



# Cambridge IGCSE™

## CHEMISTRY

Paper 1 Multiple Choice (Core)

0620/13

May/June 2025

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.

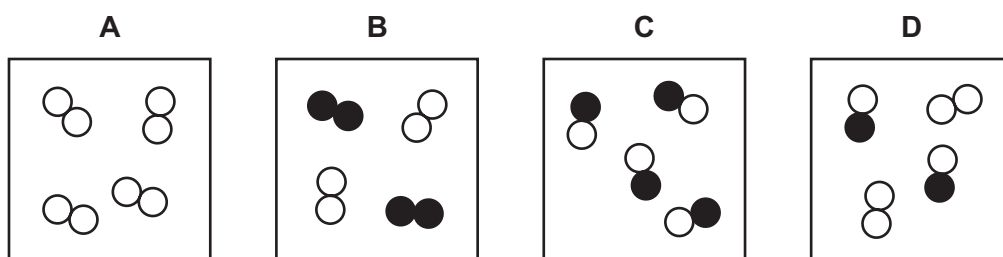


- 1 Liquid iron is cooled to form solid iron.

Which statement about the particles in iron is correct?

- A The particles move further apart.
- B The particles move faster.
- C The position of the particles becomes fixed.
- D The attractions between the particles become weaker.

- 2 Which diagram shows a mixture of an element and a compound?



- 3 Which statement about elements and their atoms is correct?

- A Aluminium is in the second period of the Periodic Table and has two occupied electron shells.
- B Helium is in Group VIII of the Periodic Table and has eight outer shell electrons.
- C Lithium is in Group I of the Periodic Table and has one occupied electron shell.
- D Sulfur is in the third period of the Periodic Table and has six outer shell electrons.

- 4 An atom of the element erbium is represented by  $^{167}_{68}\text{Er}$ .

Which row shows the number of protons, neutrons and electrons in this atom?

|          | protons | neutrons | electrons |
|----------|---------|----------|-----------|
| <b>A</b> | 68      | 99       | 68        |
| <b>B</b> | 68      | 99       | 99        |
| <b>C</b> | 99      | 68       | 68        |
| <b>D</b> | 99      | 68       | 99        |

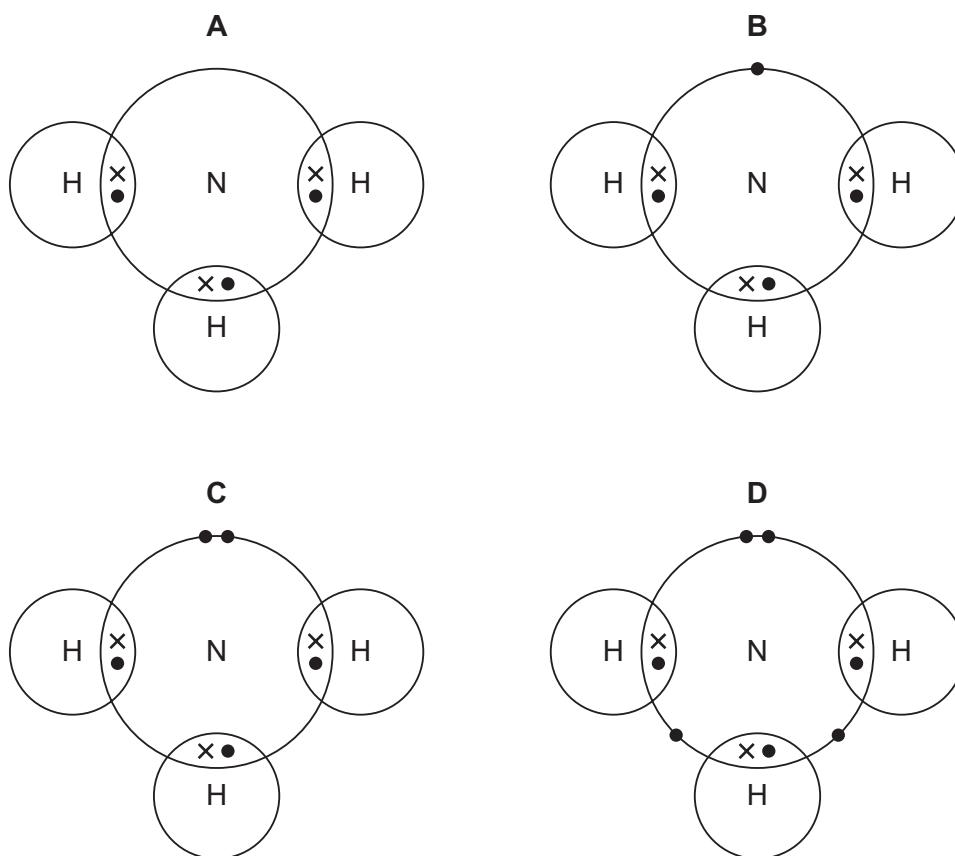
- 5 Rubidium is in Group I of the Periodic Table and bromine is in Group VII of the Periodic Table.

