



# Cambridge IGCSE™

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**COMBINED SCIENCE****0653/23**

Paper 2 Multiple Choice (Extended)

**May/June 2022****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)

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**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.

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This document has **16** pages. Any blank pages are indicated.



1 What is the outermost layer of an animal cell and a plant cell?

|          | animal cell   | plant cell    |
|----------|---------------|---------------|
| <b>A</b> | cell membrane | cell membrane |
| <b>B</b> | cell membrane | cell wall     |
| <b>C</b> | cell wall     | cell membrane |
| <b>D</b> | cell wall     | cell wall     |

2 What is the definition of diffusion?

- A** the downward movement of particles in the atmosphere
- B** the movement of particles down a concentration gradient
- C** the movement of molecules against a concentration gradient
- D** the movement of particles from a hotter to a cooler region

3 The enzyme salivary amylase starts digesting starchy foods in the mouth.

This stops when the food reaches the stomach.

Why does this happen?

- A** The acid in the stomach slows down all reactions.
- B** The shape of the active site of the enzyme is altered by the low pH.
- C** The kinetic energy of molecules is reduced by acids.
- D** The shape of the substrate molecules is changed.

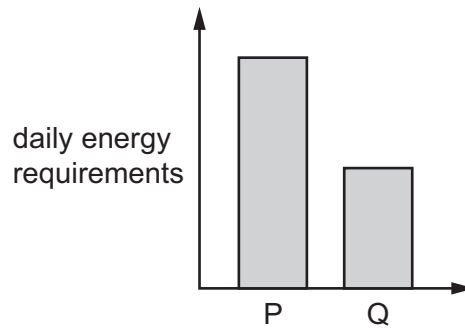
4 Stomata are found in the leaves of plants.

What is their main function?

- A** gas exchange
- B** structural support
- C** transport of food molecules
- D** transport of water

3

5 The graph shows the daily energy requirements for two people, P and Q.

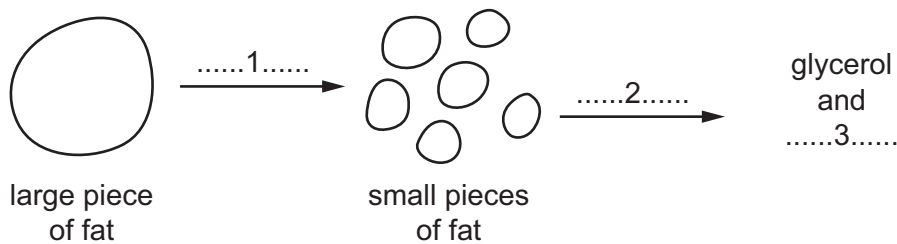


Which statements could describe P and Q?

- 1 P is a mother who is breast-feeding her baby and Q is a mother who is bottle-feeding her baby.
- 2 P is a 20-year-old adult male and Q is a 20-year-old adult female.
- 3 P is an office worker and Q is a professional cyclist.

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

6 The diagram shows the digestion of fat.



Which row completes gaps 1, 2 and 3 in the diagram?

|          | 1                    | 2                    | 3           |
|----------|----------------------|----------------------|-------------|
| <b>A</b> | chemical digestion   | chemical digestion   | amino acids |
| <b>B</b> | chemical digestion   | mechanical digestion | fatty acids |
| <b>C</b> | mechanical digestion | mechanical digestion | amino acids |
| <b>D</b> | mechanical digestion | chemical digestion   | fatty acids |

7 Which statement about root hair cells is correct?

- A** They are present in large numbers to increase the absorption of water.
- B** They are only present in young seedlings before major roots grow.
- C** They are branched to help prevent the wind dislodging a plant.
- D** They have a large surface area to allow carbon dioxide uptake.

