Cambridge
O Level

**Cambridge Assessment International Education**
Cambridge Ordinary Level

**CHEMISTRY** **5070/11**

Paper 1 Multiple Choice **May/June 2019**

**1 hour**

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 **14** printed pages and **2** blank pages.

**1** An experiment is done to measure the rate of reaction between calcium carbonate and dilute hydrochloric acid. The gas formed is collected in a gas syringe.

Which additional pieces of apparatus are essential to measure how the rate of the reaction changes with temperature and the amount of acid used?

| | apparatus to measure temperature | apparatus to measure amount of acid used |
|---|---|---|
| **A** | balance | thermometer |
| **B** | measuring cylinder | balance |
| **C** | thermometer | condenser |
| **D** | thermometer | measuring cylinder |

**2** After acidification with dilute nitric acid, a colourless solution of **X** reacts with aqueous silver nitrate to give a white precipitate.

What could **X** be?

**A** calcium iodide

**B** copper(II) chloride

**C** lead(II) iodide

**D** sodium chloride

**3** A paper chromatography experiment is carried out to separate and identify the mixture of amino acids produced from the hydrolysis of a protein.

Which apparatus is needed?

**A** chromatography paper, locating agent, marker pen, solvent

**B** chromatography paper, locating agent, pencil, ruler, solvent

**C** chromatography paper, locating agent, ruler, solvent, thermometer

**D** chromatography paper, locating agent, pencil, solvent, thermometer

**4** Which conditions will give the highest rate of diffusion of a gas?

| | molecular mass of gas | temperature |
|---|---|---|
| **A** | large | high |
| **B** | large | low |
| **C** | small | high |
| **D** | small | low |

**5** Cobalt is a transition element.

A particle of cobalt contains 24 electrons and has a nucleon number of 60.

Which statement about this particle is correct?

**A** It is a 3+ ion.

**B** It is a 3– ion.

**C** It contains 24 neutrons.

**D** It contains 24 protons.

**6** Diamond and graphite are two different forms of the element carbon. They each have different uses.

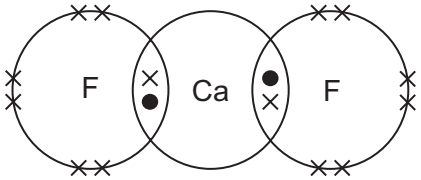
Which row is correct?

| | use | | |
|---|---|---|---|
| | to cut glass | as an electrode | as a lubricant |
| **A** | diamond | diamond | graphite |
| **B** | diamond | graphite | graphite |
| **C** | graphite | diamond | diamond |
| **D** | graphite | graphite | diamond |

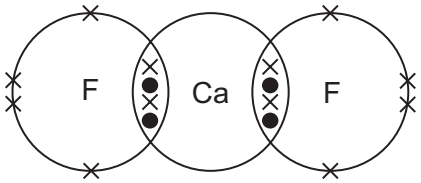
**7** Which diagram shows the outer electron arrangement in calcium fluoride?

key
- ● an electron from calcium
- × an electron from fluorine

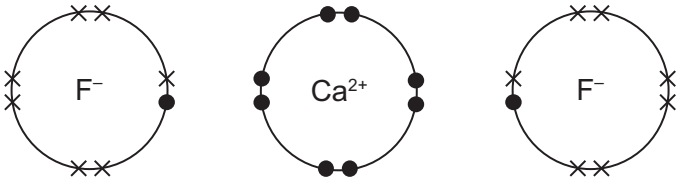
**A**



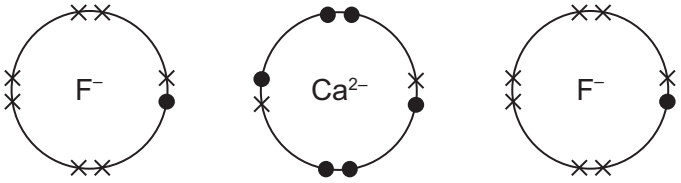

**B**




**C**




**D**




**8** What is the number of shared pairs of electrons in an ammonia molecule?

**A** 3 **B** 4 **C** 5 **D** 6

**9** Two statements about metals are given.

1 Metals contain a lattice of negative ions in a ‘sea of electrons’.

2 The electrical conductivity of metals is related to the mobility of the electrons in the structure.

Which is correct?

**A** Both statements are correct and statement 1 explains statement 2.

**B** Both statements are correct but statement 1 does not explain statement 2.

**C** Statement 1 is correct and statement 2 is incorrect.

**D** Statement 2 is correct and statement 1 is incorrect.

**10** Powdered calcium carbonate reacts with dilute hydrochloric acid to produce calcium chloride, water and carbon dioxide.