Rubidium reacts with bromine to form an ionic compound.

Which row shows the electron change taking place for rubidium and the correct formula of the rubidium ion formed?

|          | electron change | formula of ion formed |
|----------|-----------------|-----------------------|
| <b>A</b> | electron gained | $\text{Rb}^+$         |
| <b>B</b> | electron gained | $\text{Rb}^-$         |
| <b>C</b> | electron lost   | $\text{Rb}^+$         |
| <b>D</b> | electron lost   | $\text{Rb}^-$         |

- 6 Which dot-and-cross diagram represents the electronic configuration for the outer shell electrons in ammonia,  $\text{NH}_3$ ?



- 7 Which statements about graphite are correct?

- Each carbon atom is covalently bonded to four other carbon atoms.
- Graphite is an electrical conductor because it contains ions that are free to move.
- Graphite is used as a lubricant because it has layers that slide over each other.

**A** 1 and 2

**B** 1 only

**C** 2 and 3

**D** 3 only

8 Which equation represents the reaction of magnesium with dilute hydrochloric acid?

- A  $\text{Mg(s)} + 2\text{HCl(aq)} \rightarrow \text{MgCl}_2\text{(aq)} + \text{H}_2\text{(g)}$   
 B  $\text{Mg(s)} + 2\text{HCl(l)} \rightarrow \text{MgCl}_2\text{(s)} + \text{H}_2\text{(g)}$   
 C  $2\text{Mg(s)} + 2\text{HCl(aq)} \rightarrow 2\text{MgCl(aq)} + \text{H}_2\text{(g)}$   
 D  $2\text{Mg(s)} + 2\text{HCl(l)} \rightarrow 2\text{MgCl(s)} + \text{H}_2\text{(g)}$

9 The relative formula mass,  $M_r$ , of calcium carbonate,  $\text{CaCO}_3$ , is 100.

What is the mass of carbon present in 100 g of calcium carbonate?

- A 12 g                      B 36 g                      C 40 g                      D 60 g

10 What is the definition of relative atomic mass?

- A It is the average mass of the isotopes of an element compared to  $\frac{1}{12}$ th of the mass of an atom of  $^{12}\text{C}$ .  
 B It is the total mass of the isotopes of an element compared to  $\frac{1}{12}$ th of the mass of an atom of  $^{12}\text{C}$ .  
 C It is the average mass of an element compared to  $\frac{1}{12}$ th of the mass of an atom of  $^{12}\text{C}$ .  
 D It is the total mass of an element compared to  $\frac{1}{12}$ th of the mass of an atom of  $^{12}\text{C}$ .

11 Which row describes the electrolysis of molten potassium bromide?

|   | product at anode | product at cathode |
|---|------------------|--------------------|
| A | bromine          | hydrogen           |
| B | bromine          | potassium          |
| C | hydrogen         | bromine            |
| D | potassium        | bromine            |

12 What is produced in a hydrogen–oxygen fuel cell?

- A hydrogen and oxygen  
 B hydrogen only  
 C carbon dioxide  
 D water

- 13** When ammonium nitrate is added to water, the temperature of the mixture decreases.

