



# Cambridge IGCSE™

## COMBINED SCIENCE

0653/21

Paper 2 Multiple Choice (Extended)

October/November 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.
- Take the weight of 1.0 kg to be 9.8 N (acceleration of free fall =  $9.8 \text{ m/s}^2$ ).

### 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 One of the characteristics of living organisms is the ability to detect and respond to changes in the environment.

What is this characteristic?

- A excretion
  - B growth
  - C movement
  - D sensitivity
- 2 Which structure is present in palisade mesophyll cells and is needed for photosynthesis?
- A cell wall
  - B chloroplast
  - C nucleus
  - D vacuole

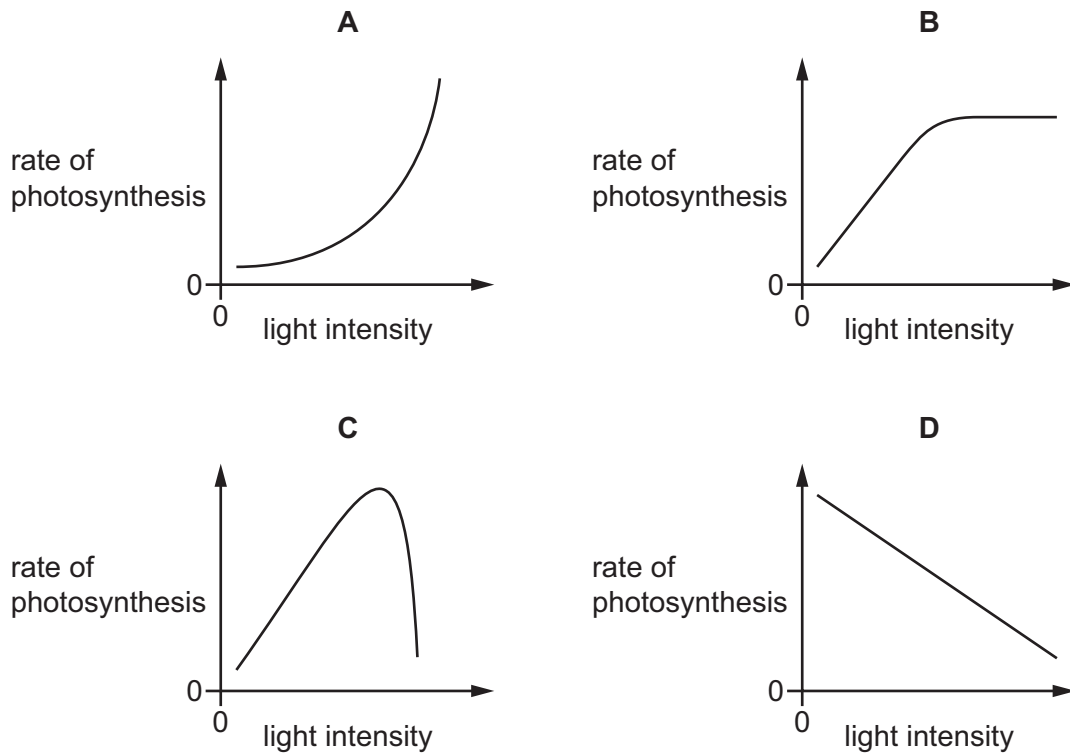
- 3 Osmosis is the net movement of water molecules through a partially permeable membrane.

In which direction does this net movement of water molecules take place?

- A from a concentrated solution to a dilute solution
  - B from a dilute solution to pure water
  - C from a region of lower water potential to a region of higher water potential
  - D from a region of higher water potential to a region of lower water potential
- 4 The temperature of an enzyme-controlled reaction increases towards its optimum temperature.
- Which row shows the effects of this increase in temperature on the reaction?

|   | kinetic energy of substrate | frequency of effective collisions | amount of product formed |
|---|-----------------------------|-----------------------------------|--------------------------|
| A | decreases                   | decreases                         | decreases                |
| B | increases                   | decreases                         | increases                |
| C | decreases                   | increases                         | decreases                |
| D | increases                   | increases                         | increases                |

5 Which graph shows the effect of light intensity on the rate of photosynthesis?



6 A person eats some bread which contains starch.

Which row shows where the chemical digestion of the starch starts and finishes?

