



**Cambridge Assessment International Education**  
Cambridge International General Certificate of Secondary Education (9–1)

**CHEMISTRY**

**0971/11**

Paper 1 Multiple Choice (Core)

**May/June 2019**

**45 minutes**

Additional Materials: Multiple Choice Answer Sheet  
Soft clean eraser  
Soft pencil (type B or HB is recommended)



**READ THESE INSTRUCTIONS FIRST**

Write in soft pencil.

Do not use staples, paper clips, glue or correction fluid.

Write your name, centre number and candidate number on the Answer Sheet in the spaces provided unless this has been done for you.

**DO NOT WRITE IN ANY BARCODES.**

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 separate Answer Sheet.

**Read the instructions on the Answer Sheet very carefully.**

Each correct answer will score one mark. A mark will not be deducted for a wrong answer.

Any rough working should be done in this booklet.

A copy of the Periodic Table is printed on page 16.

Electronic calculators may be used.

This document consists of **15** printed pages and **1** blank page.

- 1 Sodium chloride is a liquid at 900 °C.

How are the particles arranged and how do the particles move in sodium chloride at 900 °C?

	arrangement of particles	motion of particles
<b>A</b>	regular	vibrate about a fixed point
<b>B</b>	regular	move randomly
<b>C</b>	random	vibrate about a fixed point
<b>D</b>	random	move randomly

- 2 2.00 g of powdered calcium carbonate is added to 50.0 cm<sup>3</sup> of hydrochloric acid.

Which apparatus is used to measure the calcium carbonate and the hydrochloric acid?

	calcium carbonate	hydrochloric acid
<b>A</b>	balance	burette
<b>B</b>	balance	thermometer
<b>C</b>	pipette	burette
<b>D</b>	pipette	thermometer

- 3 Rock salt is a mixture of sand and sodium chloride.

Sodium chloride is soluble in water but not in hexane.

Sand is insoluble in both water and hexane.

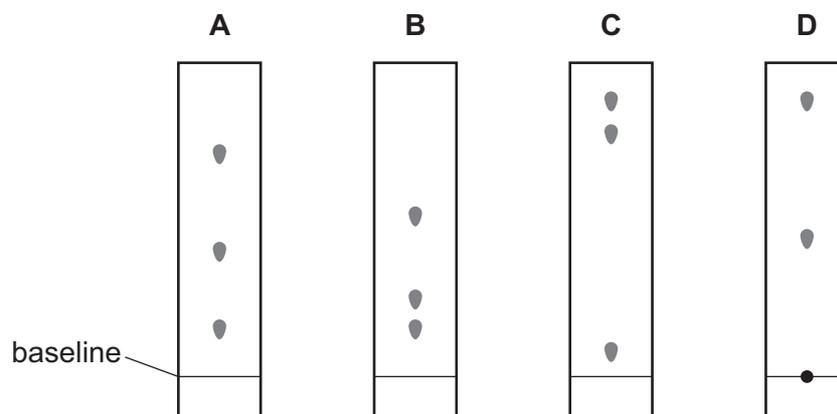
What is required to separate the sand from the sodium chloride?

- 1 filter paper
- 2 fractionating column
- 3 hexane
- 4 water

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

- 4 The colours in four dyes are separated using chromatography.

Which chromatogram shows an insoluble colour?



- 5 Which statement about an atom of fluorine,  ${}^{19}_{9}\text{F}$ , is correct?

- A** It contains more protons than neutrons.  
**B** It contains a total of 28 protons, neutrons and electrons.  
**C** Its isotopes contain different numbers of protons.  
**D** Its nucleus contains 9 neutrons.

- 6 Calcium reacts with chlorine to produce calcium chloride.

What happens when a calcium ion forms during this reaction?

- A** The calcium atom gains one electron.  
**B** The calcium atom gains two electrons.  
**C** The calcium atom loses one electron.  
**D** The calcium atom loses two electrons.

- 7 Which row describes the formation of single covalent bonds in methane?

<b>A</b>	atoms share a pair of electrons	both atoms gain a noble gas electronic structure
<b>B</b>	atoms share a pair of electrons	both atoms have the same number of electrons in their outer shell
<b>C</b>	electrons are transferred from one atom to another	both atoms gain a noble gas electronic structure
<b>D</b>	electrons are transferred from one atom to another	both atoms have the same number of electrons in their outer shell

- 8 Diamond and graphite have giant covalent structures of carbon atoms.