8 Physical activity affects our rate and depth of breathing.

What happens during **increased** physical activity?

|          | rate of breathing | depth of breathing |
|----------|-------------------|--------------------|
| <b>A</b> | decreases         | decreases          |
| <b>B</b> | decreases         | increases          |
| <b>C</b> | increases         | decreases          |
| <b>D</b> | increases         | increases          |

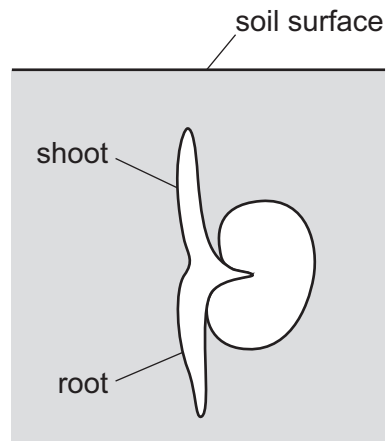
9 Some statements about adrenaline are listed.

- 1 It has one target organ.
- 2 It is a hormone.
- 3 It is produced by a gland.
- 4 It is transported in the blood.

Which statements are correct?

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

10 The diagram shows a seed germinating in soil.

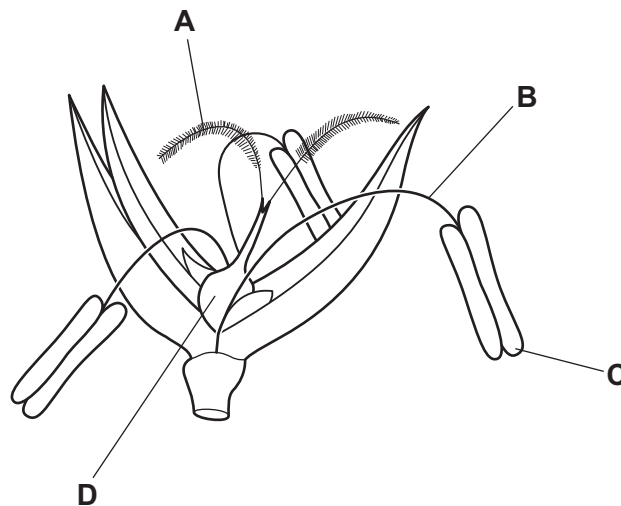


Which tropic responses are taking place in the shoot and root while they are still underground?

|          | shoot        | root         |
|----------|--------------|--------------|
| <b>A</b> | gravitropism | gravitropism |
| <b>B</b> | gravitropism | phototropism |
| <b>C</b> | phototropism | gravitropism |
| <b>D</b> | phototropism | phototropism |

11 The diagram shows a typical wind-pollinated flower.

Which structure is the stigma?



12 During sexual intercourse the penis transfers sperm cells to the vagina.

What is the pathway for sperm cells from their site of production to the vagina?

- A sperm ducts → testes → urethra → vagina
- B testes → sperm ducts → urethra → vagina
- C testes → urethra → sperm ducts → vagina
- D urethra → testes → sperm ducts → vagina

13 The diagram shows a food chain from an ocean ecosystem.

microscopic plants → krill → small fish → tuna → shark

What is the trophic level of the tuna?

- A primary consumer
- B quaternary consumer
- C secondary consumer
- D tertiary consumer

14 When solid sodium carbonate is added to dilute hydrochloric acid, it dissolves and carbon dioxide is given off.

Which statement is correct?

- A This is a chemical change because sodium carbonate dissolves.
- B This is a chemical change because the acid reacts with sodium carbonate.
- C This is a physical change because sodium carbonate dissolves.
- D This is a physical change because the acid reacts with sodium carbonate.

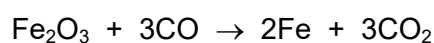
15 Which statement about non-metallic elements is correct?

- A They are hard.
- B They are malleable.
- C They conduct electricity.
- D They have low densities.