|          | starts  | finishes        |
|----------|---------|-----------------|
| <b>A</b> | mouth   | small intestine |
| <b>B</b> | mouth   | large intestine |
| <b>C</b> | stomach | small intestine |
| <b>D</b> | stomach | large intestine |

7 Which row describes the structure and function of an artery?

|          | structure                                  | function                                       |
|----------|--------------------------------------------|------------------------------------------------|
| <b>A</b> | thicker wall and smaller lumen than a vein | carries blood at high pressure away from heart |
| <b>B</b> | thicker wall and smaller lumen than a vein | carries blood at low pressure towards heart    |
| <b>C</b> | thinner wall and larger lumen than a vein  | carries deoxygenated blood at low pressure     |
| <b>D</b> | thinner wall and larger lumen than a vein  | carries oxygenated blood at high pressure      |

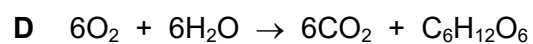
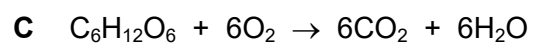
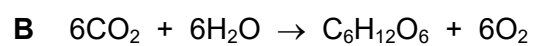
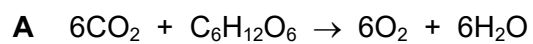
8 Which row shows possible causes of coronary heart disease?

|          | lack of exercise | smoking | stress |
|----------|------------------|---------|--------|
| <b>A</b> | ✓                | ✓       | ✓      |
| <b>B</b> | ✓                | x       | ✓      |
| <b>C</b> | x                | ✓       | ✓      |
| <b>D</b> | x                | x       | x      |

9 Which row describes gas exchange surfaces in humans?

|          | thickness of surface | surface area |
|----------|----------------------|--------------|
| <b>A</b> | thick                | large        |
| <b>B</b> | thick                | small        |
| <b>C</b> | thin                 | large        |
| <b>D</b> | thin                 | small        |

10 What is the balanced symbol equation for aerobic respiration?



11 Which food chain shows the correct feeding levels?

- A**    grass → grasshopper → bluebird → snake  
          producer            tertiary            secondary            primary  
                                  consumer            consumer            consumer
- B**    grass → grasshopper → bluebird → snake  
          producer            primary            secondary            tertiary  
                                  consumer            consumer            consumer
- C**    grass → grasshopper → bluebird → snake  
          tertiary            secondary            primary            producer  
          consumer            consumer            consumer
- D**    grass → grasshopper → bluebird → snake  
          primary            secondary            tertiary            producer  
          consumer            consumer            consumer

12 What is an example of an ecosystem?

- A** all the animals in an ocean
- B** all the organisms and their environment in a desert
- C** all the plants and their environment in a lake
- D** all the trees in a forest

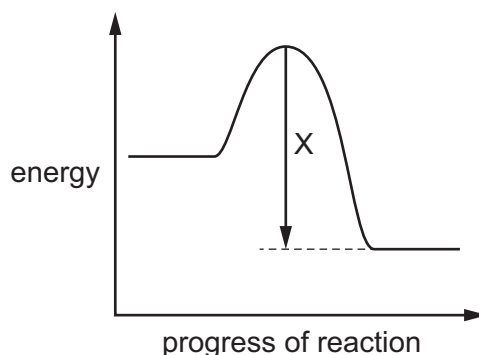
13 Which changes to the composition of the atmosphere are caused by cutting down forests?

|          | concentration of<br>carbon dioxide gas | concentration of<br>oxygen gas |
|----------|----------------------------------------|--------------------------------|
| <b>A</b> | decreases                              | decreases                      |
| <b>B</b> | decreases                              | increases                      |
| <b>C</b> | increases                              | decreases                      |
| <b>D</b> | increases                              | increases                      |

14 Which statement describes the changes that occur when water freezes?

- A** The water molecules gain energy and move faster.
- B** The water molecules lose energy and move slower.
- C** The water molecules gain energy as liquid water forms a solid.
- D** The water molecules lose energy as solid water forms a liquid.

15 A reaction pathway diagram for a reaction is shown.



Which statement describes and explains energy change X?

- A Thermal energy is given out as bonds break.
- B Thermal energy is given out as bonds form.
- C Thermal energy is taken in as bonds break.
- D Thermal energy is taken in as bonds form.

