Cambridge Assessment International Education

# Cambridge IGCSE™

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

Paper 1 Multiple Choice (Core) **October/November 2023**

**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.


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**1** Which statement about solids, liquids or gases is correct?

**A** Solids are easy to compress.

**B** Liquids are easy to compress.

**C** Liquids expand to fill their container.

**D** Gases expand to fill their container.

**2** Which substance is a mixture?

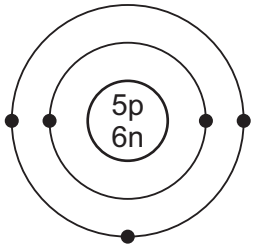
**A** air

**B** graphite

**C** oxygen

**D** water

**3** The structure of an atom of element X is shown.




key
● = electron
n = neutron
p = proton

What is element X?

**A** boron

**B** carbon

**C** sodium

**D** sulfur

**4** Sodium reacts with chlorine to form sodium chloride.

Which statements describe what happens to the sodium atoms in this reaction?

1 Sodium atoms form positive ions.

2 Sodium atoms form negative ions.

3 Sodium atoms gain electrons.

4 Sodium atoms lose electrons.

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

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**5** Which statement about ammonia is correct?

**A** It conducts electricity when liquid.

**B** It contains three covalent bonds.

**C** It has a high boiling point.

**D** It has a giant covalent structure.

**6** Which row describes the structure and a use of graphite?

| | structure | use |
|---|---|---|
| **A** | giant covalent | lubricant |
| **B** | giant covalent | cutting tools |
| **C** | simple molecular | lubricant |
| **D** | simple molecular | cutting tools |

**7** The equation represents the reaction between solid magnesium oxide and dilute hydrochloric acid to form magnesium chloride and water.

$$MgO + 2HCl \rightarrow MgCl_2 + H_2O$$

Which row shows the state symbols for hydrochloric acid, magnesium chloride and water?

| | $HCl$ | $MgCl_2$ | $H_2O$ |
|---|---|---|---|
| **A** | (aq) | (aq) | (l) |
| **B** | (aq) | (l) | (l) |
| **C** | (l) | (aq) | (aq) |
| **D** | (l) | (l) | (aq) |

**8** What is the equation for the reaction between calcium and chlorine?

**A** $2Ca + Cl \rightarrow Ca_2Cl$

**B** $2Ca + Cl_2 \rightarrow Ca_2Cl_2$

**C** $Ca + Cl \rightarrow CaCl$

**D** $Ca + Cl_2 \rightarrow CaCl_2$

**9** Calcium nitrate has the formula $Ca(NO_3)_2$.

What is the relative formula mass, $M_r$, of calcium nitrate?

**A** 102 **B** 150 **C** 164 **D** 204

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**10** Dilute sulfuric acid is electrolysed using platinum electrodes. The gases produced at each electrode are collected.

The gases are mixed together and ignited with a lighted splint.

What is formed during this reaction?

**A** hydrogen sulfide

**B** sulfur dioxide

**C** sulfuric acid

**D** water

**11** Electricity is passed through molten sodium chloride using inert electrodes.

What is observed at the electrodes?

**A** A colourless gas is produced at the negative electrode.

**B** A pale yellow-green gas is produced at the positive electrode.

**C** A silver-coloured metal is produced at the positive electrode.

**D** No change is observed because the electrodes are inert.

**12** Fuel cells are used as energy sources in cars.

Which row gives a fuel used in a fuel cell and the products formed?

| | fuel in a fuel cell | products formed |
|---|---|---|
| **A** | hydrogen | carbon dioxide and water |
| **B** | hydrogen | water only |
| **C** | petrol | carbon dioxide and water |
| **D** | petrol | water only |

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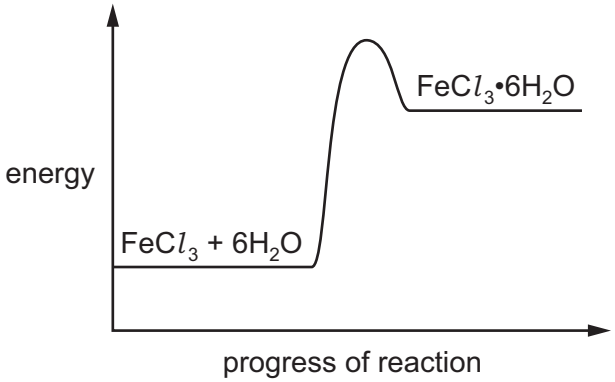
**13** When water is added to anhydrous iron(III) chloride, $FeCl_3$, hydrated iron(III) chloride, $FeCl_3 \cdot 6H_2O$, is formed and energy is given out.

