



# 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.



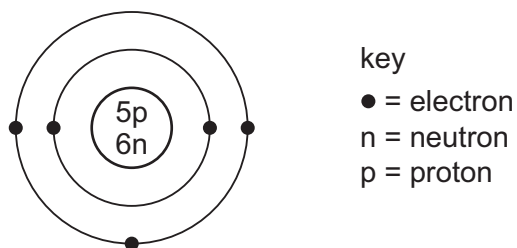
1 Which statement about solids, liquids or gases is correct?

- 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.



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

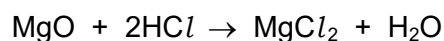
5 Which statement about ammonia is correct?

- 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.



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

|   | HCl  | MgCl <sub>2</sub> | H <sub>2</sub> O |
|---|------|-------------------|------------------|
| 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  $2\text{Ca} + \text{Cl} \rightarrow \text{Ca}_2\text{Cl}$
- B  $2\text{Ca} + \text{Cl}_2 \rightarrow \text{Ca}_2\text{Cl}_2$
- C  $\text{Ca} + \text{Cl} \rightarrow \text{CaCl}$
- D  $\text{Ca} + \text{Cl}_2 \rightarrow \text{CaCl}_2$

9 Calcium nitrate has the formula  $\text{Ca}(\text{NO}_3)_2$ .

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

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

- 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.

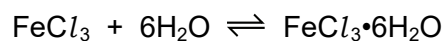
What is observed at the electrodes?

- 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.

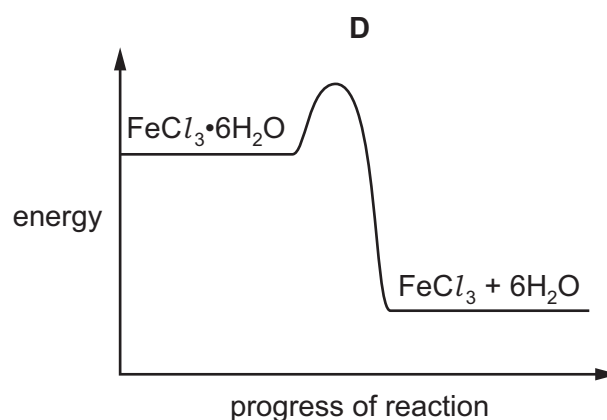
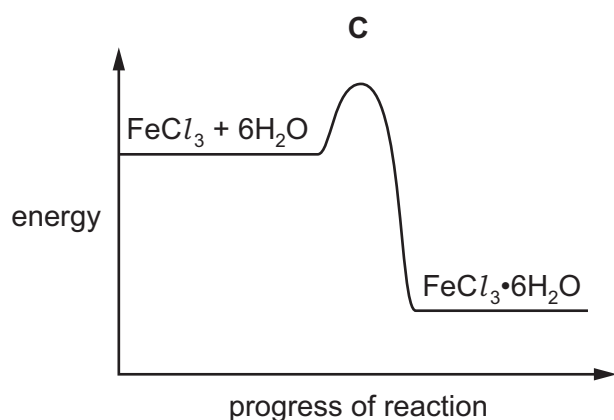
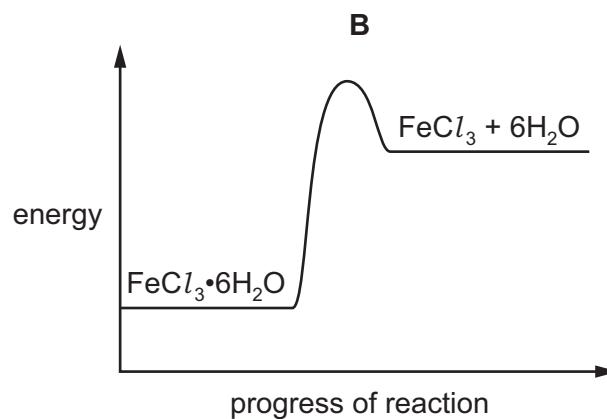
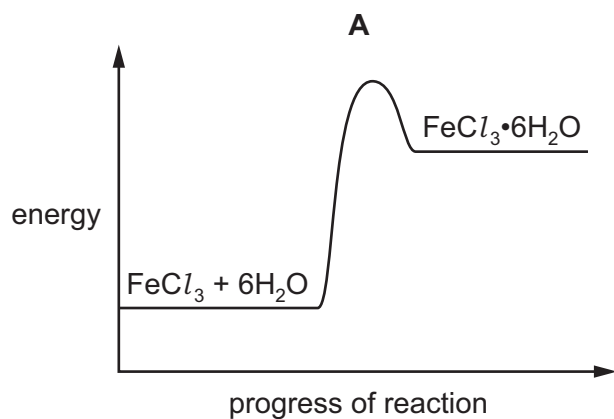
Which row gives a fuel used in a fuel cell and the products formed?