16 Zinc reacts with dilute sulfuric acid.

Which statement explains why the rate of this reaction increases when the temperature of the acid is increased?

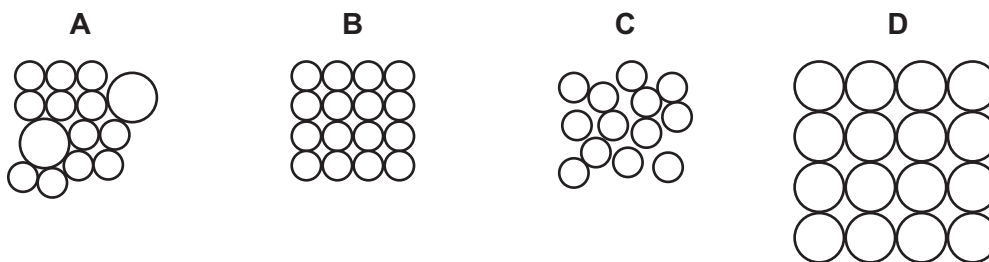
- A The particles are closer together and the particles collide more frequently.
- B The particles move faster and fewer particles have the minimum energy to react.
- C The particles collide more frequently and more particles have the minimum energy to react.
- D The particles collide more frequently and the activation energy of the reaction is reduced.

17 An element is in Period 3 of the Periodic Table.

Which information is given by the period number of this element?

- A its proton number
- B its metallic character
- C the number of electrons in the outer shell of an atom of the element
- D the number of electron shells in an atom of the element

18 Which diagram represents the atoms in an alloy?



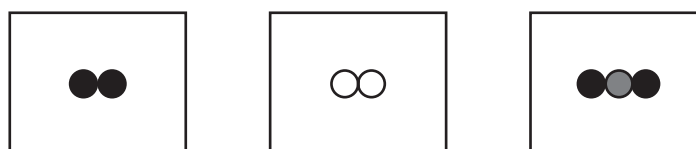
19 Which metal reacts most quickly with cold water?

- A** calcium
- B** magnesium
- C** potassium
- D** sodium

20 What is the reason for the treatment of the domestic water supply with chlorine?

- A** to improve the taste
- B** to kill microbes
- C** to remove odours
- D** to remove insoluble impurities

21 The diagrams show molecules of three of the main gases in clean, dry air. The different circles represent atoms of different elements.



Which elements are shown as ● and ○?

|          | ●        | ○        |
|----------|----------|----------|
| <b>A</b> | hydrogen | nitrogen |
| <b>B</b> | hydrogen | oxygen   |
| <b>C</b> | oxygen   | hydrogen |
| <b>D</b> | oxygen   | nitrogen |

**22** Petroleum is a mixture of hydrocarbons.

Which method is used to separate these hydrocarbons?

- A** crystallisation
- B** filtration
- C** fractional distillation
- D** simple distillation

**23** Which equation represents cracking?

- A**  $\text{C}_{10}\text{H}_{22} \rightarrow 2\text{C}_2\text{H}_4 + \text{C}_6\text{H}_{12} + \text{H}_2$
- B**  $\text{C}_{10}\text{H}_{20} + \text{H}_2 \rightarrow \text{C}_{10}\text{H}_{22}$
- C**  $2\text{C}_{10}\text{H}_{22} + 21\text{O}_2 \rightarrow 20\text{CO} + 22\text{H}_2\text{O}$
- D**  $2\text{C}_{10}\text{H}_{22} + 31\text{O}_2 \rightarrow 20\text{CO}_2 + 22\text{H}_2\text{O}$

**24** Aqueous chlorine is added to aqueous potassium bromide.

What is observed?

- A** no visible change
- B** a white precipitate forms
- C** reaction mixture becomes lighter in colour
- D** reaction mixture becomes darker in colour

**25** Four equations are listed.

- 1  $\text{Fe}_2\text{O}_3 + 3\text{CO} \rightarrow 2\text{Fe} + 3\text{CO}_2$
- 2  $\text{C} + \text{O}_2 \rightarrow \text{CO}_2$
- 3  $2\text{CO} \rightarrow \text{C} + \text{CO}_2$
- 4  $\text{CO}_2 + \text{Fe} \rightarrow \text{FeO} + \text{CO}$

Which equations represent reactions that take place in the blast furnace?

