# Cambridge IGCSE™

**CO-ORDINATED SCIENCES** **0654/12**

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.

**[Turn over**

**1** Which statement about the characteristics of living organisms is correct?

    **A** Excretion is the removal of excess substances and toxic materials.

    **B** Movement is the ability to detect and respond to environmental changes.

    **C** Nutrition is the breaking down of molecules to release energy.

    **D** Respiration is the manufacture of carbohydrates from raw materials.

**2** The diagram shows a beetle.
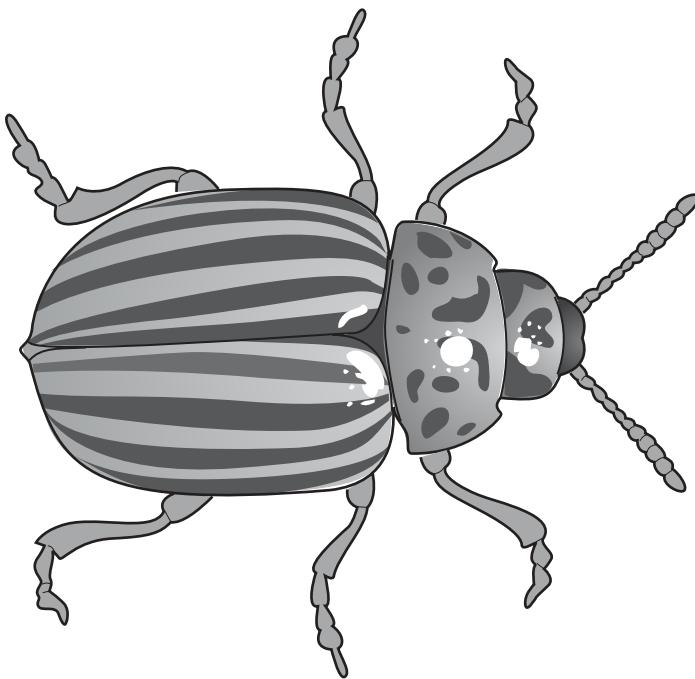
The length of the diagram is 75 mm.

The actual length of the beetle is 5 mm.

What is the magnification?

    **A** ×5         **B** ×15         **C** ×80         **D** ×375

**3** A colourless liquid gives the test results shown.

| test | colour obtained |
|---|---|
| Benedict's | blue |
| biuret | purple |
| iodine | blue / black |

Which nutrients are in the colourless liquid?

**A** protein, reducing sugar and starch

**B** protein and reducing sugar only

**C** protein and starch only

**D** protein only

**4** Which type of molecule are enzymes?

**A** carbohydrate

**B** fat

**C** protein

**D** starch

**5** Which conditions cause the highest rate of transpiration in a plant?

|  | temperature | wind speed |
|---|---|---|
| **A** | high | high |
| **B** | high | low |
| **C** | low | high |
| **D** | low | low |

**6** Which row provides the greatest amount of the nutrient needed to move food through the alimentary canal?

|  | nutrient content / 100 g | | | |
|---|---|---|---|---|
|  | calcium / mg | fibre / g | protein / g | sugar / g |
| **A** | 36.0 | 5.1 | 9.0 | 24.8 |
| **B** | 35.0 | 2.8 | 3.3 | 20.0 |
| **C** | 46.0 | 10.9 | 9.0 | 0.8 |
| **D** | 8.5 | 0.0 | 28.0 | 0.0 |

**7** The rates of water uptake and loss are measured in four leaves. The results are shown in the table.

Which leaf is least likely to wilt?

| | rate of water uptake / mm$^3$ per minute | rate of water loss / mm$^3$ per minute |
|---|---|---|
| **A** | 8 | 15 |
| **B** | 9 | 11 |
| **C** | 12 | 13 |
| **D** | 15 | 10 |

**8** Small mammals need more energy to maintain a constant body temperature.

The graph shows the rate of oxygen used by species of shrews with different body masses.
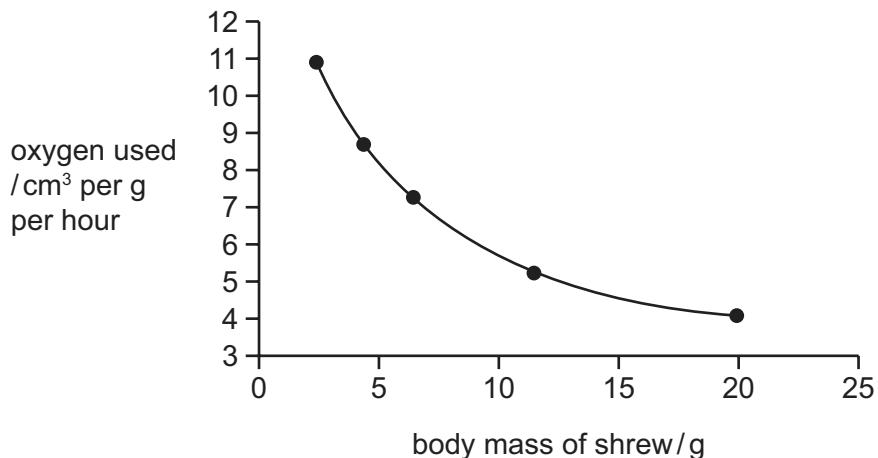


Which statements are correct?