- 16 Which statement about the movement of particles during the electrolysis of dilute sulfuric acid is correct?
- A Anions move to the negative electrode and lose electrons.
  - B Electrons travel through the electrolyte from the cathode to the anode.
  - C Electrons travel through the external circuit from the anode to the cathode.
  - D Positive ions move to the anode and gain electrons.
- 17 Which row describes what happens to the frequency of collisions between reacting particles and the energy of these collisions when the concentration of the reactants is decreased?

|   | frequency of collisions | energy of collisions |
|---|-------------------------|----------------------|
| A | decreases               | decreases            |
| B | decreases               | no change            |
| C | increases               | decreases            |
| D | increases               | no change            |

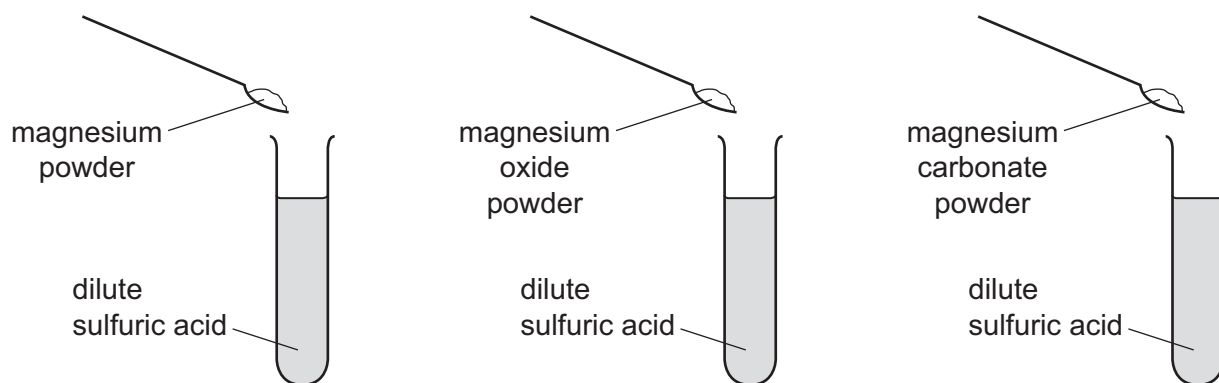
- 18 The equation for a reaction that occurs in the blast furnace is shown.



Which statement about the reaction is correct?

- A  $\text{Fe}_2\text{O}_3$  is the oxidising agent.
- B  $\text{CO}_2$  is the reducing agent.
- C CO is reduced.
- D  $\text{Fe}_2\text{O}_3$  is oxidised.

19 Three powders are added to dilute sulfuric acid, as shown.



Which powders react to produce water?

|          | magnesium | magnesium oxide | magnesium carbonate |
|----------|-----------|-----------------|---------------------|
| <b>A</b> | ✓         | ✓               | ✗                   |
| <b>B</b> | ✓         | ✗               | ✗                   |
| <b>C</b> | ✗         | ✓               | ✓                   |
| <b>D</b> | ✗         | ✗               | ✓                   |

key

✓ = does produce water

✗ = does not produce water

20 Salt X is produced in the reaction between solid Y and acid Z.

The following method is used to prepare crystals of salt X.

- Solid Y is added to acid Z until no further reaction occurs.
- Any unreacted solid Y is removed by filtration.
- The filtrate is evaporated to the point of crystallisation and left to cool.
- Salt X crystallises.

Which row shows the substances that can be used to produce a salt by using this method?

|          | solid Y                  | acid Z                   | salt X                      |
|----------|--------------------------|--------------------------|-----------------------------|
| <b>A</b> | insoluble copper         | dilute hydrochloric acid | soluble copper(II) chloride |
| <b>B</b> | insoluble lead carbonate | dilute sulfuric acid     | insoluble lead sulfate      |
| <b>C</b> | soluble sodium hydroxide | dilute hydrochloric acid | soluble sodium chloride     |
| <b>D</b> | insoluble zinc oxide     | dilute sulfuric acid     | soluble zinc sulfate        |



21 The results of two tests on substance Q are shown.

| test  | result  |
|---|---|
| add dilute hydrochloric acid to solid Q         | bubbles of colourless gas, R, which turns limewater milky |
| add aqueous sodium hydroxide to a solution of Q | green precipitate   |

Which cation is present in Q and what is gas R?

|          | cation present in Q | gas R          |
|----------|---------------------|----------------|
| <b>A</b> | iron(II)            | carbon dioxide |
| <b>B</b> | iron(II)            | chlorine       |
| <b>C</b> | iron(III)           | carbon dioxide |
| <b>D</b> | iron(III)           | chlorine       |

22 In which mixture is the aqueous metal ion displaced by the metal?

- A**  $\text{Cu}^{2+}$  and Zn    **B**  $\text{Fe}^{2+}$  and Cu    **C**  $\text{Mg}^{2+}$  and Zn    **D**  $\text{Zn}^{2+}$  and Fe

23 Iron is extracted from iron(III) oxide in the blast furnace.

Which reaction produces the heat to maintain a high temperature in the furnace?

