Cambridge Assessment International Education

Cambridge IGCSE™

CHEMISTRY **0620/11**

Paper 1 Multiple Choice (Core) **October/November 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.

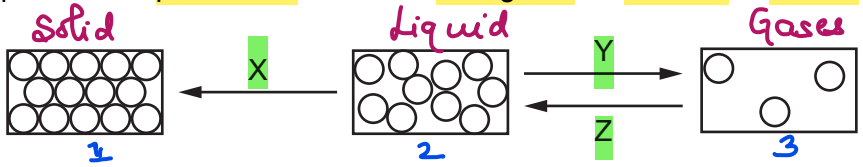
This document has **16** pages. Any blank pages are indicated.

[Turn over

Solid, Liquid, Gases

1 The three rectangles show the arrangements of the particles in each of the three states of matter.

X, Y and Z represent the processes needed to change from one state to another.



What are the processes X, Y and Z?

	X	Y	Z
A	melting	condensing	evaporating
B	evaporating	melting	freezing
C	melting	freezing	condensing
D	freezing	evaporating	condensing

2 Which substance is a pure compound?

A air → mixture of gases

B brass → alloy

C ethanol

D petroleum → mixture

3 The Group I element potassium (metal) forms an ionic bond with the Group VII element fluorine (non-metal).

K = 2, 8, 8, 1
F = 2, 7

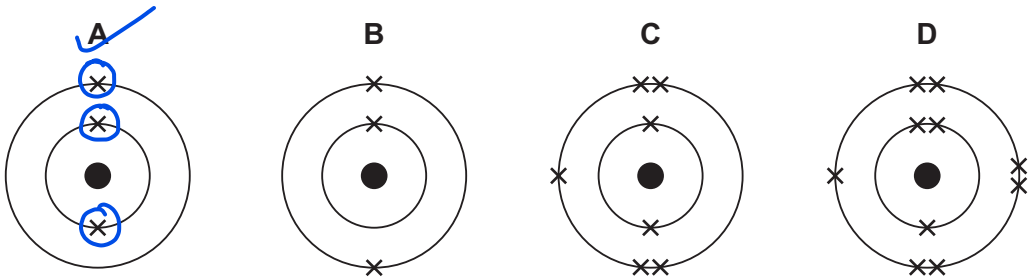
Which two ions are produced?

A K^+ and F^+ **B** K^+ and F^- **C** K^- and F^- **D** K^- and F^+

4 An isotope of lithium has the symbol $^{7}_{3}Li$.

Li = 2, 1

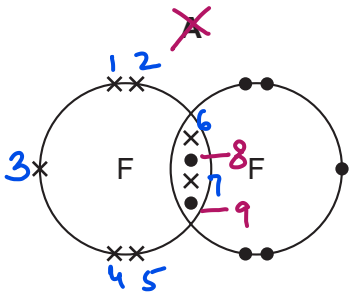
What is the arrangement of electrons in one atom of this isotope of lithium?



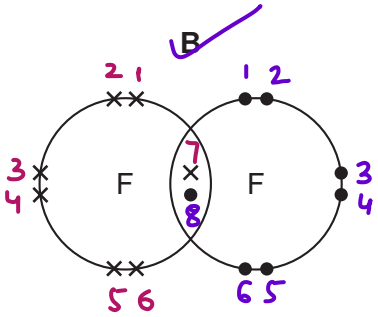
5 Fluorine, F_2, is in the same group of the Periodic Table as chlorine, Cl_2.

Which diagram represents the arrangement of the outer-shell electrons in a molecule of fluorine?

A



B



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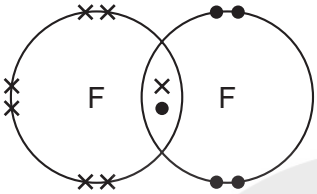

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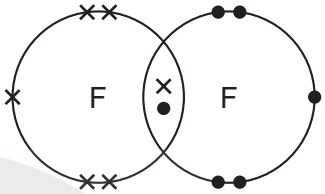


6 Which use of graphite depends on the layers of carbon atoms being able to slide over each other?

A cutting tools

B electrodes

C jewellery

D lubricant

7 Which equations are balanced?

1 $Fe_2O_3 + 3CO \rightarrow 2Fe + 3CO_2$

2 $ZnCO_3 + 2HCl \rightarrow ZnCl_2 + CO_2 + 2H_2O$

3 $Mg(NO_3)_2 + NaOH \rightarrow Mg(OH)_2 + 2NaNO_3$

4 $CaCO_3 + H_2SO_4 \rightarrow CaSO_4 + H_2O + CO_2$

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

8 The equation for the combustion of methane is shown.

$1CH_4 + 2O_2 \rightarrow CO_2 + 2H_2O$

Which mass of methane produces 36 g of water?

