Cambridge Assessment International Education

Cambridge IGCSE™

CHEMISTRY **0620/13**

Paper 1 Multiple Choice (Core) **May/June 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.

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

1 Two different physical states of iodine are described.

In state 1, iodine exists as I_2 molecules that are widely spaced and in rapid random movement.

In state 2, iodine exists as I_2 molecules that are closely packed and only vibrate.

Iodine can be converted directly from state 2 to form state 1.

Which row about state 2 and the change from state 2 to state 1 is correct?

	state 2	the change from state 2 to state 1
A	liquid	evaporation
B	liquid	sublimation
C	solid	evaporation
D	solid	sublimation

2 A student measures the time taken for 2.0 g of magnesium to dissolve in 50 cm^3 of dilute sulfuric acid.

Which apparatus is essential to complete the experiment?

1 stop-clock

2 measuring cylinder

3 thermometer

4 balance

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

3 Which method is used to separate a mixture of the following liquids?

liquid	boiling point / °C
methanol	64.5
ethanol	78.5
propan-1-ol	97.2
butan-1-ol	117.0

A crystallisation

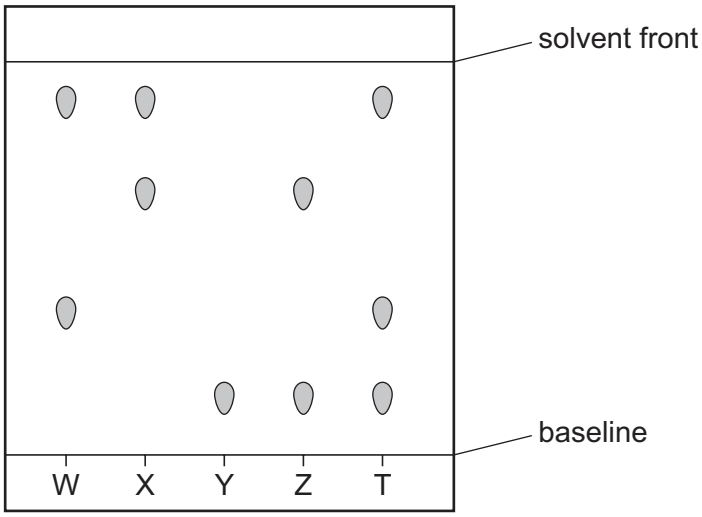
B evaporation

C filtration

D fractional distillation

4 Paper chromatography is used to separate four different coloured inks, W, X, Y and Z, and an unknown ink T.

The chromatogram is shown.



Which inks are present in ink T?

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

5 Which row identifies an alloy, a pure metal and a non-metal?

	alloy	pure metal	non-metal
A	brass	carbon	copper
B	brass	copper	carbon
C	copper	brass	carbon
D	copper	carbon	brass

6 An atom of an element contains 4 electrons, 4 protons and 6 neutrons.

In which group of the Periodic Table is this element placed?

A Group II

B Group IV

C Group VI

D Group VIII

7 Which row describes an ionic solid?

	soluble in water	conducts electricity when solid	conducts electricity when molten
A	✓	✗	✓
B	✗	✗	✗
C	✓	✗	✗
D	✗	✓	✓