- A** calcium carbonate  $\rightarrow$  calcium oxide + carbon dioxide  
**B** carbon + oxygen  $\rightarrow$  carbon dioxide  
**C** iron(III) oxide + carbon monoxide  $\rightarrow$  iron + carbon dioxide  
**D** silicon dioxide + calcium oxide  $\rightarrow$  calcium silicate

24 Which statement about the treatment of the water supply is correct?

- A** After filtration and chlorination, the water contains no impurities.  
**B** Chlorine is added to remove dissolved impurities.  
**C** Water is filtered and chlorinated to remove solids and kill bacteria.  
**D** Water is filtered to remove dissolved impurities.

- 25 Which statement best describes the members of a homologous series?
- A They have different general formulae and different chemical properties.
  - B They have different general formulae and similar chemical properties.
  - C They have the same general formula and different chemical properties.
  - D They have the same general formula and similar chemical properties.

- 26 Methane, ethane and propane are all alkanes. Their formulae are shown.

methane,  $\text{CH}_4$

ethane,  $\text{C}_2\text{H}_6$

propane,  $\text{C}_3\text{H}_8$

Which statement is **not** correct?

- A All three compounds are hydrocarbons.
  - B All three compounds burn.
  - C Methane is the main constituent of natural gas.
  - D Propane burns completely to form carbon dioxide and hydrogen.
- 27 Which substance rapidly turns aqueous bromine from orange to colourless?
- A ethane
  - B ethanol
  - C ethene
  - D methane

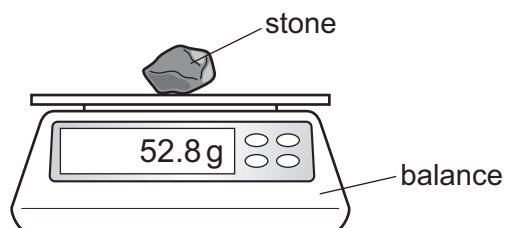
- 28 A climber climbs a mountain.

The gravitational field strength at the top of the mountain is less than it is at the bottom.

How do the mass and the weight of the climber at the top compare with the mass and the weight at the bottom?

|          | mass at top compared with mass at bottom | weight at top compared with weight at bottom |
|----------|--|--|
| <b>A</b> | less                                     | less   |
| <b>B</b> | less                                     | the same                                     |
| <b>C</b> | the same                                 | less   |
| <b>D</b> | the same                                 | the same                                     |

- 29 A stone is placed on a balance. The reading on the balance is shown.



The stone is lowered carefully into a measuring cylinder that contains  $50 \text{ cm}^3$  of water. The level of the water in the measuring cylinder rises to the  $72 \text{ cm}^3$  mark.

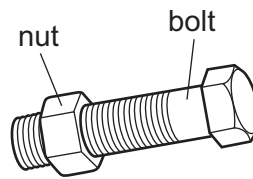
What is the density of the stone?

- A  $0.42 \text{ g/cm}^3$     B  $0.73 \text{ g/cm}^3$     C  $1.36 \text{ g/cm}^3$     D  $2.40 \text{ g/cm}^3$
- 30 A man lifts four heavy boxes from the ground onto a high shelf, one at a time.
- When does he develop the greatest power?
- A lifting a box of mass 20 kg in 3.0 s  
 B lifting a box of mass 20 kg in 4.0 s  
 C lifting a box of mass 30 kg in 3.0 s  
 D lifting a box of mass 30 kg in 4.0 s
- 31 The volume of a gas decreases and the temperature of the gas increases.

Which row describes the changes to the separation and to the speed of the gas molecules?

|          | separation | speed     |
|----------|------------|-----------|
| <b>A</b> | decreases  | decreases |
| <b>B</b> | decreases  | increases |
| <b>C</b> | increases  | decreases |
| <b>D</b> | increases  | increases |

32 A mechanic cannot remove a large steel nut from a steel bolt because it is too tight.



What does the mechanic do to help remove the nut?