Which statement describes graphite?

- A It has a strong, rigid three-dimensional structure.
- B It has four strong covalent bonds between each carbon atom.
- C It has layers, which can slide over each other.
- D It has no free electrons, so does not conduct electricity.

- 9 The compound magnesium nitrate has the formula  $\text{Mg}(\text{NO}_3)_2$ .

What is the relative formula mass of magnesium nitrate?

- A 86                      B 134                      C 148                      D 172

- 10 Four substances are electrolysed using inert electrodes.

Which row describes the electrode products?

	substance	anode product	cathode product
A	concentrated aqueous sodium chloride	hydrogen	chlorine
B	concentrated hydrochloric acid	chlorine	oxygen
C	dilute sulfuric acid	oxygen	hydrogen
D	molten lead bromide	lead	bromine

- 11 Dissolving ammonium chloride in water is an endothermic change.

Which row shows the energy change and temperature change of the mixture during the dissolving of ammonium chloride?

	energy change	temperature change
A	energy is absorbed	decrease
B	energy is absorbed	increase
C	energy is released	decrease
D	energy is released	increase

- 12 Which process is a physical change?

- A burning wood
- B cooking an egg
- C melting an ice cube
- D rusting iron

- 13** Hydrogen peroxide solution decomposes very slowly at room temperature to produce oxygen gas. This gas forms a rising foam when liquid detergent is added.

Five test-tubes are half filled with hydrogen peroxide solution. A drop of liquid detergent is added to each one.

Different metal oxides are added to four of the test-tubes and the height of the foam formed after 1 minute is measured. The results are shown.

metal oxide	height of foam / cm
no metal oxide added	0.1
aluminium oxide	0.1
calcium oxide	0.2
copper(II) oxide	2.3
manganese(IV) oxide	5.4

Which conclusion can be drawn from these results?

- A** Metal oxides do not affect the rate of this reaction.
  - B** All metal oxides increase the rate of this reaction and act as catalysts.
  - C** Manganese(IV) oxide is the best catalyst of the four metal oxides tested.
  - D** Only transition element oxides increase the rate of this reaction.
- 14** When blue-green crystals of nickel(II) sulfate are heated, water is produced and a yellow solid remains. When water is added to the yellow solid, the blue-green colour returns.

Which process describes these changes?

- A** combustion
- B** corrosion
- C** neutralisation
- D** reversible reaction





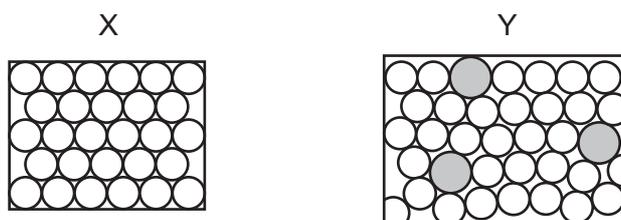
22 Which row describes the properties of a transition element?

	melting point	density	forms coloured compounds
<b>A</b>	high	low	no
<b>B</b>	high	high	yes
<b>C</b>	low	low	no
<b>D</b>	low	low	yes

23 Which statement about elements in Group VIII of the Periodic Table is correct?

- A** They all have a full outer shell of electrons.
- B** They all react with Group I elements to form ionic compounds.
- C** They are all diatomic molecules.
- D** They are all liquids at room temperature.

24 The diagrams show the structure of two substances used to make electrical conductors.



Which statement correctly describes X and Y?

- A** X is a pure metal and Y is a compound.
- B** X is a pure metal and Y is an alloy.
- C** X is a solid and Y is a liquid.
- D** X is harder and stronger than Y.

25 The reactions of three metals, P, Q and R, are shown.

	metal reacts with dilute hydrochloric acid	metal reacts with water
P	yes	no
Q	no	no
R	yes	yes

What is the order of reactivity of the metals?

	most reactive	→	least reactive
<b>A</b>	P	Q	R
<b>B</b>	Q	R	P
<b>C</b>	R	Q	P
<b>D</b>	R	P	Q

26 Iron is extracted from its ore in a blast furnace.

Hematite, coke, limestone and hot air are added to the furnace.

Which explanation is **not** correct?

- A** Coke burns and produces a high temperature.
- B** Hematite is the ore containing the iron as iron(III) oxide.
- C** Hot air provides the oxygen for the burning.
- D** Limestone reduces the iron(III) oxide to iron.

