Cambridge Assessment International Education

Cambridge IGCSE™ (9–1)

CHEMISTRY **0971/12**

Paper 1 Multiple Choice (Core) **May/June 2020**

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. A mark will not be deducted for a wrong answer.
- Any rough working should be done on this question paper.
- The Periodic Table is printed in the question paper.

This document has **16** pages. Blank pages are indicated.

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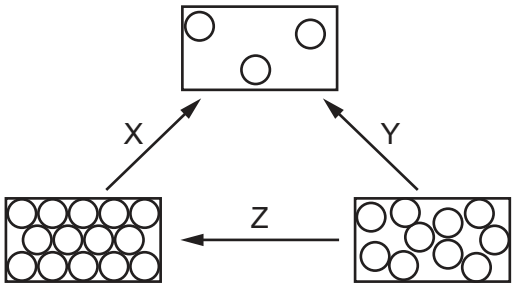
1 Each rectangle shows the arrangement of particles in each of the three states of matter.

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



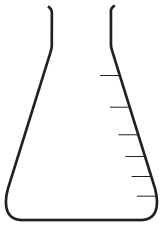
What are the processes X, Y and Z?

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

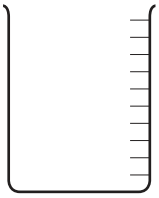
2 Which piece of apparatus is used to measure 25.0 cm^3 of aqueous sodium hydroxide?

A

B



C



D

3 Which process is used to produce drinking water from sea water?

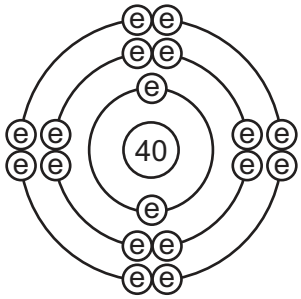
A crystallisation

B distillation

C filtration

D chlorination

4 The diagram shows the electronic structure of a particle with a nucleon number (mass number) of 40.



The table shows the suggestions that three students, 1, 2 and 3, made to identify the particle.

	student		
	1	2	3
particle	Ar	Cl	Ca^{2+}

Which students are correct?

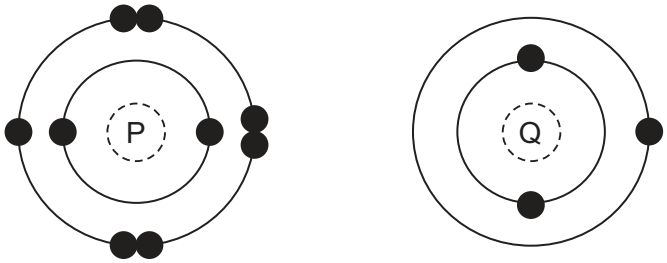
A 1 and 2 only **B** 1 and 3 only **C** 2 and 3 only **D** 1, 2 and 3

5 The Group I element sodium forms an ionic bond with the Group VII element fluorine.

Which two ions are produced?

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

6 The electronic structures of two atoms, P and Q, are shown.



P and Q combine together to form a compound.

What is the type of bonding in the compound and what is the formula of the compound?

	type of bonding	formula
A	ionic	PQ
B	ionic	PQ_2
C	covalent	PQ_2
D	covalent	PQ

7 Graphite is a macromolecule.

Which statements about graphite are correct?

1 Carbon atoms form four covalent bonds with neighbouring atoms.

2 There are free electrons between layers of carbon atoms.

3 Graphite is a useful lubricant.

4 Graphite is a good conductor of electricity.

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

8 Aluminium oxide has the formula Al_2O_3.

Which statement about aluminium oxide is correct?

A 2 g of aluminium atoms are combined with 3 g of oxygen atoms.

B 2 g of aluminium atoms are combined with 3 g of oxygen molecules.

C Aluminium oxide has a relative formula mass of 102.

D Pure aluminium oxide contains a higher mass of oxygen than of aluminium.

9 Dilute sulfuric acid is electrolysed using carbon electrodes.

Which row shows the products formed at each electrode?

	anode	cathode
A	hydrogen	oxygen
B	hydrogen	sulfur
C	oxygen	hydrogen
D	oxygen	sulfur

10 Which fuel does **not** rely on combustion to release energy?

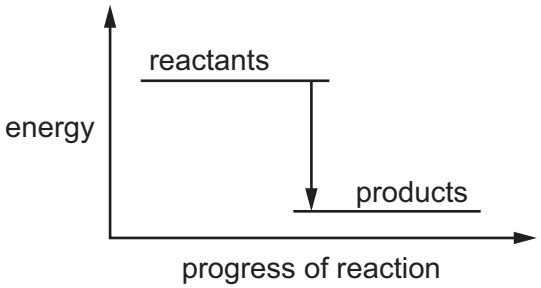
A gasoline

B hydrogen

C methane

D uranium

11 The energy level diagram shows the energy of the reactants and products in a chemical reaction.



Which row correctly describes the energy change and the type of reaction shown?