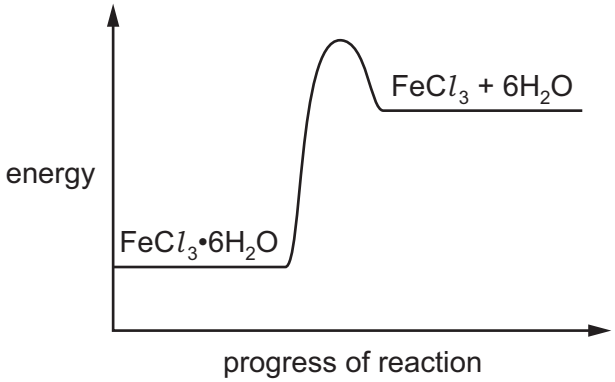
$$FeCl_3 + 6H_2O \rightleftharpoons FeCl_3 \cdot 6H_2O$$

Which reaction pathway diagram represents the formation of anhydrous iron(III) chloride in the **reverse** reaction?

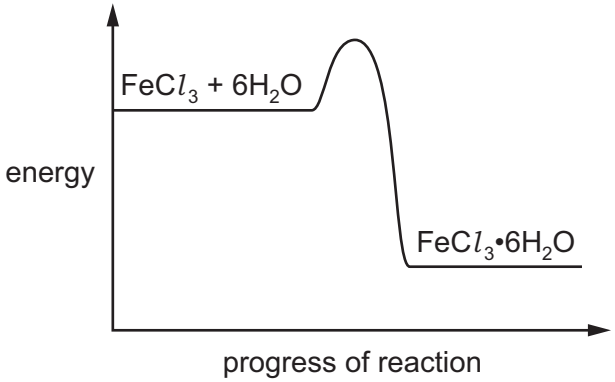
**A**



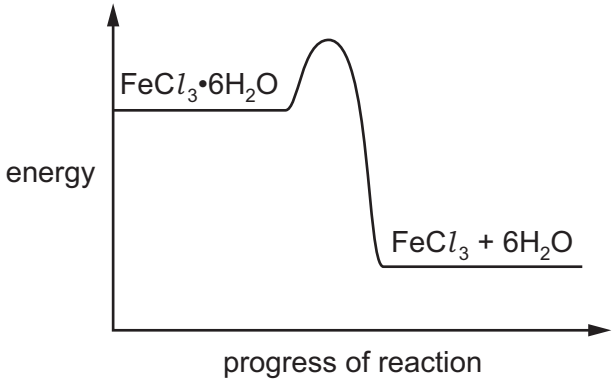

**B**




**C**




**D**




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

**A** burning carbon in air

**B** dissolving copper(II) sulfate crystals in water

**C** evaporating ethanol

**D** freezing water

**15** Anhydrous cobalt(II) chloride is blue and turns pink when water is added.

How is this reaction reversed?

**A** adding dilute acid

**B** filtering

**C** heating

**D** cooling

**16** Ethanol can be turned into ethanoic acid by passing it over hot copper(II) oxide.

$$CH_3CH_2OH + 2CuO \rightarrow CH_3COOH + H_2O + 2Cu$$

What is this type of reaction?

**A** precipitation

**B** redox

**C** thermal decomposition

**D** neutralisation

**17** 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

**18** Information about four solutions, P, Q, R and S, is listed.

Solution P reacts with ammonium chloride to form ammonia.

Solution Q reacts with sodium carbonate to form carbon dioxide.

Solution R contains a high concentration of $OH^-$ ions.

Solution S turns litmus red.

Which solutions are alkaline?

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

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**19** Which oxides are basic?

1 calcium oxide

2 sodium oxide

3 iron(II) oxide

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

**20** Which row describes the changes across a period of the Periodic Table, from left to right?

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

**21** Which row shows properties of an element that is in the same group of the Periodic Table as lithium?

| | electrical conductivity | density in $g/cm^3$ |
|---|---|---|
| **A** | high | 0.97 |
| **B** | high | 8.93 |
| **C** | low | 0.07 |
| **D** | low | 3.12 |

**22** Which row describes how the properties of Group I elements change as the group is descended?

| | melting point | density | reactivity |
|---|---|---|---|
| **A** | increases | increases | increases |
| **B** | increases | decreases | decreases |
| **C** | decreases | increases | increases |
| **D** | decreases | decreases | decreases |

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**23** The elements in Group VII include chlorine, bromine and iodine.