key
✓ = yes
✗ = no

8 Which molecule contains more than one pair of shared electrons?

A chlorine

B hydrogen

C hydrogen chloride

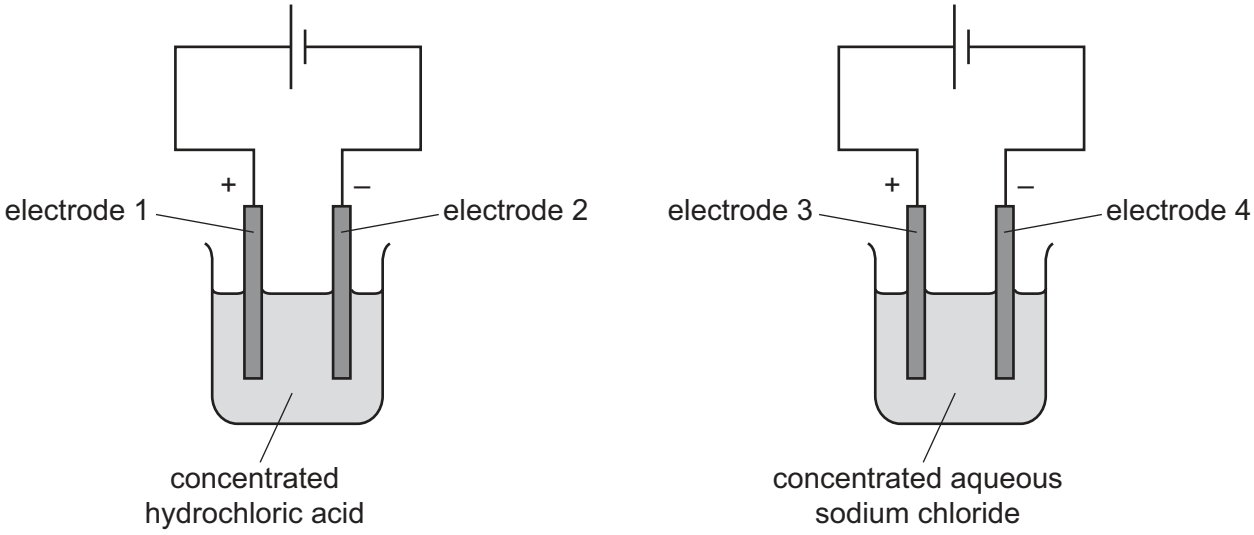
D water

9 Compounds that contain nitrogen can be used as fertilisers.

Which compound contains the greatest proportion of nitrogen by mass?

A CH_4N_2O **B** NH_4Cl **C** NH_4NO_3 **D** $(NH_4)_2SO_4$

10 The diagram shows the electrolysis of concentrated hydrochloric acid and concentrated aqueous sodium chloride using carbon electrodes.



At which electrodes is hydrogen produced?

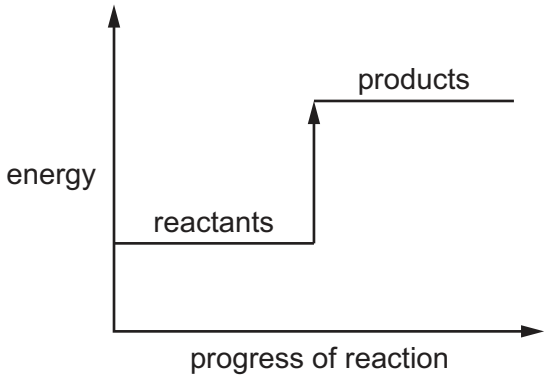
A electrode 1 only

B electrodes 1 and 3

C electrode 2 only

D electrodes 2 and 4

11 The energy level diagram for a reaction is shown.



Which statement is correct?

A The reaction is endothermic and heat energy is released.

B The reaction is endothermic and heat energy is taken in.

C The reaction is exothermic and heat energy is released.

D The reaction is exothermic and heat energy is taken in.

12 Which row identifies a chemical change and a physical change?

	chemical change	physical change
A	boiling ethanol	burning ethanol
B	burning ethanol	evaporating ethanol
C	dissolving ethanol in water	burning ethanol
D	evaporating ethanol	dissolving ethanol in water

13 Metal M reacts with steam and produces gas G.

Which row identifies gas G and the type of reaction when metal M reacts with steam?

	gas G	type of reaction
A	hydrogen	redox
B	hydrogen	neutralisation
C	oxygen	redox
D	oxygen	neutralisation

14 The rate of the reaction between lumps of zinc and dilute sulfuric acid is determined.

The experiment is repeated four times, making only one change each time.

The changes are listed.

1 The lumps of zinc are replaced with powdered zinc.

2 Water is added to the dilute sulfuric acid.

3 The temperature of the dilute sulfuric acid is increased.

4 A catalyst is added to the reaction mixture.

Which changes produce an increase in the rate of reaction?

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

15 Water is added to anhydrous copper(II) sulfate.

What happens during the reaction?

A The copper(II) sulfate turns blue and the solution formed gets colder.

B The copper(II) sulfate turns blue and the solution formed gets hotter.

C The copper(II) sulfate turns white and the solution formed gets colder.

D The copper(II) sulfate turns white and the solution formed gets hotter.