A 16 g **B** 18 g **C** 32 g **D** 64 g

9 What is produced at each electrode during the electrolysis of aqueous solutions using inert electrodes?

	positive electrode (anode)	negative electrode (cathode)
A	metals or hydrogen	non-metals only
B	metals or oxygen	non-metals only
C	non-metals only	metals or hydrogen
D	non-metals only	metals or oxygen

10 Which statement about a hydrogen-oxygen fuel cell in a car is correct?

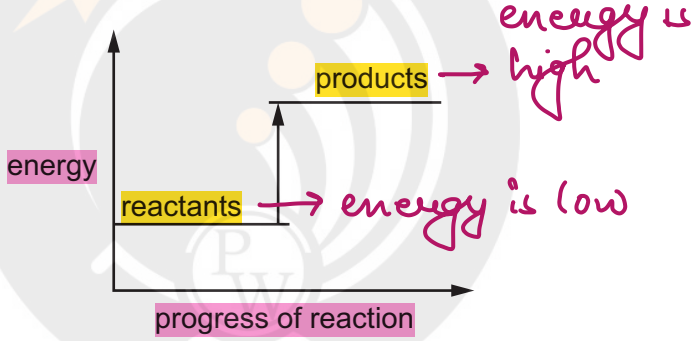
A The fuel cell produces heat, which powers the car.

B The fuel cell is supplied with hydrogen directly from the air.

C The only emission from the fuel cell is nitrogen gas, which is non-polluting.

D The fuel cell produces electricity, which powers an electric motor.

11 The reaction pathway diagram for a reaction is shown.



Which statements are correct?

1 The reaction is exothermic.

2 The reaction is endothermic.

3 The temperature of the surroundings increases.

4 The temperature of the surroundings decreases.

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

12 Which process involves a chemical change?

A adding sodium to water

B boiling water

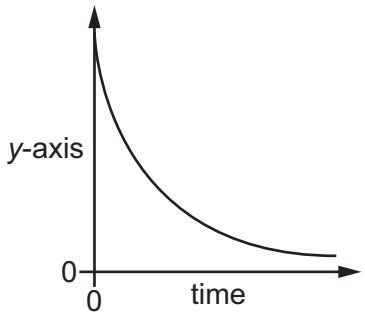
C dissolving sodium chloride in water

D producing water from aqueous sodium chloride

13 An experiment is carried out to find the rate of reaction between hydrochloric acid and zinc.

$$Zn(s) + 2HCl(aq) \rightarrow ZnCl_2(aq) + H_2(g)$$

The results of the experiment are shown.



What is the label on the *y*-axis?

A amount of $ZnCl_2$ produced

B concentration of HCl

C mass of Zn reacted

D volume of H_2 produced

14 Solid S changes colour from white to blue when water is added.

What is S?

A anhydrous cobalt(II) chloride

B anhydrous copper(II) sulfate

C hydrated cobalt(II) chloride

D hydrated copper(II) sulfate

15 Which equation shows the reduction of copper?

A $CuO + C \rightarrow Cu + CO$

B $2CuS + 3O_2 \rightarrow 2CuO + 2SO_2$

C $Cu(g) \rightarrow Cu(l)$

D $Cu(l) \rightarrow Cu(s)$

16 Which solids react with dilute sulfuric acid to form aqueous magnesium sulfate?

1 magnesium
2 magnesium hydroxide
3 magnesium nitrate
4 magnesium oxide

$Mg + H_2SO_4 \rightarrow MgSO_4 + H_2\uparrow$

$Mg(OH)_2 + H_2SO_4 \rightarrow MgSO_4 + 2H_2O$

$Mg(NO_3)_2 + H_2SO_4 \rightarrow MgSO_4 + 2HNO_3$

$MgO + H_2SO_4 \rightarrow MgSO_4 + H_2O$.

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

17 Which statements about an aqueous acid are correct?

1 Ammonia is formed when solid ammonium nitrate is added to an aqueous acid.
2 Effervescence is seen when sodium carbonate is added to an aqueous acid.
3 Methyl orange becomes yellow when added to an aqueous acid.
4 Red litmus remains red when added to an aqueous acid.

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

18 Copper(II) sulfate is formed by reacting excess solid copper(II) carbonate with dilute sulfuric acid.

Which processes are part of the preparation of solid copper(II) sulfate?

