Cambridge Assessment International Education

# Cambridge IGCSE™

**CHEMISTRY** **0620/13**

Paper 1 Multiple Choice (Core) **October/November 2024**

**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** Which conditions cause gas particles to move the fastest and the furthest apart?

| | temperature | pressure |
|---|---|---|
| **A** | high | high |
| **B** | low | high |
| **C** | high | low |
| **D** | low | low |

**2** Which statement describes a liquid at room temperature?

**A** A sample of a liquid has a fixed volume and shape.

**B** A sample of a liquid does **not** have a fixed volume or shape.

**C** The particles are touching but can move by sliding over each other.

**D** The particles spread out and fill all available space.

**3** A compound, X, has a melting point of 71 °C and a boiling point of 375 °C.

Which statement about X is correct?

**A** It is a liquid at 52 °C and a gas at 175 °C.

**B** It is a liquid at 69 °C and a gas at 380 °C.

**C** It is a liquid at 75 °C and a gas at 350 °C.

**D** It is a liquid at 80 °C and a gas at 400 °C.

**4** What is the nucleon number of an atom?

**A** the number of neutrons

**B** the number of protons

**C** the total number of protons and neutrons

**D** the total number of protons and electrons

**5** An atom has three electron shells. There are three electrons in the outer shell.

How many protons and how many neutrons are in this atom?

| | protons | neutrons |
|---|---|---|
| **A** | 13 | 14 |
| **B** | 13 | 27 |
| **C** | 14 | 13 |
| **D** | 21 | 24 |

**6** Which row gives the number of covalent bonds in **one** molecule of ammonia and in **one** molecule of hydrogen chloride?

| | ammonia | hydrogen chloride |
|---|---|---|
| **A** | 3 | 1 |
| **B** | 3 | 2 |
| **C** | 4 | 1 |
| **D** | 4 | 2 |

**7** Which statements about the structure and bonding in diamond are correct?

1 Each carbon atom in diamond is bonded to three other carbon atoms only.

2 Diamond contains many strong covalent bonds.

3 Diamond contains layers of carbon atoms, which can slide over each other.

4 Diamond has a giant structure.

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

**8** Magnesium burns in oxygen to form magnesium oxide.

The equation for the reaction is shown.

$$2Mg + O_2 \rightarrow 2MgO$$

Which mass of magnesium oxide is formed when 48 g of magnesium is burned?

**A** 20 g **B** 40 g **C** 80 g **D** 160 g

**9** Propane, $C_3H_8$, is burned in a limited amount of oxygen.

Which equation represents this reaction?

**A** $C_3H_8 + 5O_2 \rightarrow 3CO_2 + 4H_2O$

**B** $C_3H_8 + 4O_2 \rightarrow 3CO + 4H_2O$

**C** $C_3H_8 + 4O_2 \rightarrow 3CO_2 + 2H_2O + 2H_2$

**D** $2C_3H_8 + 7O_2 \rightarrow 6CO + 8H_2O$

**10** The isotope of which element is used to define the relative atomic mass of other elements?

**A** sulfur

**B** oxygen

**C** nitrogen

**D** carbon

**11** What is the definition of electrolysis?

**A** the formation of a positive ion by the removal of electrons using an electric current

**B** the decomposition of an ionic compound, when molten or in aqueous solution, by the passage of an electric current

**C** the substance containing ions through which an electric current can pass

**D** the coating of a metal with a different metal by passing an electric current through an aqueous solution of an ionic salt

**12** Which statement about electroplating a copper spoon with silver is correct?

**A** Both the anode and cathode are made of carbon.

**B** The copper spoon is the anode.

**C** Aqueous copper(II) sulfate is the electrolyte.

**D** Silver is formed at the negative electrode.

**13** Which row describes the reaction pathway diagram and energy change in an exothermic reaction?

| | reaction pathway diagram | energy is |
|---|---|---|
| **A** | reactants higher than products | absorbed |
| **B** | reactants higher than products | released |
| **C** | reactants lower than products | absorbed |
| **D** | reactants lower than products | released |

**14** The table shows the initial and final temperatures for four different reactions.

| reaction | initial temperature / °C | final temperature / °C |
|---|---|---|
| 1 | 19 | 28 |
| 2 | 18 | 16 |
| 3 | 20 | 20 |
| 4 | 18 | 19 |

Which reactions are endothermic?

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

**15** Which process is a chemical change?

**A** boiling water

**B** cooking an egg

**C** dissolving sugar

**D** melting ice cubes

**16** A student reacts strips of zinc with dilute sulfuric acid and measures the time taken to produce 100 $cm^3$ of hydrogen.

The experiment is repeated using different conditions.