27 Why is aluminium used to make containers for storing food?

- A** It conducts electricity.
- B** It has a high melting point.
- C** It is resistant to corrosion.
- D** It is strong.

28 Water can be treated by filtration then chlorination.

Which uses do **not** need water of this quality?

- 1 water for cooling in industry
- 2 water for washing clothes
- 3 water for drinking

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

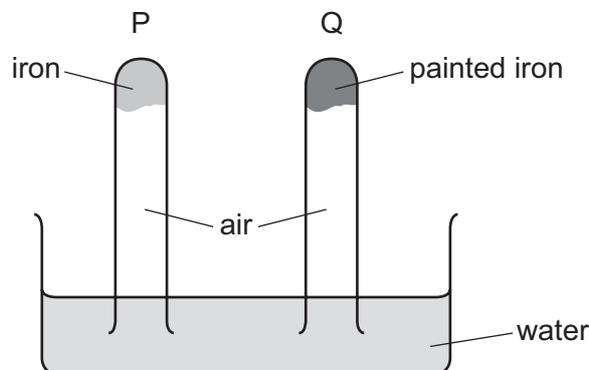
29 Four sources of air pollution are listed.

- 1 burning fossil fuels containing sulfur
- 2 nitrogen reacting with oxygen in car engines
- 3 incomplete combustion of carbon fuels
- 4 adding lead compounds to petrol

Which sources produce acid rain?

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

30 The diagram shows an experiment to investigate how paint affects the rusting of iron.

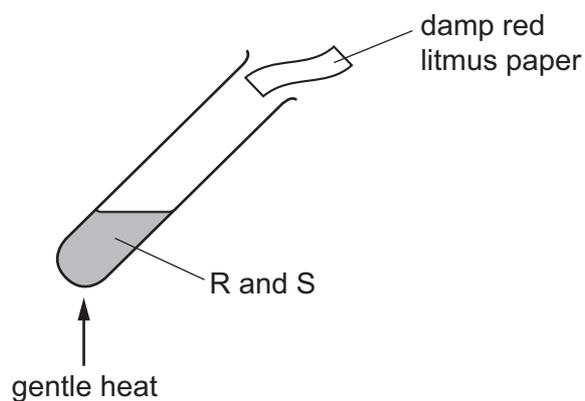


What happens to the water level in tubes P and Q?

	tube P	tube Q
<b>A</b>	falls	rises
<b>B</b>	no change	rises
<b>C</b>	rises	falls
<b>D</b>	rises	no change

31 A mixture of two substances, R and S, is heated.

The damp red litmus paper turns blue.



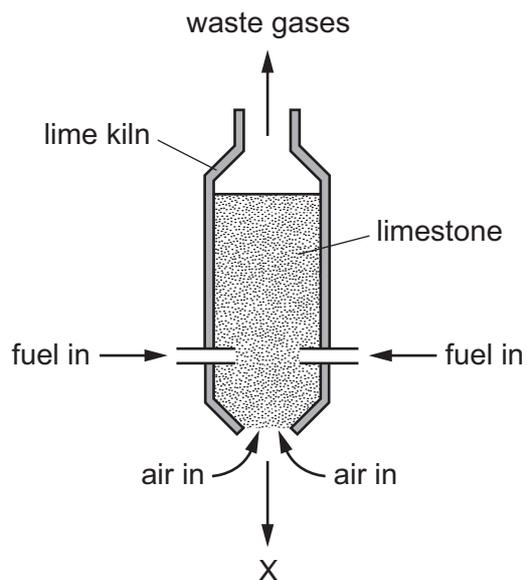
What are R and S?

	R	S
<b>A</b>	a basic oxide	ammonium chloride
<b>B</b>	a basic oxide	sodium nitrate
<b>C</b>	an acidic oxide	ammonium chloride
<b>D</b>	an acidic oxide	sodium nitrate

32 Which statement describes a disadvantage of sulfur dioxide?

- A** It can be used as a bleach when making wood pulp.
- B** It can be used to kill bacteria in food.
- C** It can be used to manufacture sulfuric acid.
- D** It dissolves in water to form acid rain.