	description of energy change	type of reaction
A	energy is given out to the surroundings	endothermic
B	energy is given out to the surroundings	exothermic
C	energy is taken in from the surroundings	endothermic
D	energy is taken in from the surroundings	exothermic

12 Which list contains **only** chemical changes?

A melting, evaporating, dissolving

B rusting, freezing, subliming

C neutralisation, polymerisation, combustion

D boiling, condensing, distillation

13 Which row shows the changes that **all** increase the rate of a chemical reaction?

	concentration of reactants	temperature	particle size
A	decrease	decrease	decrease
B	decrease	increase	increase
C	increase	decrease	increase
D	increase	increase	decrease

[Turn over

14 Which reaction is reversible?

A an iron nail rusting when left in moist air

B limestone reacting with an acid to form carbon dioxide gas

C magnesium burning in air to produce a white ash

D white anhydrous copper(II) sulfate turning blue when water is added

15 When heated strongly, silicon(IV) oxide reacts with carbon.

$$SiO_2 + 2C \rightarrow Si + 2CO$$

Which term describes what happens to silicon(IV) oxide?

A thermal decomposition

B neutralisation

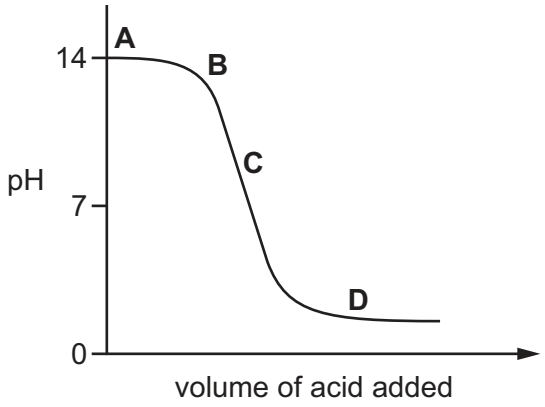
C oxidation

D reduction

16 The graph shows how the pH of a solution changes as an acid is added to an alkali.

$$\text{acid} + \text{alkali} \rightarrow \text{salt} + \text{water}$$

Which letter represents the area of the graph where both acid and salt are present?



17 Element G is a metal in Group I of the Periodic Table and element H is a non-metal in Group VII. Both of these elements form oxides.

Which statement about their oxides is correct?

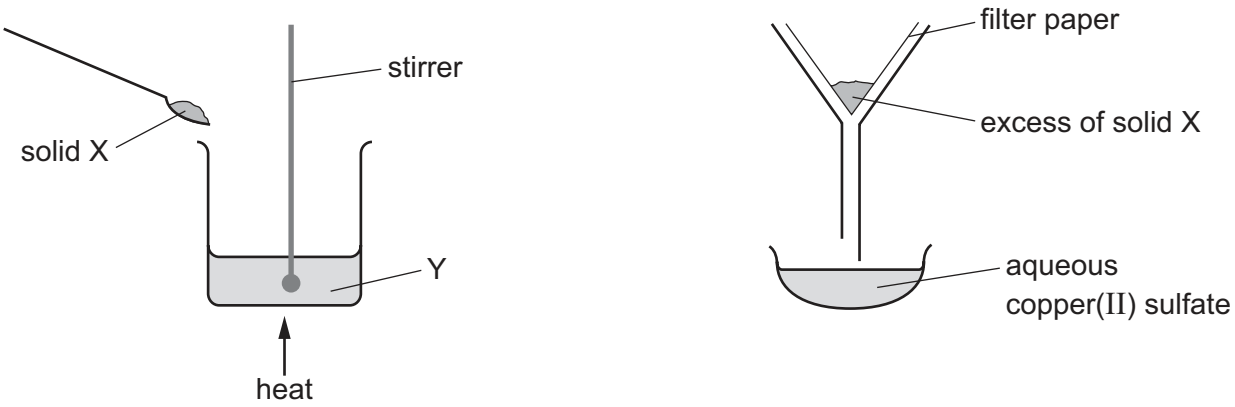
A Both oxides are acidic.

B Both oxides are basic.

C The oxide of G is acidic and the oxide of H is basic.

D The oxide of H is acidic and the oxide of G is basic.

18 The apparatus shown is used to prepare aqueous copper(II) sulfate.



What are X and Y?

	X	Y
A	copper	aqueous iron(II) sulfate
B	copper(II) chloride	dilute sulfuric acid
C	copper(II) oxide	dilute sulfuric acid
D	sulfur	aqueous copper(II) chloride

19 An aqueous solution of a compound M is tested.

The results are shown.

