Cambridge Assessment International Education

Cambridge IGCSE™

CHEMISTRY **0620/12**

Paper 1 Multiple Choice (Core) **February/March 2023**

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 The arrangements of particles in solids, liquids and gases are different.

Which statement about the molecules in ice, water or steam is correct?

A The H_2O molecules are on average closest together in steam.

B The H_2O molecules are on average furthest apart in water.

C The H_2O molecules in steam have the second highest average velocity.

D The H_2O molecules in ice are able to vibrate.

2 The melting points and boiling points of three elements, at 1 atm pressure, are shown.

	melting point / °C	boiling point / °C
argon	–189	–186
nitrogen	–210	–196
oxygen	–218	–183

Separate samples of argon, nitrogen and oxygen are stored at –200 °C and at 1 atm pressure.

How many samples are liquids?

A 0 **B** 1 **C** 2 **D** 3

3 Which statement describes a compound?

A It contains two or more elements chemically combined.

B It contains two or more elements physically combined.

C It contains two or more elements forming an alloy.

D It contains two or more elements that can easily be separated.

4 Which statement about elements in the Periodic Table is correct?

A A potassium ion, K^+, has the same electronic configuration as a chloride ion, Cl^-.

B The electronic configuration of a Ca^{2+} ion is 2,8,8,2.

C The halogens are in Group VI and so their atoms have six electrons in their outer shell.

D Magnesium is in Period 3 and so a magnesium ion, Mg^{2+}, has three occupied electron shells.

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5 Which statement about ions and ionic bonds is correct?

A Bromine atoms form negatively charged bromide ions.

B Ionic bonds form between elements in Group VII of the Periodic Table.

C Positive ions are formed when atoms lose protons.

D Potassium iodide contains negatively charged potassium ions.

6 Which molecule has only two shared pairs of electrons?

A CH_4 **B** Cl_2 **C** HCl **D** H_2O

7 Which statement about graphite explains why it is used as an electrode?

A It contains ions.

B It has a giant covalent structure.

C It is a metal.

D It has mobile electrons.

8 Methane, CH_4, burns in air to form carbon dioxide and water.

What is the balanced equation for this reaction?

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

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

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

D $CH_4(g) + 3O_2(g) \rightarrow CO_2(g) + 2H_2O(g)$

9 Magnesium reacts with steam.

$$Mg + H_2O \rightarrow MgO + H_2$$

When 2.43 g of magnesium reacts with an excess of steam, the products are 4.03 g of magnesium oxide and 0.20 g of hydrogen.

What is produced when 7.29 g of magnesium reacts with an excess of steam?

A 1.34 g of magnesium oxide and 0.07 g of hydrogen

B 4.03 g of magnesium oxide and 0.20 g of hydrogen

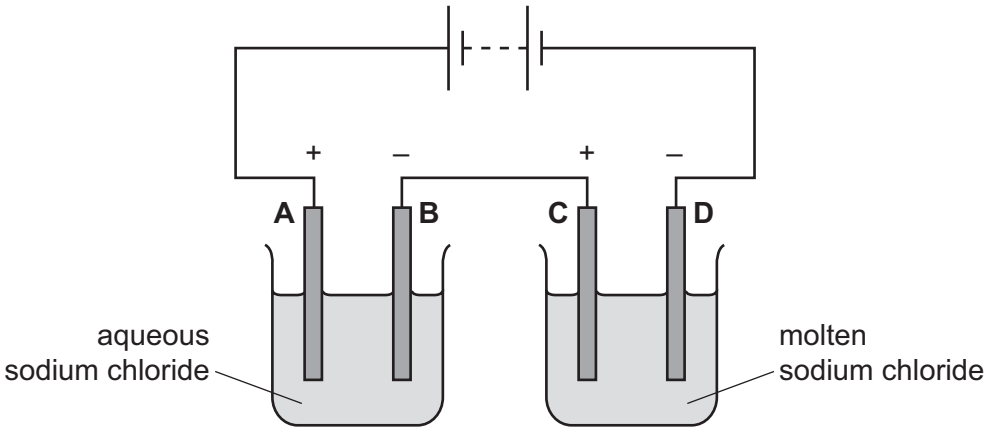
C 8.06 g of magnesium oxide and 0.40 g of hydrogen

D 12.09 g of magnesium oxide and 0.60 g of hydrogen

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10 The diagram shows an electrolysis circuit.