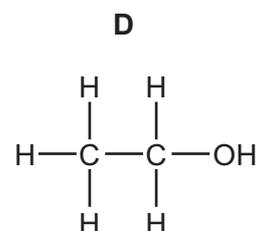
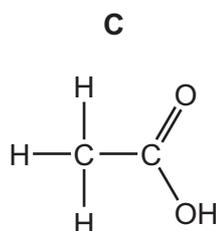
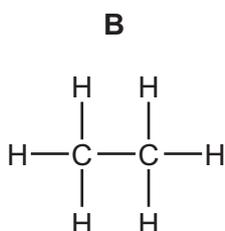
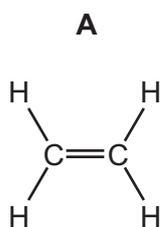
33 The diagram represents a lime kiln used to heat limestone to a very high temperature.



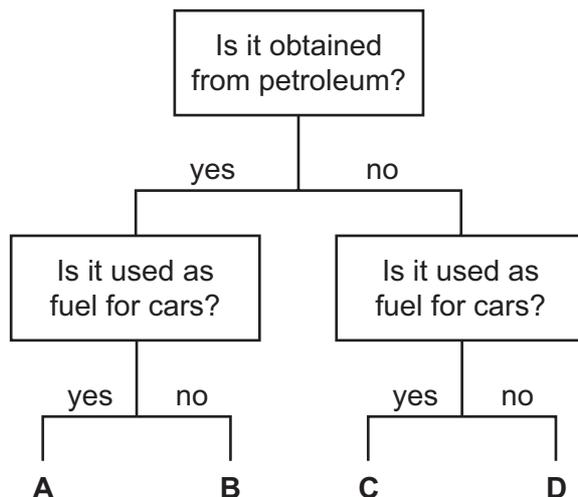
What leaves the kiln at X?

- A calcium carbonate
- B calcium hydroxide
- C calcium oxide
- D calcium sulfate

34 What is the structure of ethanol?



35 Which fuel could be gasoline?



36 A hydrocarbon W burns to form carbon dioxide and water.

W decolourises bromine water.

What is the name of W and what is its structure?

	name of W	structure of W
<b>A</b>	ethane	$  \begin{array}{c}  \text{H} \quad \text{H} \\    \quad   \\  \text{H}-\text{C}-\text{C}-\text{H} \\    \quad   \\  \text{H} \quad \text{H}  \end{array}  $
<b>B</b>	ethane	$  \begin{array}{c}  \text{H} \quad \text{H} \\  \diagdown \quad / \\  \text{C}=\text{C} \\  / \quad \diagdown \\  \text{H} \quad \text{H}  \end{array}  $
<b>C</b>	ethene	$  \begin{array}{c}  \text{H} \quad \text{H} \\    \quad   \\  \text{H}-\text{C}-\text{C}-\text{H} \\    \quad   \\  \text{H} \quad \text{H}  \end{array}  $
<b>D</b>	ethene	$  \begin{array}{c}  \text{H} \quad \text{H} \\  \diagdown \quad / \\  \text{C}=\text{C} \\  / \quad \diagdown \\  \text{H} \quad \text{H}  \end{array}  $