- A cool the nut and heat the bolt
- B heat the bolt only
- C heat the nut and the bolt through the same temperature rise
- D heat the nut only

33 What is the main method of thermal energy transfer in liquids?

- A conduction
- B convection
- C absorption
- D radiation

34 Light travels at a speed of  $3.0 \times 10^8$  m/s in a vacuum.

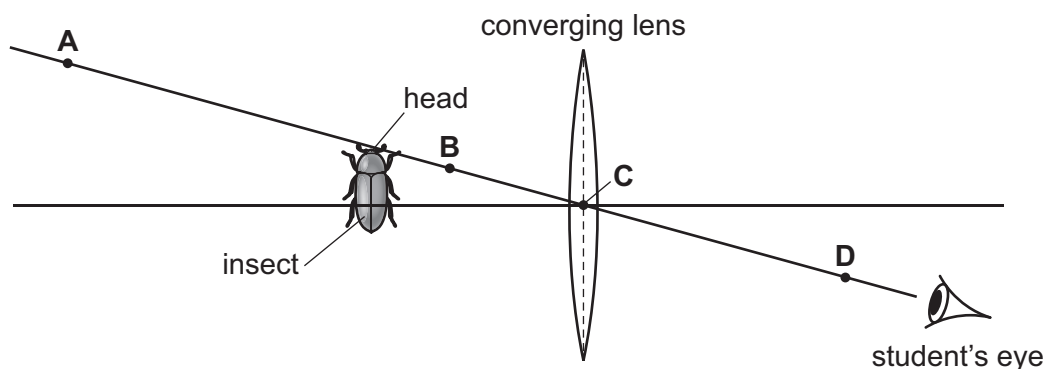
A radio station transmits radio waves at a frequency of  $9.1 \times 10^7$  Hz.

What is the wavelength of the radio waves?

- A 0.30 m
- B 0.33 m
- C 3.0 m
- D 3.3 m

35 A student uses a converging lens as a magnifying glass to view an insect.

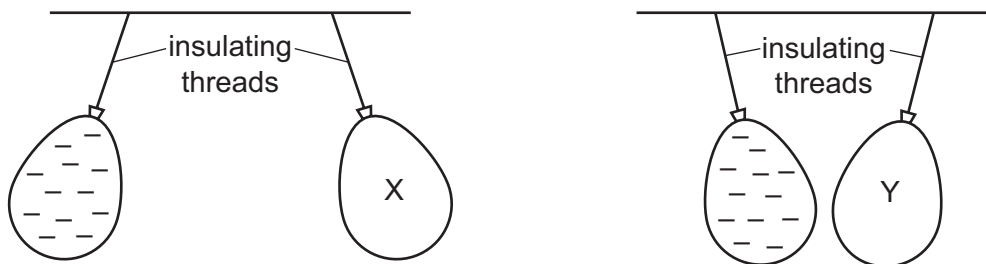
Which labelled point is a possible position for the image of the head of the insect?



36 Where does sound travel at the greatest speed?

- A in a gas
- B in a liquid
- C in a solid
- D in a vacuum

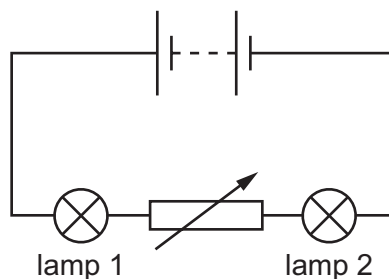
37 Two balloons X and Y are suspended by insulating threads. They are each held near a negatively charged balloon. The balloons hang as shown.



What is the charge on balloon X and what is the charge on balloon Y?

|          | balloon X | balloon Y |
|----------|-----------|-----------|
| <b>A</b> | negative  | negative  |
| <b>B</b> | negative  | positive  |
| <b>C</b> | positive  | negative  |
| <b>D</b> | positive  | positive  |

38 A circuit contains two lamps and a variable resistor.



The resistance of the variable resistor is increased.