- It gave a lilac colour in a flame test.
- It produced a white precipitate when tested with acidified barium nitrate.

What is M?

A copper(II) chloride

B copper(II) sulfate

C potassium carbonate

D potassium sulfate

20 The character of the elements and charges on the ions of the elements change across the Periodic Table.

Which row describes the elements on the left of the table and the elements on the right?

	elements on the left		elements on the right	
	character	charge on ion	character	charge on ion
A	metallic	positive	non-metallic	negative
B	metallic	negative	non-metallic	positive
C	non-metallic	positive	metallic	negative
D	non-metallic	negative	metallic	positive

21 Which statement about Group I and Group VII elements is correct?

A Group VII elements are monoatomic non-metals.

B Lithium is more reactive with water than caesium.

C The melting points of Group I metals increase down the group.

D Potassium bromide reacts with chlorine to produce an orange solution.

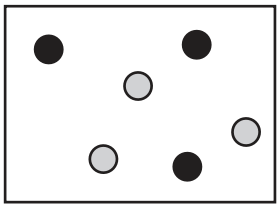
22 The properties of the element titanium, Ti, can be predicted from its position in the Periodic Table.

Which row identifies the properties of titanium?

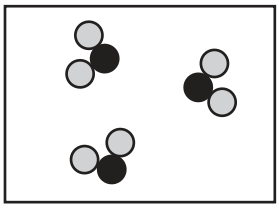
	can be used as a catalyst	conducts electricity when solid	has low density	forms coloured compounds
A	✓	✓	✓	✗
B	✓	✓	✗	✓
C	✓	✗	✓	✓
D	✗	✓	✓	✓

23 Which diagram shows a mixture of noble gases?

A



B



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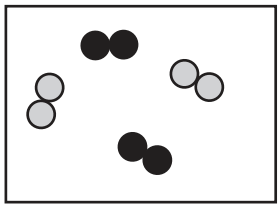

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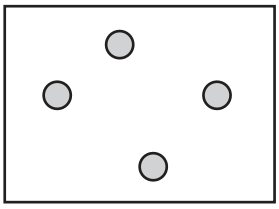


24 Which property is shown by **all** metals?

A They are extracted from their ores by heating with carbon.

B They conduct electricity.

C They form acidic oxides.

D They react with hydrochloric acid to form hydrogen.

25 The reactions of four metals, W, X, Y and Z, are shown.

metal	observations
W	reacts with steam and hydrochloric acid but not cold water
X	reacts with hydrochloric acid but not with steam or cold water
Y	reacts with hydrochloric acid and cold water
Z	does not react with hydrochloric acid

What is the order of reactivity for metals W, X, Y and Z?

	most reactive → least reactive			
A	Y	W	X	Z
B	Y	X	W	Z
C	Z	W	X	Y
D	Z	X	W	Y

26 Molten iron from the blast furnace contains impurities.

The process of turning the impure iron into steel involves blowing oxygen into the molten iron and adding calcium oxide.

What are the reasons for blowing in oxygen and adding calcium oxide?

	blowing in oxygen	adding calcium oxide
A	carbon is removed by reacting with oxygen	reacts with acidic impurities making slag
B	carbon is removed by reacting with oxygen	reacts with slag and so removes it
C	iron reacts with the oxygen	reacts with acidic impurities making slag
D	iron reacts with the oxygen	reacts with slag and so removes it

[Turn over

27 Which statement about mild steel explains why it is a good choice for car bodies?

A It is cheap and strong.

B It is a good conductor.

C It is low density.

D It resists rusting.

28 Which statement about pure water is **not** correct?

A It condenses at 100 °C.

B It freezes at 0 °C.

C It turns cobalt(II) chloride paper blue.

D It turns anhydrous copper(II) sulfate blue.