What is the correct ionic equation, including state symbols, for this reaction?

**A** $CaCO_3(s) + 2HCl(aq) \rightarrow CaCl_2(aq) + H_2O(l) + CO_2(g)$

**B** $Ca^{2+}(aq) + CO_3^{2-}(aq) + 2H^+(aq) \rightarrow Ca^{2+}(aq) + H_2O(l) + CO_2(g)$

**C** $CO_3^{2-}(aq) + 2H^+(aq) \rightarrow H_2O(l) + CO_2(g)$

**D** $CaCO_3(s) + 2H^+(aq) \rightarrow Ca^{2+}(aq) + H_2O(l) + CO_2(g)$

**11** In a volumetric experiment, 25.0 $cm^3$ of 0.100 $mol/dm^3$ sodium hydroxide reacts exactly with 20.0 $cm^3$ of sulfuric acid.

$$2NaOH + H_2SO_4 \rightarrow Na_2SO_4 + 2H_2O$$

What is the concentration of the sulfuric acid?

**A** 0.0625 $mol/dm^3$

**B** 0.0800 $mol/dm^3$

**C** 0.125 $mol/dm^3$

**D** 0.250 $mol/dm^3$

**12** The reaction for the conversion of bromoethane to ethanol is shown.

$$C_2H_5Br + NaOH \rightarrow C_2H_5OH + NaBr$$

In an experiment, 10.90 g of bromoethane is converted into 3.45 g of ethanol.

What is the percentage yield of ethanol?

[$M_r$: $C_2H_5Br$, 109; $C_2H_5OH$, 46]

**A** 32% **B** 42% **C** 75% **D** 100%

**13** One mole of a sugar, $(CH_2O)_6$, is burned.

Which volume of oxygen, measured at room temperature and pressure, is required for complete combustion of the sugar?

**A** 24 $dm^3$ **B** 36 $dm^3$ **C** 144 $dm^3$ **D** 216 $dm^3$

**14** Which statement about the purification of copper by electrolysis is correct?

**A** A pure copper anode is used.

**B** A pure copper cathode is used.

**C** The colour of the electrolyte fades throughout the process.

**D** The electrolyte used is a solution of copper oxide in water.

**15** Which negative ions are present in aqueous copper(II) sulfate?

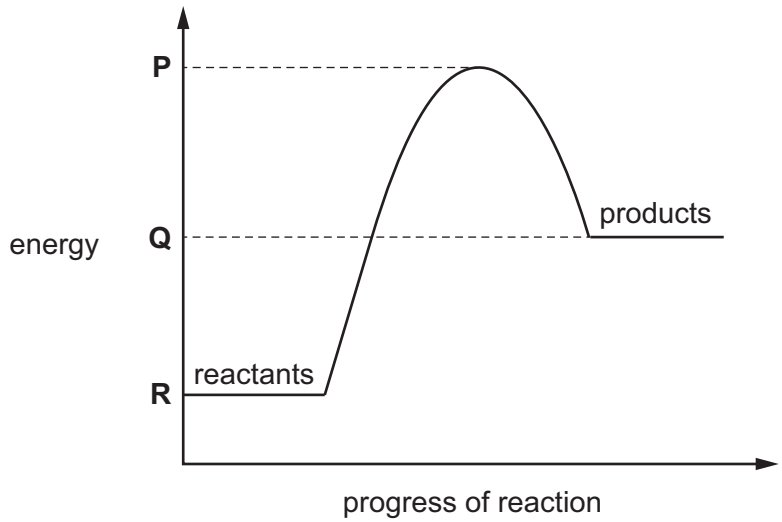
**A** copper(II) ions and hydrogen ions

**B** copper(II) ions only

**C** sulfate ions and hydroxide ions

**D** sulfate ions only

**16** The diagram shows the energy profile for a reaction.




Which statement about this reaction is correct?

**A** It is endothermic and the activation energy is **P** – **Q**.

**B** It is endothermic and the activation energy is **P** – **R**.

**C** It is exothermic and the activation energy is **P** – **Q**.

**D** It is exothermic and the activation energy is **P** – **R**.

**17** The table shows the energy released by the complete combustion of some compounds.

| compound | formula | $M_r$ | $\Delta H$ in kJ / mol |
|---|---|---|---|
| benzene | $C_6H_6$ | 78 | –3270 |
| heptane | $C_7H_{16}$ | 100 | –4800 |
| octane | $C_8H_{18}$ | 114 | –5510 |
| propane | $C_3H_8$ | 44 | –2200 |

Which compound releases the least energy when 1 g is completely burned?