The results are shown in the table.

| experiment | time to produce 100 $cm^3$ of hydrogen / s |
|---|---|
| 1 | 250 |
| 2 | 100 |

Which changes in conditions produce the results shown in experiment 2?

1 Add a catalyst.

2 Dilute the acid.

3 Use zinc powder.

4 Heat the acid.

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

**17** When blue copper(II) sulfate is heated, a white solid and water are formed.

The white solid turns blue and gives out heat when water is added to it.

Which terms describe the blue copper(II) sulfate and the reactions?

| | blue copper(II) sulfate is | reactions |
|---|---|---|
| **A** | a mixture | can be reversed |
| **B** | a mixture | **cannot** be reversed |
| **C** | hydrated | can be reversed |
| **D** | hydrated | **cannot** be reversed |

**18** Which statements about a redox reaction are correct?

1 Oxidation is the gain of oxygen.

2 Both oxidation and reduction take place in a redox reaction.

3 Reduction is the gain of oxygen.

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

**19** Which row identifies a basic oxide and describes an alkali?

| | basic oxide | description of an alkali |
|---|---|---|
| **A** | sodium oxide | insoluble base |
| **B** | sodium oxide | soluble base |
| **C** | sulfur dioxide | insoluble base |
| **D** | sulfur dioxide | soluble base |

**20** Which indicators turn blue when added to aqueous ammonia?

1 litmus

2 thymolphthalein

3 universal indicator

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

**21** Ammonium chloride reacts with solution X to produce alkaline gas Y. The equation is shown.

ammonium chloride + solution X $\rightarrow$ alkaline gas Y

Which row identifies X and Y?

| | X | Y |
|---|---|---|
| **A** | hydrochloric acid | ammonia |
| **B** | hydrochloric acid | chlorine |
| **C** | sodium hydroxide | ammonia |
| **D** | sodium hydroxide | chlorine |

**22** The solubility of some salts is shown.

| | chloride | nitrate | sulfate | carbonate |
|---|---|---|---|---|
| barium | soluble | soluble | insoluble | insoluble |
| lead(II) | insoluble | soluble | insoluble | insoluble |
| potassium | soluble | soluble | soluble | soluble |
| zinc | soluble | soluble | soluble | insoluble |

Which two aqueous solutions produce an insoluble salt when mixed together?

**A** barium chloride and zinc nitrate

**B** barium nitrate and lead(II) nitrate

**C** lead(II) nitrate and potassium carbonate

**D** potassium nitrate and zinc sulfate

**23** The table shows some properties of the halogens.

| halogen | melting point / °C | colour at room temperature | state at room temperature |
|---|---|---|---|
| chlorine | –101 | yellow-green | gas |
| bromine | –7 | red-brown | liquid |
| iodine | 114 | grey-black | solid |
| astatine | | | |

Which statement describes astatine?

**A** It is a yellow gas at room temperature.

**B** It is a black liquid at room temperature.

**C** Its melting point is higher than the melting point of bromine but lower than that of chlorine.

**D** Its melting point is higher than the melting point of both iodine and bromine.

**24** J, L and M are elements in the Periodic Table.

- J has the highest density.
- L has the highest reactivity with water.
- M has the highest atomic number.

Which row identifies the elements J, L and M?

| | J | L | M |
|---|---|---|---|
| **A** | copper | lithium | bromine |
| **B** | lithium | copper | bromine |
| **C** | bromine | lithium | copper |
| **D** | copper | bromine | lithium |

**25** Which statement about elements in Group I of the Periodic Table is correct?

**A** Rubidium has a greater density than caesium.

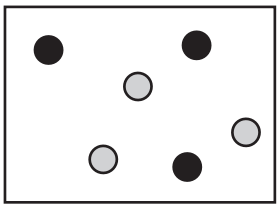
**B** Lithium has a higher melting point than potassium.

**C** Potassium is more reactive than rubidium.

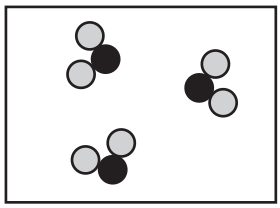
**D** Rubidium atoms have more outer shell electrons than sodium atoms.