What happens to the brightness of lamp 1 and what happens to the brightness of lamp 2?

|          | brightness of lamp 1 | brightness of lamp 2 |
|----------|----------------------|----------------------|
| <b>A</b> | decreases            | decreases            |
| <b>B</b> | decreases            | increases            |
| <b>C</b> | no change            | decreases            |
| <b>D</b> | no change            | increases            |

39 A torch (flashlight) contains a 3.0V battery. When the torch is switched on the current in the battery is 0.50 A.

How much energy is transferred by the battery in 1.0 minute?

- A** 1.5J                      **B** 6.0J                      **C** 90J                      **D** 360J

40 What is the purpose of a fuse in an electric circuit?

- A** to disconnect the circuit if the current becomes too large  
**B** to increase the voltage if the current becomes too small  
**C** to prevent someone cutting the insulation of the wiring  
**D** to stop water getting into the circuit

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## The Periodic Table of Elements

| Group                             |                                    |  |                                    |  |                                     |                                     |                                    |                                    |                                      |                                   |                                      |                                   |                                  |                                   |                                     |                                    |                                   |                                   |  |                                  |                                   |                                   |                                   |                                |                                   |                                     |                                     |                                  |                                      |                                   |                                     |
|-----------------------------------|------------------------------------|--|------------------------------------|--|-------------------------------------|-------------------------------------|------------------------------------|------------------------------------|--------------------------------------|-----------------------------------|--------------------------------------|-----------------------------------|----------------------------------|-----------------------------------|-------------------------------------|------------------------------------|-----------------------------------|-----------------------------------|--|----------------------------------|-----------------------------------|-----------------------------------|-----------------------------------|--------------------------------|-----------------------------------|-------------------------------------|-------------------------------------|----------------------------------|--------------------------------------|-----------------------------------|-------------------------------------|
| I                                 | II                                 | III  |                                    |  |                                     |                                     |                                    |                                    |                                      |                                   |                                      | IV                                | V                                | VI                                | VII                                 | VIII                               |                                   |                                   |  |                                  |                                   |                                   |                                   |                                |                                   |                                     |                                     |                                  |                                      |                                   |                                     |
| 3<br><b>Li</b><br>lithium<br>7    | 4<br><b>Be</b><br>beryllium<br>9   | <div style="border: 1px solid black; padding: 5px; width: fit-content; margin: auto;"> <b>Key</b><br/>           atomic number<br/>           atomic symbol<br/>           name<br/>           relative atomic mass         </div> |                                    |  |                                     |                                     |                                    |                                    |                                      |                                   |                                      |                                   |                                  |                                   |                                     |                                    |                                   | 2<br><b>He</b><br>helium<br>4     |  |                                  |                                   |                                   |                                   |                                |                                   |                                     |                                     |                                  |                                      |                                   |                                     |