|          | fuel in a fuel cell | products formed          |
|----------|---------------------|--------------------------|
| <b>A</b> | hydrogen            | carbon dioxide and water |
| <b>B</b> | hydrogen            | water only               |
| <b>C</b> | petrol              | carbon dioxide and water |
| <b>D</b> | petrol              | water only               |

- 13 When water is added to anhydrous iron(III) chloride,  $\text{FeCl}_3$ , hydrated iron(III) chloride,  $\text{FeCl}_3 \cdot 6\text{H}_2\text{O}$ , is formed and energy is given out.



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



- 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

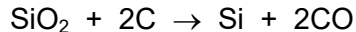
- 16** Ethanol can be turned into ethanoic acid by passing it over hot copper(II) oxide.



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.



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  $\text{OH}^-$  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

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<br>outer-shell electrons | metallic character |
|----------|------------------------------------|--------------------|
| <b>A</b> | decreases                          | decreases          |
| <b>B</b> | decreases                          | increases          |
| <b>C</b> | increases                          | increases          |
| <b>D</b> | increases                          | decreases          |

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

|          | electrical<br>conductivity | density<br>in g / cm <sup>3</sup> |
|----------|----------------------------|-----------------------------------|
| <b>A</b> | high                       | 0.97                              |
| <b>B</b> | high                       | 8.93                              |
| <b>C</b> | low                        | 0.07                              |
| <b>D</b> | low                        | 3.12                              |

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

|          | melting point | density   | reactivity |
|----------|---------------|-----------|------------|
| <b>A</b> | increases     | increases | increases  |
| <b>B</b> | increases     | decreases | decreases  |
| <b>C</b> | decreases     | increases | increases  |
| <b>D</b> | decreases     | decreases | decreases  |

**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.

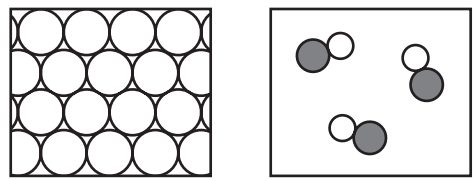
Which property makes it suitable for this use?

- A** conducts heat
- B** low density
- C** resists corrosion
- D** shiny surface



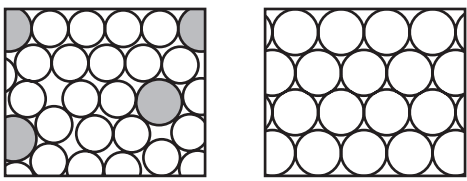
27 Which pair of diagrams represents both a pure metal and an alloy?