- 37 Why is ethanol a member of the homologous series of alcohols but propane is **not**?
- A Ethanol has two carbon atoms per molecule but propane has three.
  - B Ethanol can be made from ethene but propane is obtained from petroleum.
  - C Ethanol is a liquid but propane is a gas.
  - D Ethanol contains the same functional group as other alcohols but propane does not.
- 38 Which statements about ethanol are correct?
- 1 It can be made by fermentation.
  - 2 It is an unsaturated compound.
  - 3 It burns in air and can be used as a fuel.
- A 1, 2 and 3      B 1 and 2 only      C 1 and 3 only      D 2 and 3 only
- 39 Which statements about aqueous ethanoic acid are correct?
- 1 Ethanoic acid contains the functional group  $\text{-COOH}$ .
  - 2 Ethanoic acid reacts with carbonates to produce hydrogen.
  - 3 Ethanoic acid turns Universal Indicator paper blue.
  - 4 Ethanoic acid has a pH lower than pH 7.
- A 1 and 2      B 1 and 3      C 1 and 4      D 2 and 4
- 40 Which naturally occurring polymers are found in foods?
- 1 complex carbohydrates
  - 2 nylon
  - 3 salts
  - 4 proteins
- 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										
3 <b>Li</b> lithium 7	4 <b>Be</b> beryllium 9	<div style="border: 1px solid black; padding: 5px; text-align: center;"> <b>Key</b>                      atomic number                      atomic symbol                      name                      relative atomic mass                 </div>										2 <b>He</b> helium 4					
11 <b>Na</b> sodium 23	12 <b>Mg</b> magnesium 24											5 <b>B</b> boron 11	6 <b>C</b> carbon 12	7 <b>N</b> nitrogen 14	8 <b>O</b> oxygen 16	9 <b>F</b> fluorine 19	10 <b>Ne</b> neon 20
19 <b>K</b> potassium 39	20 <b>Ca</b> calcium 40	21 <b>Sc</b> scandium 45	22 <b>Ti</b> titanium 48	23 <b>V</b> vanadium 51	24 <b>Cr</b> chromium 52	25 <b>Mn</b> manganese 55	26 <b>Fe</b> iron 56	27 <b>Co</b> cobalt 59	28 <b>Ni</b> nickel 59	29 <b>Cu</b> copper 64	30 <b>Zn</b> zinc 65	31 <b>Ga</b> gallium 70	32 <b>Ge</b> germanium 73	33 <b>As</b> arsenic 75	34 <b>Se</b> selenium 79	35 <b>Br</b> bromine 80	36 <b>Kr</b> krypton 84
37 <b>Rb</b> rubidium 85	38 <b>Sr</b> strontium 88	39 <b>Y</b> yttrium 89	40 <b>Zr</b> zirconium 91	41 <b>Nb</b> niobium 93	42 <b>Mo</b> molybdenum 96	43 <b>Tc</b> technetium —	44 <b>Ru</b> ruthenium 101	45 <b>Rh</b> rhodium 103	46 <b>Pd</b> palladium 106	47 <b>Ag</b> silver 108	48 <b>Cd</b> cadmium 112	49 <b>In</b> indium 115	50 <b>Sn</b> tin 119	51 <b>Sb</b> antimony 122	52 <b>Te</b> tellurium 128	53 <b>I</b> iodine 127	54 <b>Xe</b> xenon 131
55 <b>Cs</b> caesium 133	56 <b>Ba</b> barium 137	57–71 lanthanoids	72 <b>Hf</b> hafnium 178	73 <b>Ta</b> tantalum 181	74 <b>W</b> tungsten 184	75 <b>Re</b> rhenium 186	76 <b>Os</b> osmium 190	77 <b>Ir</b> iridium 192	78 <b>Pt</b> platinum 195	79 <b>Au</b> gold 197	80 <b>Hg</b> mercury 201	81 <b>Tl</b> thallium 204	82 <b>Pb</b> lead 207	83 <b>Bi</b> bismuth 209	84 <b>Po</b> polonium —	85 <b>At</b> astatine —	86 <b>Rn</b> radon —
87 <b>Fr</b> francium —	88 <b>Ra</b> radium —	89–103 actinoids	104 <b>Rf</b> rutherfordium —	105 <b>Db</b> dubnium —	106 <b>Sg</b> seaborgium —	107 <b>Bh</b> bohrium —	108 <b>Hs</b> hassium —	109 <b>Mt</b> meitnerium —	110 <b>Ds</b> darmstadtium —	111 <b>Rg</b> roentgenium —	112 <b>Cn</b> copernicium —	114 <b>Fl</b> flerovium —	116 <b>Lv</b> livermorium —	—	—	—	—

lanthanoids	57 <b>La</b> lanthanum 139	58 <b>Ce</b> cerium 140	59 <b>Pr</b> praseodymium 141	60 <b>Nd</b> neodymium 144	61 <b>Pm</b> promethium —	62 <b>Sm</b> samarium 150	63 <b>Eu</b> europium 152	64 <b>Gd</b> gadolinium 157	65 <b>Tb</b> terbium 159	66 <b>Dy</b> dysprosium 163	67 <b>Ho</b> holmium 165	68 <b>Er</b> erbium 167	69 <b>Tm</b> thulium 169	70 <b>Yb</b> ytterbium 173	71 <b>Lu</b> lutetium 175
actinoids	89 <b>Ac</b> actinium —	90 <b>Th</b> thorium 232	91 <b>Pa</b> protactinium 231	92 <b>U</b> uranium 238	93 <b>Np</b> neptunium —	94 <b>Pu</b> plutonium —	95 <b>Am</b> americium —	96 <b>Cm</b> curium —	97 <b>Bk</b> berkelium —	98 <b>Cf</b> californium —	99 <b>Es</b> einsteinium —	100 <b>Fm</b> fermium —	101 <b>Md</b> mendelevium —	102 <b>No</b> nobelium —	103 <b>Lr</b> lawrencium —

The volume of one mole of any gas is 24 dm<sup>3</sup> at room temperature and pressure (r.t.p.).