16 Which statement explains why lime is added to soil?

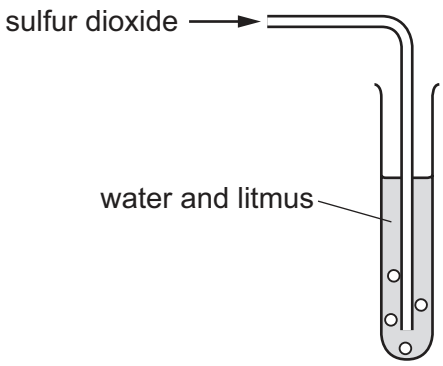
A to decrease the pH of acidic soil

B to decrease the pH of alkaline soil

C to increase the pH of acidic soil

D to increase the pH of alkaline soil

17 Sulfur dioxide is bubbled through water containing litmus.



Which row describes and explains what happens to the litmus?

	observation	explanation
A	it turns blue	sulfur dioxide is a basic oxide
B	it turns blue	sulfur dioxide is an acidic oxide
C	it turns red	sulfur dioxide is an acidic oxide
D	it turns red	sulfur dioxide is a basic oxide

[Turn over

18 The oxides of two elements, X and Y, are separately dissolved in water and the pH of each solution tested.

oxide tested	pH of solution
X	1
Y	13

Which information about X and Y is correct?

	oxide is acidic	oxide is basic	metal	non-metal
A	X	Y	X	Y
B	X	Y	Y	X
C	Y	X	X	Y
D	Y	X	Y	X

19 An acid is neutralised by adding an excess of an insoluble solid base.

A soluble salt is formed.

How is the pure salt obtained from the reaction mixture?

A crystallisation → evaporation → filtration

B evaporation → crystallisation → filtration

C filtration → crystallisation → evaporation

D filtration → evaporation → crystallisation

20 Which ion forms a precipitate that dissolves in excess with both aqueous ammonia and with aqueous sodium hydroxide?

A calcium ion, Ca^{2+}

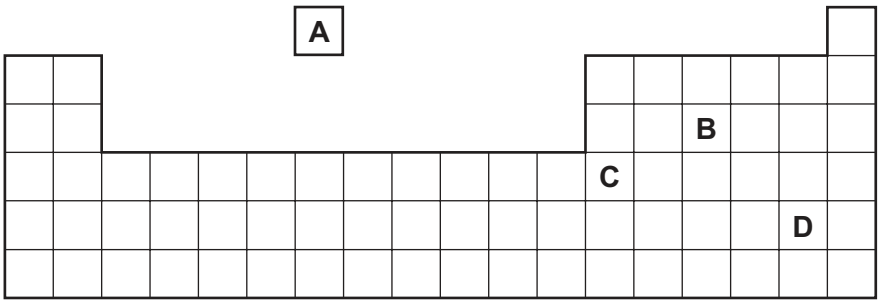
B copper(II) ion, Cu^{2+}

C iron(III) ion, Fe^{3+}

D zinc ion, Zn^{2+}

21 Part of the Periodic Table is shown.

Which element is a metal?



22 The elements sodium to argon form Period 3 of the Periodic Table.

Which row describes the trend across Period 3 from left to right?

	number of outer-shell electrons	metallic character	group number
A	decreases	decreases	decreases
B	decreases	increases	decreases
C	increases	decreases	increases
D	increases	increases	increases

23 Lithium and sodium are in Group I of the Periodic Table.

Which statements about the properties of lithium and sodium are correct?

1 Lithium has a lower melting point than sodium.

2 They both produce hydrogen when they react with water.

3 Lithium is less dense than sodium.

4 Lithium is more reactive than sodium.

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

24 Which row describes the properties of a typical transition element?

	melting point	density	used as catalyst
A	high	high	yes
B	high	low	no
C	low	high	yes
D	low	low	no

25 Which row describes an atom of a noble gas?

	number of protons	number of neutrons	number of electrons
A	2	2	0
B	2	2	2
C	8	8	8
D	8	8	10

26 Some properties of four elements, P, Q, R and S, are shown.

Solid P reacts with dilute hydrochloric acid to give hydrogen.

Solid Q does not conduct electricity.

Solid R is used to make saucepans because it is a good conductor of heat.

Solid S reacts with oxygen to form a compound where atoms of S share electrons with atoms of oxygen.

Which elements are metals?