At which electrode is hydrogen formed?



11 Which gases are used to generate electricity in a fuel cell?

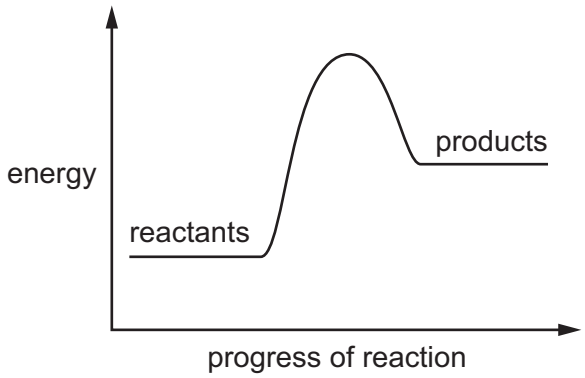
A carbon dioxide and oxygen

B hydrogen and methane

C hydrogen and oxygen

D methane and carbon dioxide

12 The reaction pathway diagram for a reaction is shown.



Which statements about the reaction are correct?

1 The reaction is endothermic.

2 The reaction is exothermic.

3 The diagram represents the combustion of methane.

4 The diagram represents the thermal decomposition of limestone.

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

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13 Which row describes a chemical change?

	new substances are made	there is a change of state
A	always	always
B	always	sometimes
C	never	always
D	never	sometimes

14 Magnesium powder reacts with an excess of dilute hydrochloric acid to produce hydrogen gas.

Which statements about this reaction are correct?

1 The smaller the particles of magnesium powder, the more slowly the hydrogen is produced.

2 The higher the temperature, the faster the magnesium powder disappears.

3 The lower the concentration of dilute hydrochloric acid, the faster the rate of reaction.

4 The faster the magnesium powder disappears, the faster the rate of reaction.

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

15 Which statement about hydrated cobalt(II) chloride is correct?

A It turns blue when it is heated.

B It turns blue when water is added to it.

C It turns pink when water is added to it.

D It turns white when it is heated.

16 An aqueous solution reacts with a solid. The products are an alkaline gas, a salt and water.

What are the aqueous solution and the solid?

	aqueous solution	solid
A	sodium hydroxide	magnesium carbonate
B	hydrochloric acid	magnesium carbonate
C	hydrochloric acid	ammonium chloride
D	sodium hydroxide	ammonium chloride

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17 Both calcium oxide, CaO, and calcium hydroxide, $Ca(OH)_2$, are used to remove sulfur dioxide, SO_2, from flue gases in industrial plants.

Which row classifies calcium oxide, calcium hydroxide and sulfur dioxide?

	calcium oxide	calcium hydroxide	sulfur dioxide
A	acidic	acidic	basic
B	acidic	basic	acidic
C	basic	acidic	acidic
D	basic	basic	acidic

18 Copper(II) sulfate is prepared by adding excess copper(II) carbonate to sulfuric acid.

Why is an **excess** of copper(II) carbonate added?