29 Which compounds **both** contribute to 'acid rain'?

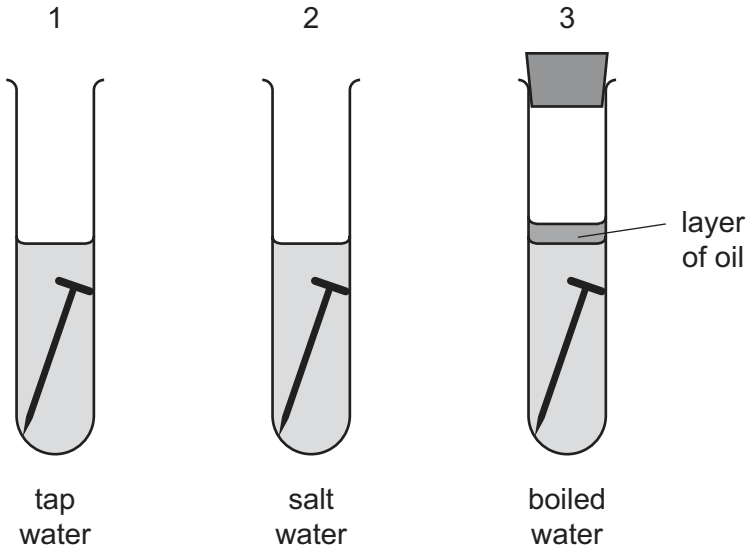
A carbon monoxide and lead compounds

B carbon monoxide and oxides of nitrogen

C oxides of nitrogen and sulfur dioxide

D sulfur dioxide and lead compounds

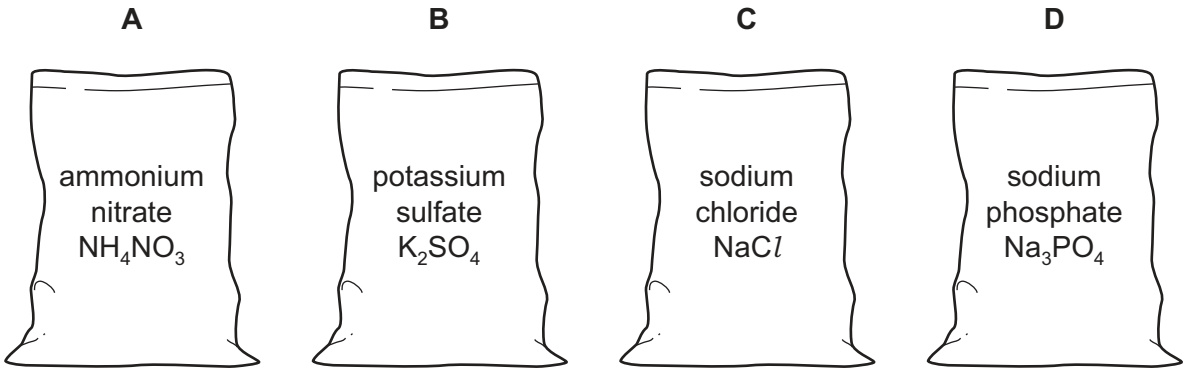
30 The diagrams show experiments to investigate rusting of iron nails.



In which test-tubes do the nails rust?

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

31 Which bag is **not** suitable for use as a fertiliser?



32 X is a colourless greenhouse gas.

It is a waste product from digestion in animals.

It is generally unreactive, but it can be burnt.

What is X?

A carbon dioxide

B methane

C nitrogen

D sulfur dioxide

33 The list shows four methods that were suggested for the formation of carbon dioxide.

1 cracking methane using steam

2 action of heat on a carbonate

3 complete combustion of methane

4 reaction of a carbonate with oxygen

Which methods would result in the production of carbon dioxide?

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

34 A student suggests three uses of calcium carbonate (limestone).

1 manufacture of cement

2 manufacture of iron

3 treating alkaline soils

Which suggestions are correct?

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

35 Which list shows the fractions obtained from distilling petroleum, in order of increasing boiling point?

A bitumen → diesel oil → fuel oil → lubricating oil

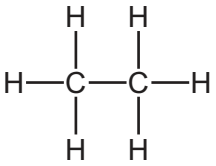
B diesel oil → gasoline → naphtha → kerosene

C gasoline → naphtha → kerosene → diesel oil

D kerosene → lubricating oil → naphtha → refinery gas

36 The structures of four compounds are shown.

1



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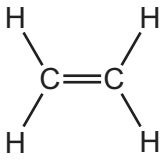

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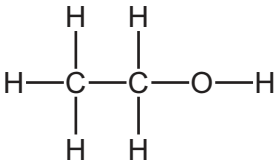

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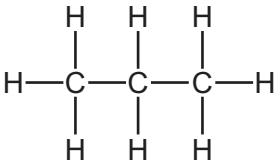

Which compounds are members of the same homologous series?

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

37 Increasing the number of atoms in one molecule of a hydrocarbon increases the amount of energy released when it burns.

What is the correct order?

	less energy released →		more energy released
A	ethene	ethane	methane
B	ethene	methane	ethane
C	methane	ethane	ethene
D	methane	ethene	ethane

38 Which statement about alcohols is correct?

A Alcohols and carboxylic acids have the same functional group.

B Ethanoic acid is produced from the reduction of ethanol.

C Ethanol is produced in an addition reaction between ethene and hydrogen.

D Water is produced from the combustion of alcohols.

39 An organic compound, P, reacts with zinc to produce a gas, Q.

What are P and Q?

	P	Q
A	ethanoic acid	carbon dioxide
B	ethanoic acid	hydrogen
C	ethanol	carbon dioxide
D	ethanol	hydrogen

40 Which substances are natural polymers?

1 proteins

2 carbohydrates

3 nylon

4 poly(ethene)

A 1 and 2 **B** 1 and 3 **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.).