The ammonium nitrate can be recovered by evaporating the water.

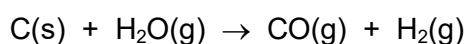
Which statement explains these observations?

- A** The ammonium nitrate dissolves in the water, and the process is endothermic.  
**B** The ammonium nitrate reacts with the water, and the process is endothermic.  
**C** The ammonium nitrate dissolves in the water, and the process is exothermic.  
**D** The ammonium nitrate reacts with the water, and the process is exothermic.
- 14** Magnesium is reacted with dilute hydrochloric acid. The table shows the total volume of hydrogen produced every 15 seconds.

|                                          |   |    |    |    |    |    |    |     |     |
|------------------------------------------|---|----|----|----|----|----|----|-----|-----|
| time/s                                   | 0 | 15 | 30 | 45 | 60 | 75 | 90 | 105 | 120 |
| total volume of hydrogen/cm <sup>3</sup> | 0 | 18 | 32 | 48 | 59 | 64 | 68 | 72  | 74  |

During which time period is the rate of reaction the fastest?

- A** 0–30 seconds  
**B** 30–60 seconds  
**C** 60–90 seconds  
**D** 90–120 seconds
- 15** Which substance forms a blue solution when it is added to water?
- A** cobalt(II) chloride  
**B** copper(II) sulfate  
**C** thymolphthalein  
**D** universal indicator
- 16** Steam reacts with carbon to produce carbon monoxide and hydrogen.



Which substance is reduced in the reaction?

- A** C                      **B** CO                      **C** H<sub>2</sub>                      **D** H<sub>2</sub>O

17 Three compounds are listed.

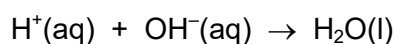
- 1 aluminium nitrate
- 2 ammonium chloride
- 3 ammonium nitrate

All three compounds are heated with aqueous sodium hydroxide.

Which compounds produce ammonia?

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

18 A solution containing hydroxide ions,  $\text{OH}^-(\text{aq})$ , is added to a solution containing hydrogen ions,  $\text{H}^+(\text{aq})$ . An equation representing the reaction is shown.



Which statement about the reaction is correct?

- A** The hydrogen ions represent an alkali.
- B** The reaction is a neutralisation reaction.
- C** The reaction is a reduction.
- D** As the  $\text{OH}^-$  ions are added, the pH of the reaction mixture falls.

19 Which compound is an acidic oxide?

- A** barium oxide
- B** carbon dioxide
- C** copper(II) oxide
- D** magnesium oxide

20 Which statement describes a hydrated salt?

- A** It is an aqueous solution of a salt.
- B** It is a solid salt that is chemically combined with water.
- C** It is a solid salt that contains no water.
- D** It is a salt that has been broken down by water.

**21** In the Periodic Table, how does the metallic character of the elements vary from left to right across a period?

- A** It decreases.
- B** It increases.
- C** It increases then decreases.
- D** It stays the same.

**22** Lithium, sodium and potassium are elements in Group I of the Periodic Table.

Which statements about these elements are correct?

- 1 They react with water to produce hydrogen.
- 2 The melting point increases down the group.
- 3 The density decreases down the group.
- 4 The reactivity increases down the group.

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

**23** X, Y and Z are each one of the elements chlorine, bromine and iodine.

When aqueous X is mixed with aqueous ions of Y, there is no reaction.

When aqueous Y is mixed with aqueous ions of Z, there is no reaction.

Which statement is correct?

- A** X is more reactive than Y.
- B** X is a pale yellow-green gas at room temperature and pressure.
- C** Y is a red-brown liquid at room temperature and pressure.
- D** Z is less reactive than Y.