A to ensure all the copper(II) carbonate has reacted

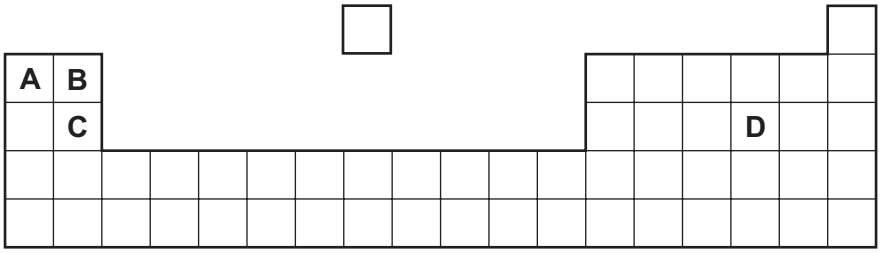
B to ensure all the sulfuric acid has reacted

C to increase the rate of reaction

D to increase the amount of copper(II) sulfate produced

19 Part of the Periodic Table is shown.

Which element has two electrons in its outer shell and three electron shells?



20 Some information about element X is given.

- melting point = 64 °C
- density = 0.86 g / cm^3
- vigorous reaction with water

Where in the Periodic Table is X placed?

A Group 0

B Group I

C Group VII

D transition metals

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21 The properties of the element titanium, Ti, can be predicted from its position in the Periodic Table.

Which row identifies the properties of titanium?

	can be used as a catalyst	conducts electricity when solid	has low density	forms coloured compounds
A	✓	✓	✓	✗
B	✓	✓	✗	✓
C	✓	✗	✓	✓
D	✗	✓	✓	✓

22 Which description of brass is correct?

A a compound of copper and zinc

B a compound of copper and tin

C a mixture of copper and zinc

D a mixture of copper and tin

23 What is the symbol of the metal used in the manufacture of aircraft because of its low density?

A Al **B** Cu **C** Fe **D** Zn

24 Which property of stainless steel makes it suitable for making cutlery?

A It conducts electricity.

B It has a high melting point.

C It is resistant to rusting.

D It is ductile.

25 Which substances react to form hydrogen gas?

1 calcium and water

2 silver and dilute hydrochloric acid

3 magnesium and steam

4 zinc and dilute hydrochloric acid

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

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26 Some statements about the reactions of the metals tin, lithium and manganese are listed.

- Tin does not react with steam but does react with dilute hydrochloric acid.
- Lithium reacts with cold water.
- Manganese does not react with cold water but does react with steam.

What is the order of reactivity of the three metals?

	least reactive →		most reactive
A	lithium	manganese	tin
B	tin	lithium	manganese
C	manganese	tin	lithium
D	tin	manganese	lithium

27 Which substances are required for iron to rust?

A oxygen and salt

B oxygen only

C water and oxygen

D water and salt

28 Coke (carbon) and limestone are two raw materials used in the extraction of iron from hematite.

Which type of reaction occurs when each substance is heated during the process?

	coke	limestone
A	redox	redox
B	redox	thermal decomposition
C	thermal decomposition	redox
D	thermal decomposition	thermal decomposition

29 Water is treated at a waterworks to make it safe to drink.

What is present in the water when it leaves the waterworks?

A bacteria and insoluble substances

B bacteria only

C soluble substances, including chlorine compounds

D chlorine compounds only

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30 The formulae of four compounds, W, X, Y and Z, are given.

compound	formula
W	$FeSO_4$
X	$(NH_4)_3PO_4$
Y	KNO_3
Z	$NaCl$

Which compounds are mixed to create a fertiliser containing the three elements necessary for improved plant growth?

A W and X **B** W and Z **C** X and Y **D** Y and Z

31 Some combustion reactions produce pollutant gases.

Which reactions produce a pollutant gas that is **not** present in clean air?