**A** benzene

**B** heptane

**C** octane

**D** propane

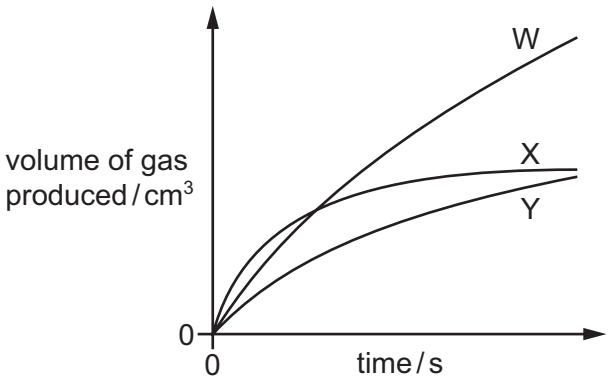
**18** Three experiments are carried out in which the same mass of magnesium is reacted with the same volume of dilute sulfuric acid at room temperature. The magnesium is in excess.

experiment 1 Large pieces of magnesium are used.

experiment 2 Small pieces of magnesium are used.

experiment 3 Large pieces of magnesium are used but the concentration of the acid is increased.

Graphs of the results are shown.




Which row is correct?

| | experiment 1 | experiment 2 | experiment 3 |
|---|---|---|---|
| **A** | W | X | Y |
| **B** | X | Y | W |
| **C** | Y | W | X |
| **D** | Y | X | W |

**19** The equations show four reversible reactions.

For which reaction would the equilibrium move to the right for both an increase in pressure and an increase in temperature?

| | reaction | enthalpy change |
|---|---|---|
| **A** | $H_2(g) + I_2(g) \rightleftharpoons 2HI(g)$ | exothermic |
| **B** | $4NO(g) + 6H_2O(g) \rightleftharpoons 4NH_3(g) + 5O_2(g)$ | endothermic |
| **C** | $PCl_5(g) \rightleftharpoons PCl_3(g) + Cl_2(g)$ | endothermic |
| **D** | $2SO_2(g) + O_2(g) \rightleftharpoons 2SO_3(g)$ | exothermic |

**20** Gas X turns acidified potassium manganate(VII) from purple to colourless.

Gas Y turns aqueous potassium iodide from colourless to brown.

What do these observations show about gas X and gas Y?

| | gas X | gas Y |
|---|---|---|
| **A** | oxidising agent | oxidising agent |
| **B** | oxidising agent | reducing agent |
| **C** | reducing agent | oxidising agent |
| **D** | reducing agent | reducing agent |

**21** Why is ethanoic acid described as a weak acid?

**A** It is an organic acid.

**B** It is a poor conductor of electricity.

**C** It is only slightly dissociated in water.

**D** It reacts only with very reactive metals.

**22** What is the best method to prepare a pure sample of copper(II) sulfate?

**A** Add copper to aqueous zinc sulfate.

**B** Add copper to dilute sulfuric acid.

**C** Add copper(II) carbonate to aqueous sodium sulfate.

**D** Add copper(II) oxide to dilute sulfuric acid.

**23** What is the percentage by mass of nitrogen in ammonium nitrate, $NH_4NO_3$?

**A** 17.5 **B** 22.2 **C** 33.3 **D** 35.0

**24** A student makes three suggestions about the Haber process and the Contact process.

1 Only one process uses a raw material obtained by fractional distillation of air.

2 Only one process involves the use of a catalyst.

3 The product of each catalysed reaction has a formula of the type $XY_3$.

Which suggestions are correct?

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

**25** Which uses for sulfuric acid are correct?

1 as a bleach in the manufacture of wood pulp for paper

2 as a food preservative in tinned foods

3 as a raw material in the manufacture of detergents

4 as a fertiliser

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

**26** Element X forms:

- a covalent compound, $H_2X$
- an ionic compound, $Na_2X$
- oxides $XO_2$ and $XO_3$.

To which group of the Periodic Table does X belong?

**A** II **B** III **C** IV **D** VI

**27** Which property is common to $^{40}Ca$, $^{39}K$ and $^{23}Na$?

**A** Their atoms all have more neutrons than protons.

**B** Their ions all have eight electrons in their outer shell.

**C** They all sink when added to water.

**D** They are all deposited at the positive electrode when their molten chloride is electrolysed.

**28** Palladium is an element, atomic number 46. Some of its properties, and the properties of its compounds, can be predicted from its position in the Periodic Table.