**24** Which row describes the properties of a transition element?

|          | melting point<br>/ °C | density<br>at r.t.p. | colour and state<br>of its oxide at r.t.p. |
|----------|-----------------------|----------------------|--------------------------------------------|
| <b>A</b> | –210                  | low                  | brown gas                                  |
| <b>B</b> | 113                   | high                 | white solid                                |
| <b>C</b> | 650                   | low                  | white solid                                |
| <b>D</b> | 1085                  | high                 | red solid                                  |

**25** Which statements about the elements in Group VIII are correct?

- 1 They all have eight electrons in their outer electron shell.
- 2 They all react with sodium to form ionic compounds.
- 3 They are all monatomic gases.

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

**26** Sulfur and potassium are two elements in the Periodic Table.

Which row identifies the element with the higher thermal conductivity and the element with the lower malleability?

|          | higher thermal conductivity | lower malleability |
|----------|-----------------------------|--------------------|
| <b>A</b> | sulfur                      | potassium          |
| <b>B</b> | sulfur                      | sulfur             |
| <b>C</b> | potassium                   | sulfur             |
| <b>D</b> | potassium                   | potassium          |

**27** Three statements about aluminium and copper are listed.

- 1 The density of aluminium is less than that of copper.
- 2 The electrical conductivity of copper is higher than that of aluminium.
- 3 Aluminium is more reactive than copper.

Which statements explain why aluminium is used instead of copper to make overhead power cables?

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

28 The table gives some information about the reactions of four metals, J, K, L and M.

| metal | reactions                                                              |
|-------|------------------------------------------------------------------------|
| J     | reacts with steam and hydrochloric acid but <b>not</b> with cold water |
| K     | reacts with hydrochloric acid but <b>not</b> with steam or cold water  |
| L     | reacts with hydrochloric acid and with cold water                      |
| M     | does <b>not</b> react with hydrochloric acid                           |

What is the order of reactivity of metals J, K, L and M?

|          | most<br>reactive | → | least<br>reactive |   |
|----------|------------------|---|-------------------|---|
| <b>A</b> | L                | J | K                 | M |
| <b>B</b> | L                | K | J                 | M |
| <b>C</b> | M                | J | K                 | L |
| <b>D</b> | M                | K | J                 | L |

29 What is the chemical name for rust?

- A** anhydrous iron(II) oxide
- B** anhydrous iron(III) oxide
- C** hydrated iron(II) oxide
- D** hydrated iron(III) oxide

30 Water from natural sources can contain many dissolved substances.

Which substances are often harmful to aquatic life?

- 1 dissolved oxygen
- 2 nitrates
- 3 phosphates

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

31 Which gas is over 30% of clean, dry air?

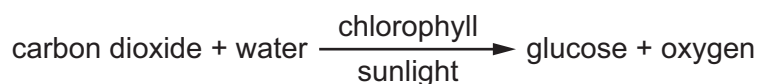
- A** argon
- B** carbon dioxide
- C** nitrogen
- D** oxygen

- 32 Farmers use fertilisers to replace elements in the soil that have been removed by the crops they grow.

Which elements in the soil are replaced by adding fertilisers?

- A** Ca, P, O      **B** K, O, S      **C** N, O, S      **D** N, K, P

- 33 The equation for the reaction between carbon dioxide and water in the presence of chlorophyll and sunlight is shown.



Which process does this equation represent?

- A** combustion  
**B** decomposition  
**C** displacement  
**D** photosynthesis
- 34 Which statement about members of a homologous series is correct?
- A** They are elements with the same chemical properties.  
**B** They are compounds with the same functional group.  
**C** They are atoms with the same number of outer shell electrons.  
**D** They are molecules with the same boiling point.
- 35 The molecular formulae of four organic compounds, W, X, Y and Z, are shown.

| W                              | X                      | Y                                | Z                         |
|--------------------------------|------------------------|----------------------------------|---------------------------|
| $\text{C}_3\text{H}_8\text{O}$ | $\text{C}_3\text{H}_6$ | $\text{C}_4\text{H}_8\text{O}_2$ | $\text{C}_6\text{H}_{14}$ |

Which statement about compounds W, X, Y and Z is correct?