| 11<br><b>Na</b><br>sodium<br>23   | 12<br><b>Mg</b><br>magnesium<br>24 |  |                                    |  |                                     |                                     |                                    |                                    |                                      |                                   |                                      |                                   |                                  |                                   |                                     |                                    |                                   | 5<br><b>B</b><br>boron<br>11      | 6<br><b>C</b><br>carbon<br>12          | 7<br><b>N</b><br>nitrogen<br>14  | 8<br><b>O</b><br>oxygen<br>16     | 9<br><b>F</b><br>fluorine<br>19   | 10<br><b>Ne</b><br>neon<br>20     |                                |                                   |                                     |                                     |                                  |                                      |                                   |                                     |
| 19<br><b>K</b><br>potassium<br>39 | 20<br><b>Ca</b><br>calcium<br>40   | 13<br><b>Al</b><br>aluminium<br>27   | 14<br><b>Si</b><br>silicon<br>28   | 15<br><b>P</b><br>phosphorus<br>31     | 16<br><b>S</b><br>sulfur<br>32      | 17<br><b>Cl</b><br>chlorine<br>35.5 | 18<br><b>Ar</b><br>argon<br>40     |                                    |                                      |                                   |                                      |                                   |                                  |                                   |                                     |                                    |                                   |                                   |  |                                  |                                   |                                   |                                   |                                |                                   |                                     |                                     |                                  |                                      |                                   |                                     |
| 37<br><b>Rb</b><br>rubidium<br>85 | 38<br><b>Sr</b><br>strontium<br>88 | 31<br><b>Ga</b><br>gallium<br>70   | 32<br><b>Ge</b><br>germanium<br>73 | 33<br><b>As</b><br>arsenic<br>75       | 34<br><b>Se</b><br>selenium<br>79   | 35<br><b>Br</b><br>bromine<br>80    | 36<br><b>Kr</b><br>krypton<br>84   |                                    |                                      |                                   |                                      |                                   |                                  |                                   |                                     |                                    |                                   |                                   |  |                                  |                                   |                                   |                                   |                                |                                   |                                     |                                     |                                  |                                      |                                   |                                     |
| 55<br><b>Cs</b><br>caesium<br>133 | 56<br><b>Ba</b><br>barium<br>137   | 39<br><b>K</b><br>potassium<br>39  | 40<br><b>Ca</b><br>calcium<br>40   | 41<br><b>Sc</b><br>scandium<br>45      | 42<br><b>Ti</b><br>titanium<br>48   | 43<br><b>V</b><br>vanadium<br>51    | 44<br><b>Cr</b><br>chromium<br>52  | 45<br><b>Mn</b><br>manganese<br>55 | 46<br><b>Fe</b><br>iron<br>56        | 47<br><b>Co</b><br>cobalt<br>59   | 48<br><b>Ni</b><br>nickel<br>59      | 49<br><b>Cu</b><br>copper<br>64   | 50<br><b>Zn</b><br>zinc<br>65    | 51<br><b>Ga</b><br>gallium<br>70  | 52<br><b>Ge</b><br>germanium<br>73  | 53<br><b>As</b><br>arsenic<br>75   | 54<br><b>Se</b><br>selenium<br>79 | 55<br><b>Br</b><br>bromine<br>80  | 56<br><b>Kr</b><br>krypton<br>84       |                                  |                                   |                                   |                                   |                                |                                   |                                     |                                     |                                  |                                      |                                   |                                     |
| 87<br><b>Fr</b><br>francium<br>—  | 88<br><b>Ra</b><br>radium<br>—     | 57<br><b>La</b><br>lanthanum<br>139  | 58<br><b>Ce</b><br>cerium<br>140   | 59<br><b>Pr</b><br>praseodymium<br>141 | 60<br><b>Nd</b><br>neodymium<br>144 | 61<br><b>Pm</b><br>promethium<br>—  | 62<br><b>Sm</b><br>samarium<br>150 | 63<br><b>Eu</b><br>europium<br>152 | 64<br><b>Gd</b><br>gadolinium<br>157 | 65<br><b>Tb</b><br>terbium<br>159 | 66<br><b>Dy</b><br>dysprosium<br>163 | 67<br><b>Ho</b><br>holmium<br>165 | 68<br><b>Er</b><br>erbium<br>167 | 69<br><b>Tm</b><br>thulium<br>169 | 70<br><b>Yb</b><br>ytterbium<br>173 | 71<br><b>Lu</b><br>lutetium<br>175 | 89<br><b>Ac</b><br>actinium<br>—  | 90<br><b>Th</b><br>thorium<br>232 | 91<br><b>Pa</b><br>protactinium<br>231 | 92<br><b>U</b><br>uranium<br>238 | 93<br><b>Np</b><br>neptunium<br>— | 94<br><b>Pu</b><br>plutonium<br>— | 95<br><b>Am</b><br>americium<br>— | 96<br><b>Cm</b><br>curium<br>— | 97<br><b>Bk</b><br>berkelium<br>— | 98<br><b>Cf</b><br>californium<br>— | 99<br><b>Es</b><br>einsteinium<br>— | 100<br><b>Fm</b><br>fermium<br>— | 101<br><b>Md</b><br>mendelevium<br>— | 102<br><b>No</b><br>nobelium<br>— | 103<br><b>Lr</b><br>lawrencium<br>— |

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

lanthanoids

actinoids

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