1 crystallisation
2 distillation
3 filtration
4 titration

$CuCO_3 + H_2SO_4 \rightarrow CuSO_4 + H_2O + CO_2\uparrow$ (s)

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

19 Element X forms ions with the formula X^{2-}.

It gain 2 $e^{\ominus}$

Which row describes element X?

	group number	type of element
A	II	metal
B	II	non-metal
C	VI	metal
D	VI	non-metal

20 Which compound is likely to be coloured?

A $KMnO_4$ **B** KNO_3 **C** K_2CO_3 **D** K_2SO_4

21 Chlorine, bromine and iodine are in the same group of the Periodic Table.

Which statements about these three elements are correct?

1 Iodine is more reactive than chlorine.

2 They are diatomic covalent molecules.

3 They are all gases at room temperature.

4 Their atoms have seven electrons in their outer shell.

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

22 The electronic configurations of four elements, P, Q, R and S, are shown.

element	electronic configuration
P	2
Q	2,2
R	2,6
S	2,8

Which elements are unreactive monatomic gases?

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

23 The table shows some physical properties of four different substances.

Which row describes the properties of a non-metallic element?

	melting point / °C	conductivity when solid	conductivity when melted
A	63	good	good
B	119	poor	poor
C	659	good	good
D	808	poor	good

24 The equation shows the reaction between a halogen and the aqueous ions of another halogen.

$$X_2 + 2Y^- \rightarrow 2X^- + Y_2$$

What is X_2 and the colour of Y^-?

	X_2	Y^-
A	chlorine	brown
B	chlorine	colourless
C	iodine	brown
D	iodine	colourless

25 Zinc oxide reacts with carbon to produce zinc.

Which equation represents this reaction?

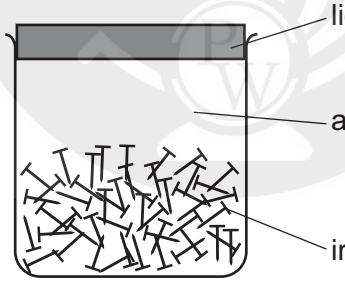
A $2ZnO + C \rightarrow 2Zn + CO$

B $2ZnO + 2C \rightarrow 2Zn + 2CO_2$

C $ZnO + C \rightarrow Zn + CO$

D $ZnO + 2C \rightarrow Zn + 2CO_2$

26 Iron nails are stored in an airtight container.



The nails begin to rust after a few days.

How can the rusting of the nails be prevented?

A Leave the lid off.

B Replace the air with argon.

C Put the container in a warm place.

D Seal the container in a bag.

27 Four substances present in the blast furnace during iron extraction are listed.

1 calcium carbonate
2 carbon dioxide
3 carbon monoxide
4 iron(III) oxide

$C + O_2 \rightarrow CO_2$
$CO_2 + C \rightarrow 2CO$

Which substances are both a reactant and a product during the reactions occurring in the blast furnace?

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

28 Which test is used to show that a sample of water is pure?

Melting point - 100°C
Freezing point - 0°C

A Evaporate the water to see if any solids remain.
B Heat the water to check its boiling point.
C Test with anhydrous cobalt(II) chloride.
D Use universal indicator paper to check its pH.

29 Which mixture of salts produces an NPK fertiliser?

A ammonium phosphate + potassium sulfate
B calcium phosphate + sodium nitrate
C potassium nitrate + calcium sulfate
D sodium phosphate + ammonium nitrate

30 What are the **main** products obtained by the fractional distillation of liquid air?

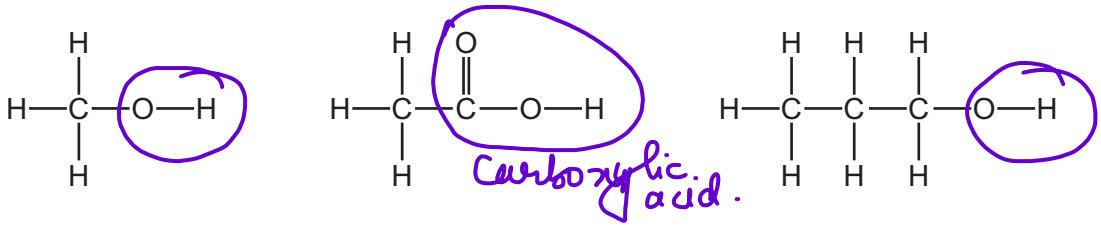
A carbon dioxide and oxygen
B carbon dioxide and water vapour
C nitrogen and oxygen
D nitrogen and water vapour