Which statements are correct?

1 Iodine is more dense than chlorine.

2 Iodine displaces chlorine from a solution containing chloride ions.

3 Bromine is a diatomic non-metal.

4 Chlorine gas is darker in colour than bromine vapour.

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

**24** Cobalt is a transition element.

What is a property of cobalt?

**A** It can form coloured compounds.

**B** It is a poor electrical conductor.

**C** It has a low density.

**D** It has a low melting point.

**25** Which statements about brass are correct?

1 It is an alloy of zinc and copper.

2 It is a compound of zinc and copper.

3 It is a mixture of zinc and copper.

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

**26** Aluminium is used to make containers for storing food.

Which property makes it suitable for this use?

**A** conducts heat

**B** low density

**C** resists corrosion

**D** shiny surface

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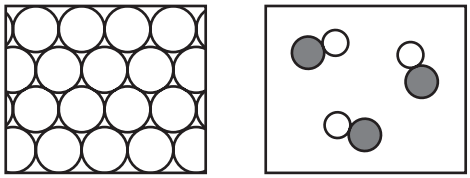
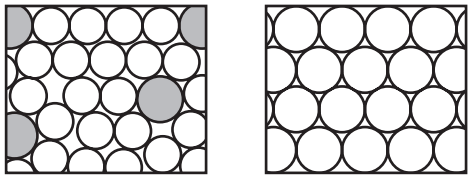
**27** Which pair of diagrams represents both a pure metal and an alloy?

**A**



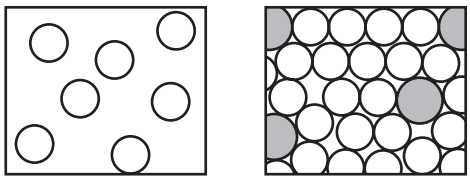
pure metal alloy

**B**



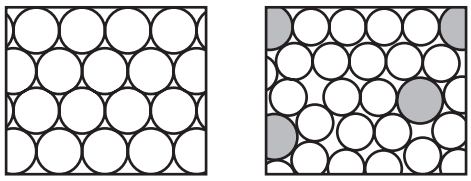
pure metal alloy

**C**



pure metal alloy

**D**



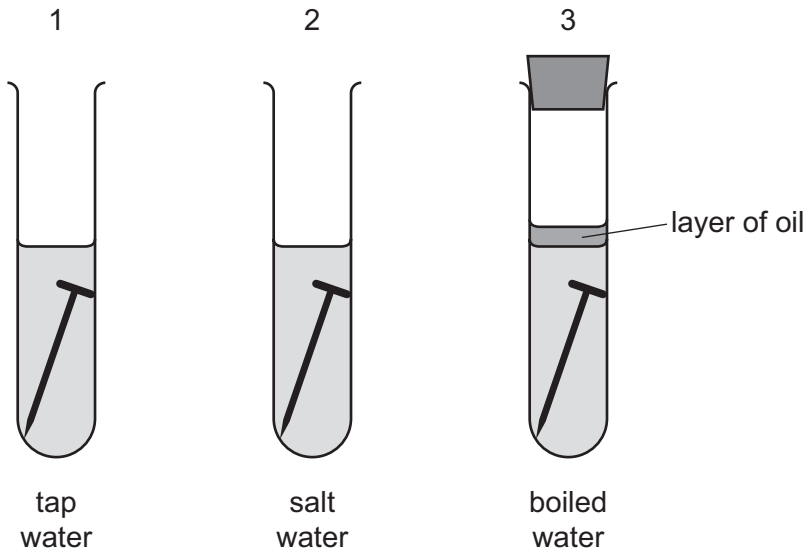
pure metal alloy

**28** A metal M is between sodium and magnesium in the reactivity series.

Which reactions occur with M and its oxide?

| | M reacts with steam | M can be extracted by heating its oxide with carbon |
|---|---|---|
| **A** | no | no |
| **B** | no | yes |
| **C** | yes | no |
| **D** | yes | yes |

**29** The diagrams show experiments to investigate rusting of iron nails.




In which test-tubes do the nails rust?