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

**26** Which statement describes how greenhouse gases in the Earth's atmosphere cause global warming?

- A** They absorb all the thermal energy that reaches the Earth from the Sun.
- B** They absorb all the thermal energy that is reflected from the Earth's surface.
- C** They absorb some of the thermal energy that is reflected from the Earth's surface.
- D** They increase thermal energy loss to space.

**27** An electric current is passed through molten calcium chloride using graphite electrodes.

Which row shows the electrode products?

|          | anode product | cathode product |
|----------|---------------|-----------------|
| <b>A</b> | calcium       | chlorine        |
| <b>B</b> | chlorine      | calcium         |
| <b>C</b> | chlorine      | hydrogen        |
| <b>D</b> | hydrogen      | chlorine        |

**28** The length of a slope is 1200 m.

A cyclist rides up the slope in a time of 200 s. The cyclist then immediately rides back down the slope in a time of 100 s.

What is the average speed of the cyclist for the whole journey?

- A** 4.0 m/s      **B** 8.0 m/s      **C** 9.0 m/s      **D** 18 m/s

**29** A block of mass 20 kg is lifted up through vertical distance  $h$ .

The gravitational potential energy of the block increases by 4.9 kJ.

What is the value of  $h$ ?

- A** 4.1 m      **B** 25 m      **C** 98 m      **D** 245 m

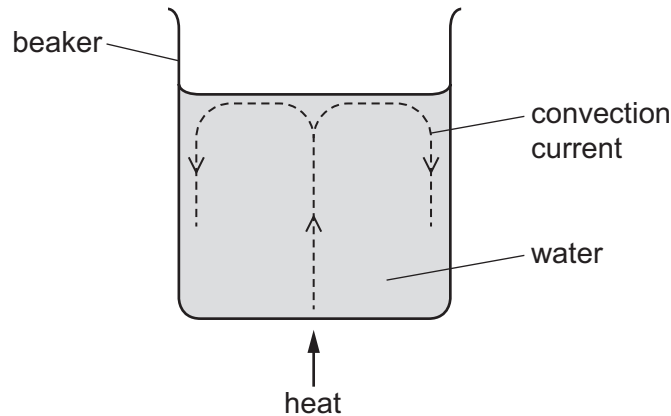
**30** What is used to generate electrical power in a geothermal power station?

- A** fossil fuels
- B** hot rocks
- C** light from the Sun
- D** the wind

**31** Which statement explains why iron is a better thermal conductor than plastic?

- A** Atoms in iron vibrate more.
- B** Electrons in iron vibrate more.
- C** There are delocalised atoms in iron.
- D** There are delocalised electrons in iron.

**32** The diagram shows a convection current in water in a beaker.



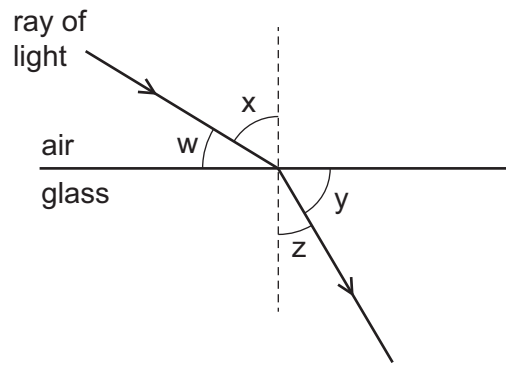
Which statement explains why the hot water at the bottom of the beaker rises?

- A** It expands and becomes less dense.
- B** It expands and becomes more dense.
- C** It contracts and becomes less dense.
- D** It contracts and becomes more dense.

**33** Which surface is the best reflector of thermal radiation?

- A** dull black
- B** dull white
- C** shiny black
- D** shiny white

- 34 The diagram shows a ray of light passing from air into glass.



Which row identifies the angle of incidence and the angle of refraction?

|          | angle of incidence | angle of refraction |
|----------|--------------------|---------------------|
| <b>A</b> | w                  | y                   |
| <b>B</b> | w                  | z                   |
| <b>C</b> | x                  | y                   |
| <b>D</b> | x                  | z                   |

- 35 Visible light is electromagnetic radiation. The wavelength range for visible light is  $4.0 \times 10^{-7}$  m to  $7.0 \times 10^{-7}$  m.