31 In which reaction is the rate of reaction increased by light?

→ Sunlight

A carbon dioxide + water → glucose + oxygen Photosynthesis
B ethanoic acid + sodium carbonate → sodium ethanoate + water + carbon dioxide
C ethene + bromine → dibromoethane
D methane + oxygen → carbon dioxide + water

32 The structures of three organic molecules are shown.



Which description of the three molecules is correct?

	they all have the same general formula, $C_nH_{2n+1}OH$	they all belong to the same homologous series
A	no	no
B	no	yes
C	yes	no
D	yes	yes

33 Petroleum is separated into fractions by fractional distillation.

Which row describes a use of the named fraction?

	fraction	use
A	bitumen	fuel for ships
B	refinery gas	jet fuel
C	fuel oil	road making
D	gasoline	fuel for cars

34 Which statement about alkanes is correct?

A They are saturated.

B They are very reactive.

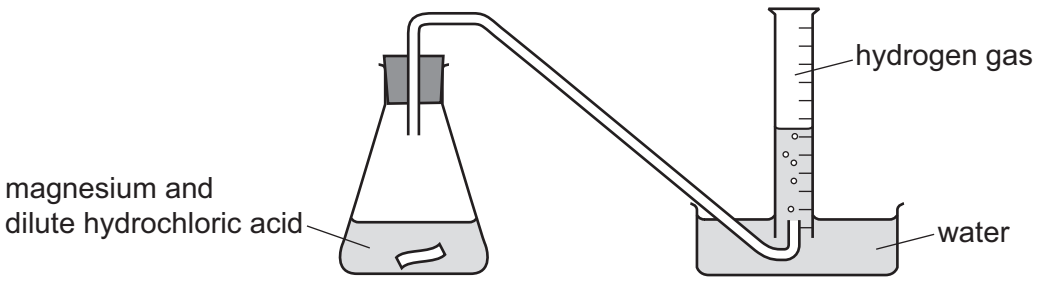
C They contain carbon, hydrogen and oxygen only.

D They contain double bonds.

35 What is the approximate volume of nitrogen in 200 cm^3 of air?

A 20 cm^3 **B** 40 cm^3 **C** 80 cm^3 **D** 160 cm^3

36 The apparatus used to investigate the rate at which hydrogen gas is given off when a piece of magnesium reacts with dilute hydrochloric acid is shown.



Which additional piece of apparatus is needed to determine the rate of reaction?

A balance

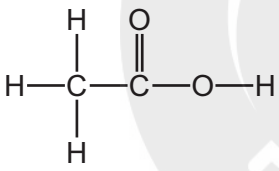
B burette

C stop-watch

D volumetric pipette

37 Which diagram shows the displayed formula of ethanol?

A



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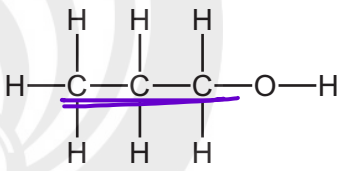

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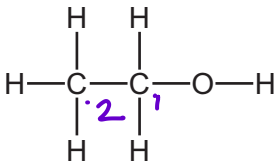

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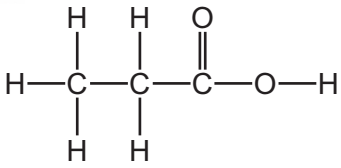

38 Ethane is used as a fuel.

Which equation shows the complete combustion of ethane?

A $2C_2H_6 + 7O_2 \rightarrow 4CO_2 + 6H_2O$

B $2C_2H_6 + 5O_2 \rightarrow 4CO + 6H_2O$

C $C_2H_4 + 3O_2 \rightarrow 2CO_2 + 2H_2O$

D $C_2H_4 + 2O_2 \rightarrow 2CO + 2H_2O$

39 The equation for the reaction of aqueous calcium nitrate and aqueous sodium hydroxide is shown.

$$Ca(NO_3)_2(aq) + 2NaOH(aq) \rightarrow Ca(OH)_2(s) + 2NaNO_3(aq)$$

Which process is used to remove calcium hydroxide from the mixture?

A chromatography

B crystallisation

C distillation

D filtration

40 The results of two tests on aqueous compound X are given.

test	result
warm with aluminium foil and aqueous sodium hydroxide	ammonia is produced
aqueous sodium hydroxide	brown precipitate

What is X?

A iron(III) nitrate

B iron(II) nitrate

C iron(III) sulfate

D iron(II) sulfate

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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.).