Which row is correct?

| | predicted property of palladium | predicted property of palladium compounds |
|---|---|---|
| **A** | Its density is similar to the density of sodium. | Some of them can act as catalysts. |
| **B** | Its density is similar to the density of sodium. | They are white in the solid state. |
| **C** | It is present in compounds in more than one oxidation state. | Some of them can act as catalysts. |
| **D** | It is present in compounds in more than one oxidation state. | They are white in the solid state. |

**29** Three different elements react by losing electrons. The ions formed all have the electronic configuration 2,8.

Which statement about these elements is correct?

**A** They are in the same group.

**B** They are in the same period.

**C** They are noble gases.

**D** They are transition elements.

**30** A power cable requires an element that:

1 conducts electricity

2 has a relatively low density

3 is resistant to aerial oxidation.

Which of these conditions does aluminium satisfy?

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

**31** Some atmospheric pollutants are listed.

1 sulfur dioxide

2 methane

3 nitrogen dioxide

4 unburned hydrocarbons

Which substances could be removed by reacting with calcium carbonate?

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

**32** River water contains many impurities.

Which process alone can produce pure water from river water?

**A** adding chlorine

**B** distillation

**C** filtering

**D** passing through carbon

**33** Compound **Q** is a hydrocarbon that has no isomers. Compound **Q** does not decolourise bromine in the dark.

Which compound could be **Q**?

**A** $C_3H_6$ **B** $C_3H_8$ **C** $C_4H_8$ **D** $C_4H_{10}$

**34** Which organic compound requires the least number of moles of oxygen for the complete combustion of one mole of the compound?

**A** $C_3H_7OH$ **B** $C_3H_7COOH$ **C** $C_3H_8$ **D** $C_4H_8$

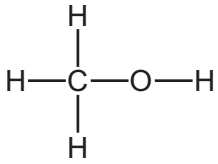
**35** When a molecule of a saturated hydrocarbon is cracked, it forms two molecules X and Y.

Which row is correct?

| | X | Y |
|---|---|---|
| **A** | $H_2$ | $C_nH_{2n}$ |
| **B** | $H_2$ | $C_nH_{2n+2}$ |
| **C** | $H_2O$ | $C_nH_{2n}$ |
| **D** | $H_2O$ | $C_nH_{2n+2}$ |

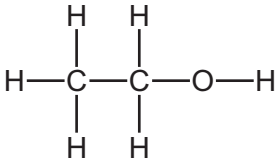
**36** The structures and names of three alcohols, P, Q and R are shown. The structures may not be named correctly.

P



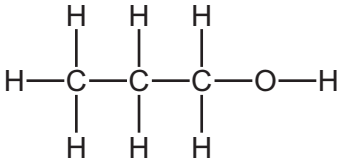
propanol

Q



ethanol

R



methanol

Which structures are correctly named?

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

**37** What is the empirical formula of ethanoic acid?

**A** $CH_2O$ **B** $CH_4O$ **C** $C_2H_3O$ **D** $C_2H_4O_2$

**38** What is the structure of propyl methanoate?

**A** $CH_3COOCH_2CH_2CH_3$

**B** $CH_3COOCCH_2CH_3$

**C** $CH_3CH_2COOCH_3$

**D** $CH_3CH_2CH_2OOCH$

**39** Which substance, on combustion, produces oxides of nitrogen?

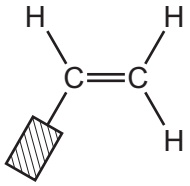
**A** fat

**B** protein

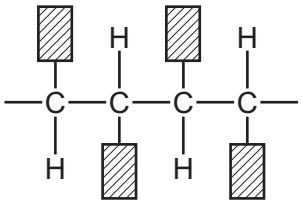
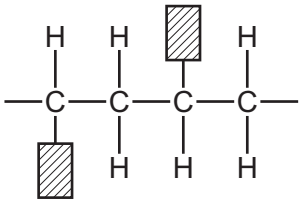
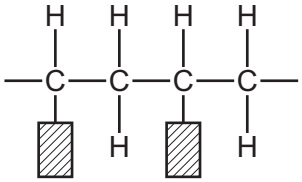
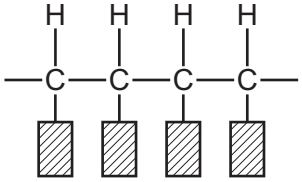
**C** starch

**D** *Terylene*

**40** The monomer used to manufacture polystyrene is shown.



By which type of polymerisation is polystyrene formed and what is a possible partial structure of the polymer?

| | type of polymerisation | possible partial structure of polymer |
|---|---|---|
| **A** | addition |  |
| **B** | addition |  |
| **C** | condensation |  |
| **D** | condensation |  |

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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.).