What is the frequency range for visible light?

- A**  $1.3 \times 10^{-15}$  Hz to  $2.3 \times 10^{-15}$  Hz
- B**  $1.3 \times 10^{-14}$  Hz to  $2.3 \times 10^{-14}$  Hz
- C**  $4.3 \times 10^{14}$  Hz to  $7.5 \times 10^{14}$  Hz
- D**  $4.3 \times 10^{15}$  Hz to  $7.5 \times 10^{15}$  Hz

- 36** The table shows the speed of sound in three different substances, X, Y and Z. One substance is a solid, one is a liquid and one is a gas.

| substance | <u>speed of sound</u><br>m/s |
|-----------|------------------------------|
| X         | 3600                         |
| Y         | 1500                         |
| Z         | 267                          |

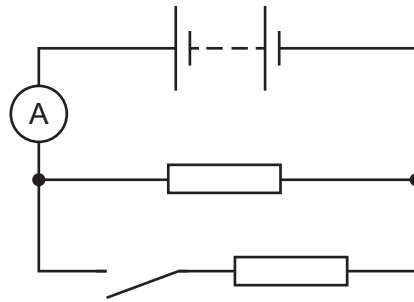
Which row identifies the states of the three substances?

|          | solid | liquid | gas |
|----------|-------|--------|-----|
| <b>A</b> | X     | Y      | Z   |
| <b>B</b> | X     | Z      | Y   |
| <b>C</b> | Z     | X      | Y   |
| <b>D</b> | Z     | Y      | X   |

- 37** Which name is given to the rate at which charge flows along a metal wire?

- A** current
- B** electromotive force (e.m.f.)
- C** potential difference (p.d.)
- D** resistance

38 In the circuit shown, the switch is open.

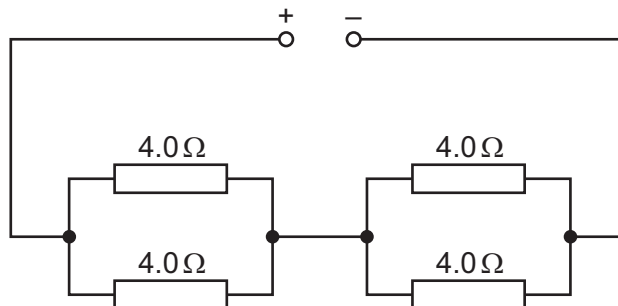


A student closes the switch.

Which row shows what happens to the ammeter reading and what happens to the total resistance of the circuit?

|          | ammeter reading | total resistance |
|----------|-----------------|------------------|
| <b>A</b> | decreases       | decreases        |
| <b>B</b> | decreases       | increases        |
| <b>C</b> | increases       | decreases        |
| <b>D</b> | increases       | increases        |

39 The circuit shows four  $4.0\ \Omega$  resistors connected to a power supply.



What is the total resistance of the circuit?

- A**  $1.0\ \Omega$       **B**  $2.0\ \Omega$       **C**  $4.0\ \Omega$       **D**  $16\ \Omega$

40 What is the main source of the energy released from the Sun?

- A** fission of helium nuclei to form hydrogen nuclei  
**B** fusion of hydrogen nuclei to form helium nuclei  
**C** hydrogen atoms combining to form hydrogen molecules  
**D** hydrogen atoms reacting with oxygen atoms to form water molecules

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The Periodic Table of Elements