**26** Which diagram shows a mixture of noble gases?

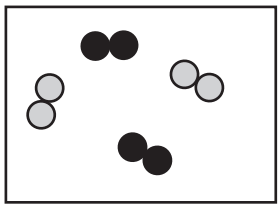
**A**



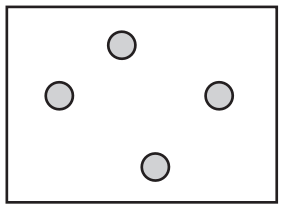
**B**



**C**



**D**



**27** Which statements about the alloy brass are correct?

1 It is harder than pure copper.

2 It does **not** conduct electricity.

3 It is a mixture of copper and nickel.

4 It is stronger than pure copper.

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

**28** The bodies of aircraft are often made using aluminium.

Which two properties of aluminium make it suitable for this use?

| | property 1 | property 2 |
|---|---|---|
| **A** | good conductor of electricity | good conductor of heat |
| **B** | good conductor of electricity | strong |
| **C** | good conductor of heat | low density |
| **D** | strong | low density |

**29** Four metals, P, Q, R and S, are added separately to water and to dilute hydrochloric acid.

The table shows the results.

| | observation with water | observation with dilute hydrochloric acid |
|---|---|---|
| P | no reaction | fizzes slowly |
| Q | fizzes rapidly | fizzes rapidly |
| R | no reaction | no reaction |
| S | fizzes slowly | fizzes rapidly |

Which conclusion can be made from these observations?

**A** P is the least reactive of the four metals.

**B** Q is more reactive than S.

**C** Q is less reactive than P.

**D** R is the most reactive of the four metals.

**30** Iron is extracted from its ore in the blast furnace.

Which statement about one of the reactions in the blast furnace is correct?

**A** Carbon monoxide is reduced to carbon dioxide.

**B** Iron(III) oxide is reduced by carbon dioxide.

**C** Slag is produced when calcium carbonate reacts with carbon dioxide.

**D** The reaction that heats the blast furnace produces carbon dioxide.

**31** Which pollutants found in river water lead to deoxygenation?

1 nitrates

2 harmful microbes

3 metal compounds

4 phosphates

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

**32** Three effects of air pollutants are listed.

1 photochemical smog

2 respiratory problems

3 acid rain

Which effects are caused by oxides of nitrogen?

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

**33** Fractional distillation is used to separate petroleum into its fractions.

Which statement about the fractional distillation of petroleum is correct?

**A** The kerosene fraction is used as a fuel for ships.

**B** The fractions with the highest boiling points are extracted from the top of the fractionating column.

**C** The naphtha fraction contains larger hydrocarbon molecules than the lubricating oil fraction.

**D** The refinery gas fraction contains hydrocarbon molecules which consist of five atoms.

**34** Fertilisers are mixtures of different compounds used to increase the growth of crops.

Which pair of substances contain the three essential elements for plant growth?

**A** ammonium nitrate and calcium phosphate

**B** ammonium nitrate and potassium chloride

**C** ammonium phosphate and potassium chloride

**D** potassium nitrate and calcium carbonate

**35** Which row gives the relative molecular mass, $M_r$, of the first member of the named homologous series?

| | homologous series | $M_r$ |
|---|---|---|
| **A** | alkanes | 12 |
| **B** | alkenes | 14 |
| **C** | alcohols | 32 |
| **D** | carboxylic acids | 60 |

**36** A hydrocarbon decolourises bromine water.

Which statement about the hydrocarbon is correct?

**A** It is an alkane.

**B** Its molecular formula is $C_2H_6$.

**C** It is a saturated hydrocarbon.

**D** It has the general formula $C_nH_{2n}$.

**37** Which statement describes how ethanol is manufactured from ethene?

**A** Steam is added to ethene using an acid catalyst at 30 °C.

**B** Steam is added to ethene using an acid catalyst at 300 °C.

**C** Ethene is fermented using yeast at 30 °C.

**D** Ethene is fermented using yeast at 300 °C.

**38** Ethanoic acid reacts with aqueous sodium carbonate.

Which gas is given off in this reaction?

**A** hydrogen

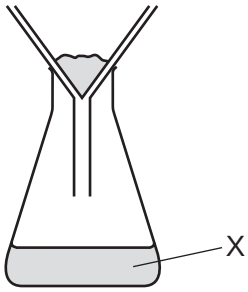
**B** carbon dioxide

**C** carbon monoxide

**D** oxygen

**39** A mixture containing an aqueous salt, sand and hot water is stirred.

The mixture is then poured into the apparatus shown.




What is X?

**A** a filtrate only

**B** a residue only

**C** a solute only

**D** a solvent only

**40** A scientist uses a titration to calculate the concentration of acid in a sample of lemon juice.

A measured volume of aqueous lemon juice and a few drops of an indicator are added to a flask.

The aqueous lemon juice is then titrated against $0.1\,\text{mol}/\text{dm}^3$ aqueous sodium hydroxide.

Which piece of apparatus is used to add the aqueous sodium hydroxide to the flask?

**A** a burette

**B** a delivery tube

**C** a measuring cylinder

**D** a volumetric pipette

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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.).