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

27 Three metals, X, Y and Z, are added separately to dilute hydrochloric acid.

The oxides of each metal are heated with carbon.

The results of the reactions are shown.

	dilute aqueous hydrochloric acid	metal oxide with carbon
X	no reaction	brown solid forms
Y	fast fizzing	no change
Z	slow fizzing	silver coloured solid forms

What are X, Y and Z?

	X	Y	Z
A	copper	calcium	zinc
B	copper	zinc	magnesium
C	iron	calcium	zinc
D	iron	zinc	magnesium

28 Which uses of the metals shown are correct?

	aluminium	stainless steel
A	aircraft bodies	car bodies
B	car bodies	aircraft bodies
C	chemical plant	food containers
D	food containers	cutlery

29 Carbon dioxide and methane are both greenhouse gases.

Which activity produces both of these gases?

A farming animals

B cracking alkanes

C the thermal decomposition of limestone

D using petrol-powered cars

30 Which statement about carbon monoxide is correct?

A It damages stone buildings.

B It is a pollutant which causes acid rain.

C It is produced during the decomposition of vegetation.

D It is formed during the incomplete combustion of natural gas.

31 Fertilisers are used to provide three of the elements needed for plant growth.

Which two compounds would give a fertiliser containing all three of these elements?

A $Ca(NO_3)_2$ and $(NH_4)_2SO_4$

B $Ca(NO_3)_2$ and $(NH_4)_3PO_4$

C KNO_3 and $(NH_4)_2SO_4$

D KNO_3 and $(NH_4)_3PO_4$

32 Sulfur dioxide is tested by reacting it with acidified potassium manganate(VII).

Which colour change is seen in the test?

A blue to white

B colourless to purple

C purple to colourless

D white to blue

33 Which products use calcium carbonate in their manufacture?

1 aluminium

2 cement

3 iron

4 sulfuric acid

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

34 What are the products when limestone (calcium carbonate) is heated strongly?

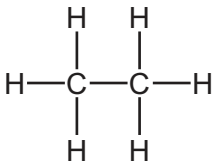
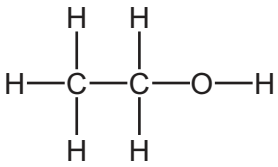
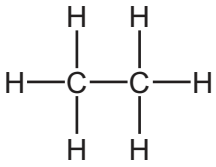
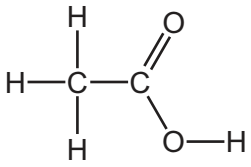
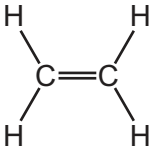
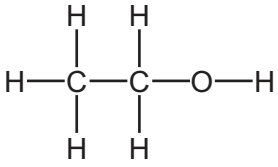
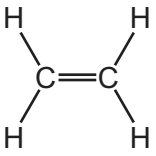
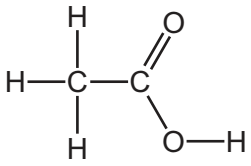
A calcium hydroxide and carbon dioxide

B calcium hydroxide and carbon monoxide

C calcium oxide and carbon dioxide

D calcium oxide and carbon monoxide

35 Which structures represent ethene and ethanol?

	ethene	ethanol
A		
B		
C		
D		

36 One of the fractions obtained from the fractional distillation of petroleum is naphtha.

What is a major use of the naphtha fraction?

A as a fuel for jet aircraft

B as a lubricant for moving machine parts

C as a smooth surface covering for roads

D as a starting material to make other chemicals

37 Which statement describes the process of cracking?

A It is the breakdown of a compound using electricity.

B It is the breakdown of long chain hydrocarbons.

C It is the combination of many small monomers.

D It is the separation of a mixture of hydrocarbons.

38 Which temperature range is used in the production of ethanol by fermentation?

A 0–20 °C **B** 25–40 °C **C** 50–70 °C **D** 80–100 °C

39 A hydrocarbon is tested with aqueous bromine.

The aqueous bromine turns from orange to colourless.

Which row describes the hydrocarbon?

	homologous series	type of hydrocarbon
A	alkane	saturated
B	alkane	unsaturated
C	alkene	saturated
D	alkene	unsaturated

40 Which polymers are constituents of food?

1 carbohydrate

2 nylon

3 *Terylene*

4 protein

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

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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.).