**A**



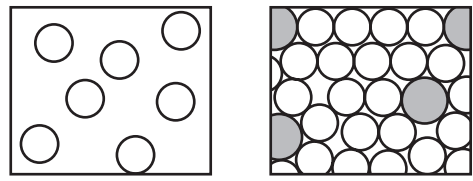
pure metal                      alloy

**B**



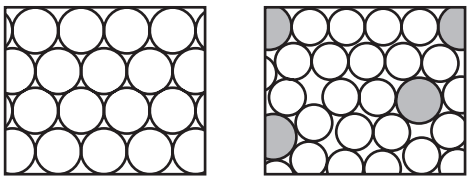
pure metal                      alloy

**C**



pure metal                      alloy

**D**



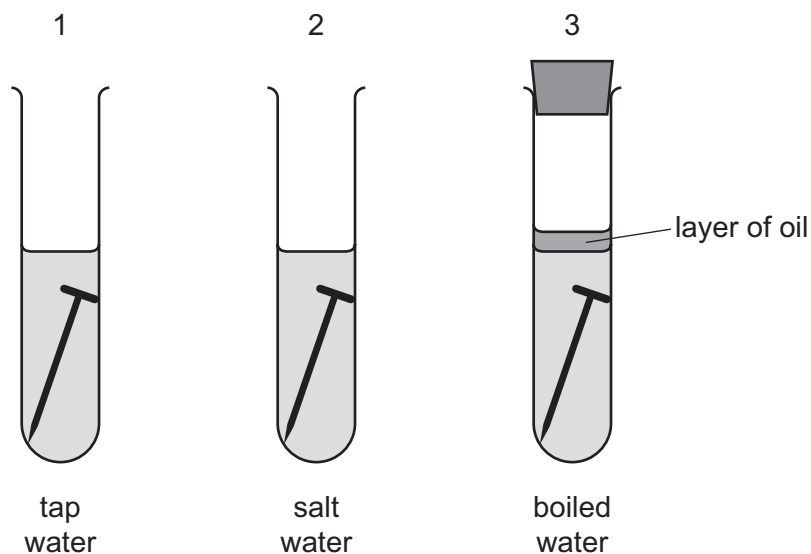
pure metal                      alloy

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 |
|----------|---------------------|-----------------------------------------------------|
| <b>A</b> | no                  | no                                                  |
| <b>B</b> | no                  | yes                                                 |
| <b>C</b> | yes                 | no                                                  |
| <b>D</b> | 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                                  |
|----------|-------------|-----------------------------------------|
| <b>A</b> | green flame | gas evolved which turns red litmus blue |
| <b>B</b> | green flame | gas evolved which turns blue litmus red |
| <b>C</b> | lilac flame | gas evolved which turns red litmus blue |
| <b>D</b> | lilac flame | gas evolved which turns blue litmus red |

- 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

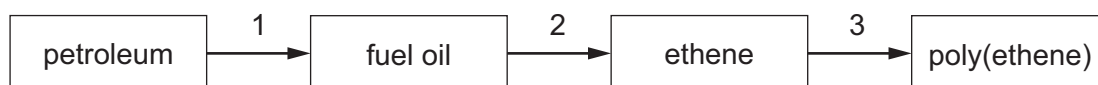
36 Four types of reactions are listed.

- 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.

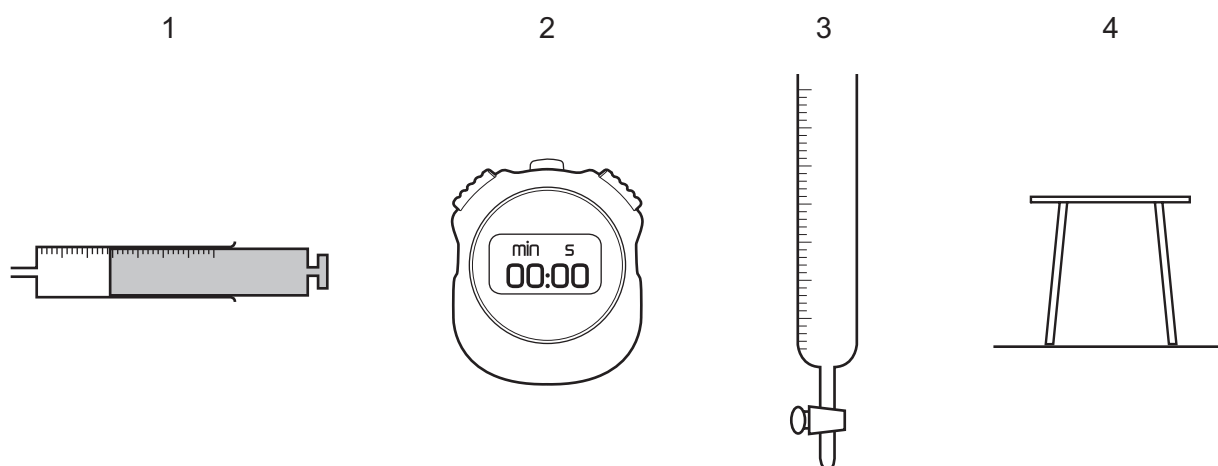


What are stages 1, 2 and 3?

