogen in the catalytic converter.
- **B** Nitrogen reacts with oxygen in the car engine.
- **C** Nitrogen reacts with oxygen in the catalytic converter.
- **D** Petrol combines with nitrogen in the car engine.

30 Which combination of chemical compounds can be used to produce the fertiliser shown?



- **A** (NH₄)₃PO₄, KC*l*
- **B** NH₄NO₃, Ca₃(PO₄)₂
- **C** NH_4NO_3 , $CO(NH_2)_2$
- **D** NH₄NO₃, K₂SO₄, (NH₄)₂SO₄
- 31 Which process does not produce carbon dioxide?
 - A combustion of a hydrocarbon
 - **B** photosynthesis
 - C reaction between an acid and a metal carbonate
 - **D** respiration
- 32 Which substance is used as a bleach in the manufacture of paper?
 - A carbon dioxide
 - B nitrogen dioxide
 - C silicon dioxide
 - D sulfur dioxide
- 33 What is an industrial use of calcium carbonate?
 - **A** cracking of hydrocarbons
 - **B** manufacture of aluminium
 - C manufacture of cement
 - D purification of water

- **34** Propane reacts with chlorine.

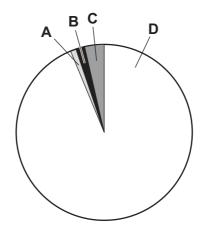
Which row shows a condition required for this reaction and identifies the type of reaction?

14

	condition	type of reaction
Α	phosphoric acid catalyst	addition
в	phosphoric acid catalyst	substitution
С	ultraviolet light	addition
D	ultraviolet light	substitution

35 The pie chart represents the composition of natural gas.

Which sector represents methane?



- 36 Which statement describes the reaction between ethene and steam?
 - A a cracking reaction which produces ethane and hydrogen gas as products
 - **B** an addition reaction which produces ethanol as the only product
 - **C** an oxidation reaction which produces ethanoic acid as the only product
 - D a slow reaction producing ethanol and carbon dioxide

37 The formula of a hydrocarbon is C_xH_y .

The equation for its complete combustion is shown.

$$C_xH_y$$
 + $8O_2 \rightarrow 5CO_2$ + $6H_2O$

What are the values of x and y?

	х	у
Α	5	6
в	5	12
С	6	5
D	12	5

38 The formula of an ester is $CH_3CH_2CH_2COOCH_2CH_2CH_3$.

Which acid and alcohol react together to make the ester?

	acid	alcohol	
Α	butanoic acid	butanol	
В	butanoic acid	propanol	
С	propanoic acid butanol		
D	propanoic acid	propanol	

39 Molecule 1 undergoes a process to make molecule 2.

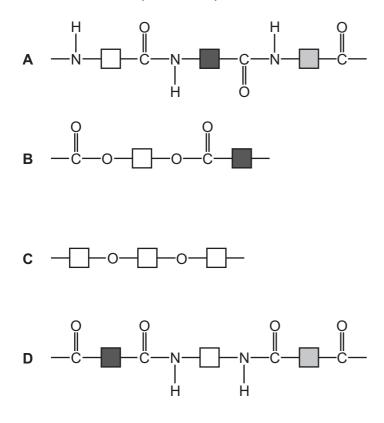
molecule 1 — molecule 2

Which row describes the molecules and the process?

	molecule 1	process	molecule 2	
Α	monomer	cracking	polymer	
в	monomer	polymerisation	polymer	
С	small molecule	polymerisation	monomer	
D	small molecule	cracking	monomer	

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40 Which structure represents a protein?



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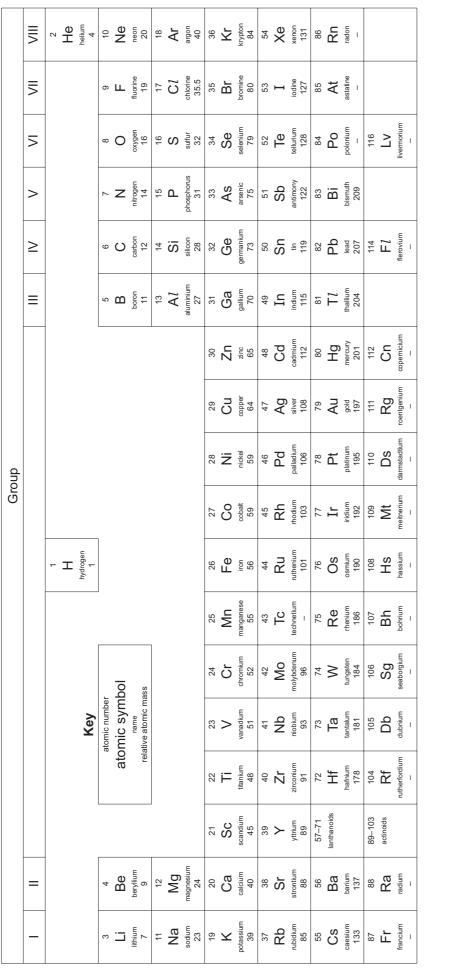
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The Periodic Table of Elements



71	Lu	Iutetium 175	103	Ļ	lawrencium	I	
70	٩۲	ytterbium 173	102	No	nobelium	I	
69	Tm	thulium 169	101	Md	mendelevium	I	
68	ц	erbium 167	100	Еm	fermium	I	
67	Ч	holmium 165	66	Es	einsteinium	I	
66	D	dysprosium 163	98	ç	californium	I	
65	Tb	terbium 159	97	凝	berkelium	I	
64	Gd	gadolinium 157	96	Cm	curium	I	
63	Eu	europium 152	95	Am	americium	I	
62	Sm	samarium 150	94	Pu	plutonium	I	
61	Pm	promethium -	93	ЧN	neptunium	I	
60	Nd	neodymium 144	92		uranium	238	
59	Pr	praseodymium 141	91	Ра	protactinium	231	
58	Ce	cerium 140	06	Th	thorium	232	
57	La	lanthanum 139	89	Ac	actinium	I	
	lanthanoids			actinoids			

The volume of one mole of any gas is 24 dm³ at room temperature and pressure (r.t.p.).

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