| Group                                                                                                             |                         |                         |                         |                             |                          |                          |                          |                        |                          |                            |                           |                           |                         |                         |                          |                           |                          |                        |
|-------------------------------------------------------------------------------------------------------------------|-------------------------|-------------------------|-------------------------|-----------------------------|--------------------------|--------------------------|--------------------------|------------------------|--------------------------|----------------------------|---------------------------|---------------------------|-------------------------|-------------------------|--------------------------|---------------------------|--------------------------|------------------------|
| I                                                                                                                 | II                      |                         |                         |                             |                          |                          |                          |                        |                          |                            |                           | III                       | IV                      | V                       | VI                       | VII                       | VIII                     |                        |
| <div>1Hhydrogen1</div> <div>Key<div>atomic number<br/>atomic symbol<br/>name<br/>relative atomic mass</div></div> |                         |                         |                         |                             |                          |                          |                          |                        |                          |                            |                           |                           |                         |                         |                          |                           |                          |                        |
| 3Li<br>lithium<br>7                                                                                               | 4Be<br>beryllium<br>9   |                         |                         |                             |                          |                          |                          |                        |                          |                            |                           |                           |                         |                         |                          |                           |                          |                        |
| 11Na<br>sodium<br>23                                                                                              | 12Mg<br>magnesium<br>24 |                         |                         |                             |                          |                          |                          |                        |                          |                            |                           |                           |                         |                         |                          |                           |                          |                        |
| 13Al<br>aluminium<br>27                                                                                           | 14Si<br>silicon<br>28   | 15P<br>phosphorus<br>31 | 16S<br>sulfur<br>32     | 17Cl<br>chlorine<br>35.5    | 18Ar<br>argon<br>40      |                          |                          |                        |                          |                            |                           |                           |                         |                         |                          |                           |                          |                        |
| 19K<br>potassium<br>39                                                                                            | 20Ca<br>calcium<br>40   | 21Sc<br>scandium<br>45  | 22Ti<br>titanium<br>48  | 23V<br>vanadium<br>51       | 24Cr<br>chromium<br>52   | 25Mn<br>manganese<br>55  | 26Fe<br>iron<br>56       | 27Co<br>cobalt<br>59   | 28Ni<br>nickel<br>59     | 29Cu<br>copper<br>64       | 30Zn<br>zinc<br>65        | 31Ga<br>gallium<br>70     | 32Ge<br>germanium<br>73 | 33As<br>arsenic<br>75   | 34Se<br>selenium<br>79   | 35Br<br>bromine<br>80     | 36Kr<br>krypton<br>84    |                        |
| 37Rb<br>rubidium<br>85                                                                                            | 38Sr<br>strontium<br>88 | 39Y<br>yttrium<br>89    | 40Zr<br>zirconium<br>91 | 41Nb<br>niobium<br>93       | 42Mo<br>molybdenum<br>96 | 43Tc<br>technetium<br>—  | 44Ru<br>ruthenium<br>101 | 45Rh<br>rhodium<br>103 | 46Pd<br>palladium<br>106 | 47Ag<br>silver<br>108      | 48Cd<br>cadmium<br>112    | 49In<br>indium<br>115     | 50Sn<br>tin<br>119      | 51Sb<br>antimony<br>122 | 52Te<br>tellurium<br>128 | 53I<br>iodine<br>127      | 54Xe<br>xenon<br>131     |                        |
| 55Cs<br>caesium<br>133                                                                                            | 56Ba<br>barium<br>137   | 57–71<br>lanthanoids    |                         | 72Hf<br>hafnium<br>178      | 73Ta<br>tantalum<br>181  | 74W<br>tungsten<br>184   | 75Re<br>rhenium<br>186   | 76Os<br>osmium<br>190  | 77Ir<br>iridium<br>192   | 78Pt<br>platinum<br>195    | 79Au<br>gold<br>197       | 80Hg<br>mercury<br>201    | 81Tl<br>thallium<br>204 | 82Pb<br>lead<br>207     | 83Bi<br>bismuth<br>209   | 84Po<br>polonium<br>—     | 85At<br>astatine<br>—    | 86Rn<br>radon<br>—     |
| 87Fr<br>francium<br>—                                                                                             | 88Ra<br>radium<br>—     | 89–103<br>actinoids     |                         | 104Rf<br>rutherfordium<br>— | 105Db<br>dubnium<br>—    | 106Sg<br>seaborgium<br>— | 107Bh<br>bohrium<br>—    | 108Hs<br>hassium<br>—  | 109Mt<br>meitnerium<br>— | 110Ds<br>darmstadtium<br>— | 111Rg<br>roentgenium<br>— | 112Cn<br>copernicium<br>— | 113Nh<br>nihonium<br>—  | 114Fl<br>flerovium<br>— | 115Mc<br>moscovium<br>—  | 116Lv<br>livermorium<br>— | 117Ts<br>tennessine<br>— | 118Og<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>— |

actinoids

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