|          | 1                       | 2                       | 3                       |
|----------|-------------------------|-------------------------|-------------------------|
| <b>A</b> | cracking                | polymerisation          | fractional distillation |
| <b>B</b> | cracking                | fractional distillation | polymerisation          |
| <b>C</b> | fractional distillation | cracking                | polymerisation          |
| <b>D</b> | fractional distillation | polymerisation          | cracking                |

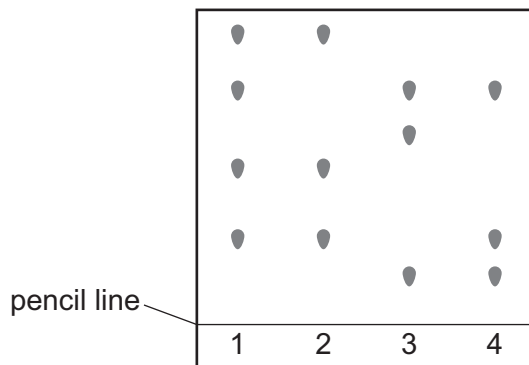
38 Magnesium reacts with dilute hydrochloric acid to produce hydrogen gas.

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



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

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

**BLANK PAGE**

**BLANK PAGE**

---

Permission to reproduce items where third-party owned material protected by copyright is included has been sought and cleared where possible. Every reasonable effort has been made by the publisher (UCLES) to trace copyright holders, but if any items requiring clearance have unwittingly been included, the publisher will be pleased to make amends at the earliest possible opportunity.

To avoid the issue of disclosure of answer-related information to candidates, all copyright acknowledgements are reproduced online in the Cambridge Assessment International Education Copyright Acknowledgements Booklet. This is produced for each series of examinations and is freely available to download at [www.cambridgeinternational.org](http://www.cambridgeinternational.org) after the live examination series.

Cambridge Assessment International Education is part of Cambridge Assessment. Cambridge Assessment is the brand name of the University of Cambridge Local Examinations Syndicate (UCLES), which is a department of the University of Cambridge.