- A** W and Z could both be alcohols.  
**B** Y is the only compound that could be a carboxylic acid.  
**C** W is a hydrocarbon.  
**D** X is ethene.

**36** Fractional distillation is used to separate petroleum into useful fractions.

Which statement about the properties of the fractions of petroleum is correct?

- A** The refinery gas fraction has a lower volatility than the gasoline fraction.
- B** The molecules in the gasoline fraction have a longer chain length than the molecules in the naphtha fraction.
- C** The naphtha fraction has a higher boiling point than the kerosene fraction.
- D** The fuel oil fraction has a higher viscosity than the diesel oil fraction.

**37** Which statements about the alkanes are correct?

- 1 They are generally unreactive except in terms of combustion and substitution by chlorine.
- 2 They have the general formula  $C_nH_{2n+2}$ .
- 3 They contain double carbon–carbon covalent bonds.
- 4 They decolourise aqueous bromine.

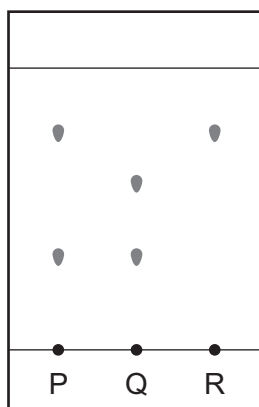
**A** 1, 2 and 3      **B** 1 and 2 only      **C** 1, 3 and 4      **D** 2 and 4

**38** Which products can be formed by the cracking of one molecule of hexane,  $C_6H_{14}$ ?

- A**  $C_4H_{10}$  and  $C_2H_4$  only
- B**  $C_{12}H_{26}$  and  $H_2$  only
- C**  $C_3H_7$  only
- D**  $C_2H_6$  and  $C_4H_{10}$  only

- 39 Three coloured inks, P, Q and R, are tested using paper chromatography.

The chromatogram is shown.



Which statement is correct?

- A P is a pure substance.
  - B P and Q have a colour that could be the same in both inks.
  - C The top line of the chromatogram is called the baseline.
  - D All the colours in R are also in Q.
- 40 The table shows the results of two separate tests on a sample of aqueous T.

| test                   | observation   |
|------------------------|---------------|
| flame test             | yellow flame  |
| add dilute nitric acid | effervescence |

What is the identity of T?

- A sodium chloride
- B calcium chloride
- C sodium carbonate
- D calcium carbonate

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The Periodic Table of Elements

| Group                      |                             |                                                                                             |                                 |                             |                              |                             |                              |                              |                                |                               |                               |                             |                             |                             |                               |                              |                             |                        |
|----------------------------|-----------------------------|---------------------------------------------------------------------------------------------|---------------------------------|-----------------------------|------------------------------|-----------------------------|------------------------------|------------------------------|--------------------------------|-------------------------------|-------------------------------|-----------------------------|-----------------------------|-----------------------------|-------------------------------|------------------------------|-----------------------------|------------------------|
| I                          | II                          |                                                                                             |                                 |                             |                              |                             |                              |                              |                                |                               |                               | III                         | IV                          | V                           | VI                            | VII                          | VIII                        |                        |
| 3<br>Li<br>lithium<br>7    | 4<br>Be<br>beryllium<br>9   | <div>Key</div> <div>atomic number<br/>atomic symbol<br/>name<br/>relative atomic mass</div> |                                 |                             |                              |                             |                              |                              |                                |                               |                               | 1<br>H<br>hydrogen<br>1     | 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    | 10<br>Ne<br>neon<br>20 |
|                            |                             |                                                                                             |                                 |                             |                              |                             |                              |                              |                                |                               |                               |                             |                             |                             |                               |                              |                             |                        |
|                            |                             |                                                                                             |                                 |                             |                              |                             |                              |                              |                                |                               |                               |                             |                             |                             |                               |                              |                             |                        |
| 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   | 75<br>Re<br>rhenium<br>186  | 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>— | 107<br>Bh<br>bohrium<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>oganesson<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  |
| actinoids   | 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.).