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

**30** Some uses of water are listed.

1 for drinking

2 in chemical reactions

3 in swimming pools

4 in washing

For which uses is it necessary to chlorinate the water?

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

**31** Two tests are done on an NPK fertiliser.

test 1 flame test

test 2 heat with aqueous sodium hydroxide and aluminium foil

Which observations are made?

| | test 1 | test 2 |
|---|---|---|
| **A** | green flame | gas evolved which turns red litmus blue |
| **B** | green flame | gas evolved which turns blue litmus red |
| **C** | lilac flame | gas evolved which turns red litmus blue |
| **D** | lilac flame | gas evolved which turns blue litmus red |

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**32** The gases from the engine of a car contain oxides of nitrogen.

How are these oxides formed?

**A** Nitrogen reacts with carbon dioxide.

**B** Nitrogen reacts with carbon monoxide.

**C** Nitrogen reacts with oxygen.

**D** Nitrogen reacts with petrol.

**33** Which statements explain why plastics should be recycled?

1 They do not decompose when added to land fill.

2 They pollute rivers and oceans, harming wildlife.

3 They can produce toxic gases when burned.

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

**34** Unwanted vegetation is sometimes placed in a bin where it decomposes. The compost formed is used to fertilise soils.

Which gas is likely to be present in a higher percentage inside the bin than in the air outside the bin?

**A** carbon monoxide

**B** methane

**C** oxygen

**D** sulfur dioxide

**35** Ethene reacts with steam and with bromine in two separate reactions.

What are the products of these two reactions?

**A** ethanoic acid and bromoethane

**B** ethanoic acid and dibromoethane

**C** ethanol and bromoethane

**D** ethanol and dibromoethane

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**36** Four types of reactions are listed.

1 substitution

2 combustion

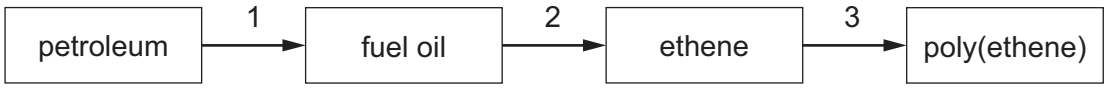
3 polymerisation

4 addition

Which reactions will ethane undergo?

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

**37** The flow diagram shows how poly(ethene) may be made from petroleum.



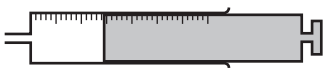

What are stages 1, 2 and 3?

| | 1 | 2 | 3 |
|---|---|---|---|
| **A** | cracking | polymerisation | fractional distillation |
| **B** | cracking | fractional distillation | polymerisation |
| **C** | fractional distillation | cracking | polymerisation |
| **D** | fractional distillation | polymerisation | cracking |

**38** Magnesium reacts with dilute hydrochloric acid to produce hydrogen gas.

Which pieces of apparatus are needed to determine the rate of this reaction?

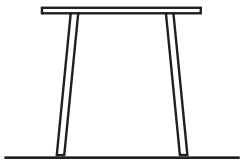
1



2

3

4



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

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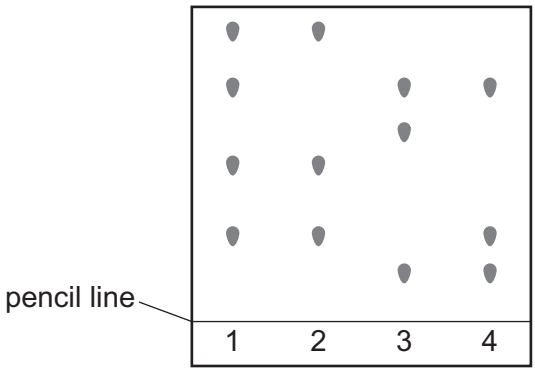
**39** The chromatograms of four different dyes are shown.




How many different colours are present in the four dyes?

**A** 4 **B** 5 **C** 6 **D** 13

**40** The results of some tests on an aqueous solution of substance X are listed.

1 A cream precipitate is produced when adding aqueous silver nitrate.

2 Adding aqueous sodium hydroxide produces a green precipitate which dissolves in excess alkali.

3 Adding aqueous ammonia produces a green precipitate which is insoluble in excess ammonia.

What is substance X?

**A** chromium(III) bromide

**B** chromium(III) chloride

**C** iron(II) bromide

**D** iron(II) chloride

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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.).