The Periodic Table of Elements

| Group                      |                             |                                                                                             |                             |                                 |                              |                              |                              |                              |                                |                               |                               |                             |                             |                             |                               |                              |                            |                              |                         |  |
|----------------------------|-----------------------------|---------------------------------------------------------------------------------------------|-----------------------------|---------------------------------|------------------------------|------------------------------|------------------------------|------------------------------|--------------------------------|-------------------------------|-------------------------------|-----------------------------|-----------------------------|-----------------------------|-------------------------------|------------------------------|----------------------------|------------------------------|-------------------------|--|
| I                          | II                          |                                                                                             |                             |                                 |                              |                              |                              |                              |                                |                               |                               | III                         | IV                          | V                           | VI                            | VII                          | VIII                       |                              |                         |  |
|                            |                             | <div>1<br/>H<br/>hydrogen<br/>1</div>                                                       |                             |                                 |                              |                              |                              |                              |                                |                               |                               |                             |                             |                             |                               |                              |                            |                              |                         |  |
|                            |                             | <div>Key</div> <div>atomic number<br/>atomic symbol<br/>name<br/>relative atomic mass</div> |                             |                                 |                              |                              |                              |                              |                                |                               |                               |                             |                             |                             |                               |                              |                            |                              |                         |  |
| 3<br>Li<br>lithium<br>7    | 4<br>Be<br>beryllium<br>9   |                                                                                             |                             |                                 |                              |                              |                              |                              |                                |                               |                               |                             |                             | 5<br>B<br>boron<br>11       | 6<br>C<br>carbon<br>12        | 7<br>N<br>nitrogen<br>14     | 8<br>O<br>oxygen<br>16     | 9<br>F<br>fluorine<br>19     |                         |  |
| 11<br>Na<br>sodium<br>23   | 12<br>Mg<br>magnesium<br>24 |                                                                                             |                             |                                 |                              |                              |                              |                              |                                |                               |                               |                             |                             | 13<br>Al<br>aluminium<br>27 | 14<br>Si<br>silicon<br>28     | 15<br>P<br>phosphorus<br>31  | 16<br>S<br>sulfur<br>32    | 17<br>Cl<br>chlorine<br>35.5 | 18<br>Ar<br>argon<br>40 |  |
| 19<br>K<br>potassium<br>39 | 20<br>Ca<br>calcium<br>40   | 21<br>Sc<br>scandium<br>45                                                                  | 22<br>Ti<br>titanium<br>48  | 23<br>V<br>vanadium<br>51       | 24<br>Cr<br>chromium<br>52   | 25<br>Mn<br>manganese<br>55  | 26<br>Fe<br>iron<br>56       | 27<br>Co<br>cobalt<br>59     | 28<br>Ni<br>nickel<br>59       | 29<br>Cu<br>copper<br>64      | 30<br>Zn<br>zinc<br>65        | 31<br>Ga<br>gallium<br>70   | 32<br>Ge<br>germanium<br>73 | 33<br>As<br>arsenic<br>75   | 34<br>Se<br>selenium<br>79    | 35<br>Br<br>bromine<br>80    | 36<br>Kr<br>krypton<br>84  |                              |                         |  |
| 37<br>Rb<br>rubidium<br>85 | 38<br>Sr<br>strontium<br>88 | 39<br>Y<br>yttrium<br>89                                                                    | 40<br>Zr<br>zirconium<br>91 | 41<br>Nb<br>niobium<br>93       | 42<br>Mo<br>molybdenum<br>96 | 43<br>Tc<br>technetium<br>—  | 44<br>Ru<br>ruthenium<br>101 | 45<br>Rh<br>rhodium<br>103   | 46<br>Pd<br>palladium<br>106   | 47<br>Ag<br>silver<br>108     | 48<br>Cd<br>cadmium<br>112    | 49<br>In<br>indium<br>115   | 50<br>Sn<br>tin<br>119      | 51<br>Sb<br>antimony<br>122 | 52<br>Te<br>tellurium<br>128  | 53<br>I<br>iodine<br>127     | 54<br>Xe<br>xenon<br>131   |                              |                         |  |
| 55<br>Cs<br>caesium<br>133 | 56<br>Ba<br>barium<br>137   | 57–71<br>lanthanoids                                                                        |                             | 72<br>Hf<br>hafnium<br>178      | 73<br>Ta<br>tantalum<br>181  | 74<br>W<br>tungsten<br>184   | 76<br>Os<br>osmium<br>190    | 77<br>Ir<br>iridium<br>192   | 78<br>Pt<br>platinum<br>195    | 79<br>Au<br>gold<br>197       | 80<br>Hg<br>mercury<br>201    | 81<br>Tl<br>thallium<br>204 | 82<br>Pb<br>lead<br>207     | 83<br>Bi<br>bismuth<br>209  | 84<br>Po<br>polonium<br>—     | 85<br>At<br>astatine<br>—    | 86<br>Rn<br>radon<br>—     |                              |                         |  |
| 87<br>Fr<br>francium<br>—  | 88<br>Ra<br>radium<br>—     | 89–103<br>actinoids                                                                         |                             | 104<br>Rf<br>rutherfordium<br>— | 105<br>Db<br>dubnium<br>—    | 106<br>Sg<br>seaborgium<br>— | 108<br>Hs<br>hassium<br>—    | 109<br>Mt<br>meitnerium<br>— | 110<br>Ds<br>darmstadtium<br>— | 111<br>Rg<br>roentgenium<br>— | 112<br>Cn<br>copernicium<br>— | 113<br>Nh<br>nihonium<br>—  | 114<br>Fl<br>flerovium<br>— | 115<br>Mc<br>moscovium<br>— | 116<br>Lv<br>livermorium<br>— | 117<br>Ts<br>tennessine<br>— | 118<br>Og<br>oganeson<br>— |                              |                         |  |

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

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