1 $2CH_4 + 3O_2 \rightarrow 2CO + 4H_2O$

2 $2H_2 + O_2 \rightarrow 2H_2O$

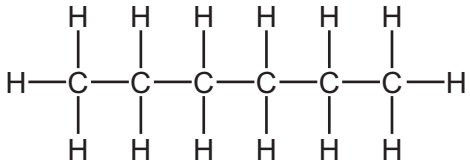
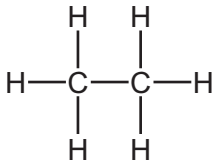
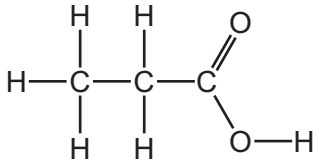
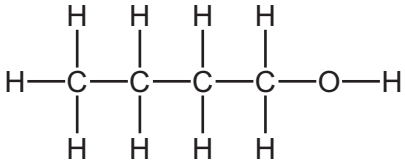
3 $C + O_2 \rightarrow CO_2$

4 $N_2 + O_2 \rightarrow 2NO$

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

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32 Which row identifies the homologous series to which the molecular structure belongs?

	molecular structure	homologous series
A		alkane
B		alkene
C		alcohol
D		carboxylic acid

33 Petroleum is fractionally distilled at an oil refinery.

The table shows some fractions and uses.

	fraction	use
1	gasoline	fuel for ships
2	refinery gas	lubrication
3	naphtha	making chemicals
4	kerosene	jet fuel

Which rows identify a use for the fraction listed?

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

34 What is the word equation for the preparation of ethanol?

A glucose → ethanol + carbon dioxide

B glucose + yeast → ethanol + water

C ethane + water → ethanol

D ethene + water → ethanol + carbon dioxide

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35 Which row describes properties of aqueous ethanoic acid?

	pH	effect of adding magnesium	effect of adding sodium carbonate
A	1	reacts to form hydrogen	reacts to form carbon dioxide and water only
B	4	reacts to form hydrogen	reacts to form a salt, carbon dioxide and water
C	5	no reaction	reacts to form a salt, carbon dioxide and water
D	8	no reaction	reacts to form carbon dioxide and water only

36 Which row describes the relative sizes of monomer and polymer molecules?

	monomer	polymer
A	large	large
B	large	small
C	small	large
D	small	small

37 2.00 g of powdered calcium carbonate is added to 50.0 cm^3 of hydrochloric acid.

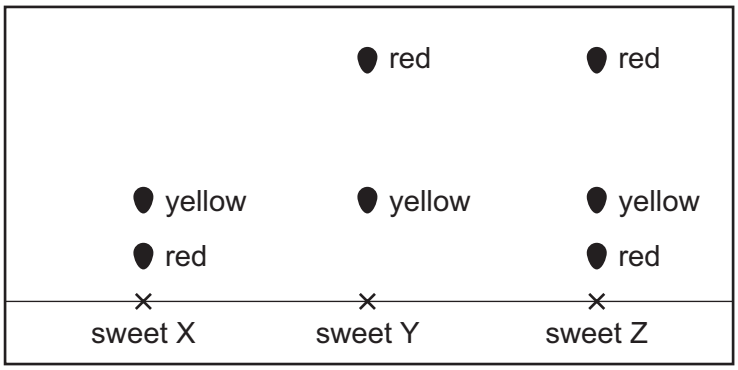
Which apparatus is used to measure these quantities of calcium carbonate and hydrochloric acid?

	calcium carbonate	hydrochloric acid
A	balance	burette
B	balance	thermometer
C	pipette	burette
D	pipette	thermometer

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38 The diagram shows a chromatogram obtained from the colours of three different sweets, X, Y and Z.



How many different **red** dyes are present in the sweets?

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

39 A mixture contains sand and an aqueous solution of sodium chloride.

Which processes are used to obtain a sample of solid sand **and** a sample of solid sodium chloride from the mixture?

A crystallisation followed by filtration

B evaporation followed by filtration

C filtration followed by crystallisation

D simple distillation followed by crystallisation

40 A student tests an unknown compound M.

The compound:

- produces a lilac flame using a flame test
- produces a gas which turns limewater cloudy when dilute hydrochloric acid is added.

What is M?

A sodium sulfate

B sodium carbonate

C potassium sulfate

D potassium carbonate

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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.).