1 Heavier shrews use oxygen more slowly than lighter shrews.

2 Heavier shrews respire faster than lighter shrews.

3 Heavier shrews lose heat more slowly than lighter shrews.

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

**9** The diagram shows a section through the skin.
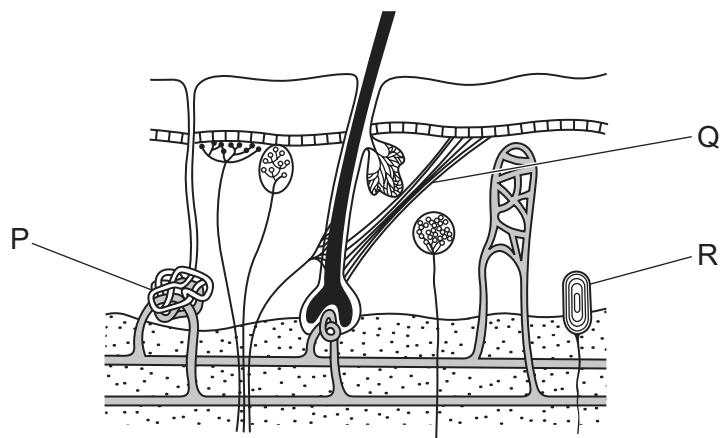


Which row contains the correct names of the structures labelled P, Q and R?

|   | P | Q | R |
|---|---|---|---|
| **A** | sweat gland | hair | blood vessel |
| **B** | receptor | hair | receptor |
| **C** | sweat gland | hair erector muscle | receptor |
| **D** | receptor | hair erector muscle | blood vessel |

**10** Which diagram shows fertilisation occurring in a flower?
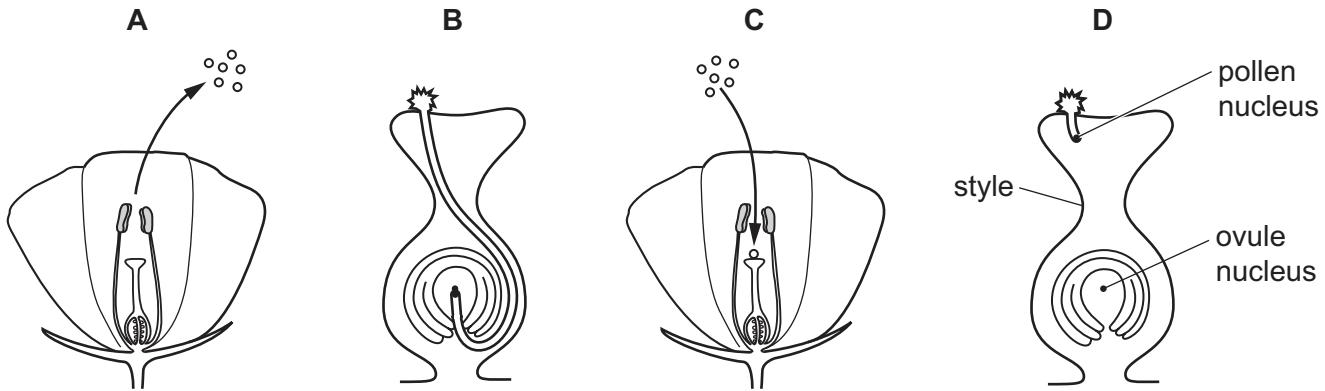


**11** Which term describes differences between individuals of the same species?

**A** competition

**B** generation

**C** selection

**D** variation

**12** Which type of organism gets its energy from breaking down dead or waste organic matter?

    **A**   carnivore

    **B**   consumer

    **C**   decomposer

    **D**   producer

**13** The concentration of carbon dioxide in the atmosphere has increased during the last 200 years.

What has contributed to this increase?

    **A**   burning large areas of forest

    **B**   increasing use of pesticides

    **C**   planting more crops

    **D**   using fewer fossil fuels

**14** A sample of water contains two useful substances, insoluble chalk and a soluble salt.

Which two processes are used to individually separate the insoluble chalk from the soluble salt and from the water?

    **A**   distillation and chromatography

    **B**   distillation and crystallisation

    **C**   filtration and chromatography

    **D**   filtration and crystallisation

**15** Which statement about isotopes of the same element is correct?

    **A**   They have the same number of protons but different number of electrons.

    **B**   They have the same number of protons but different number of neutrons.

    **C**   They have the same number of neutrons but different number of electrons.

    **D**   They have the same number of neutrons but different number of protons.

**16** Which equation represents the reaction between aluminium and oxygen?

    **A**   $2Al + 3O \rightarrow Al_2O_3$

    **B**   $Al_2 + 3O \rightarrow Al_2O_3$

    **C**   $2Al_2 + 3O_2 \rightarrow 2Al_2O_3$

    **D**   $4Al + 3O_2 \rightarrow 2Al_2O_3$

**17** Which substance does **not** undergo electrolysis?

    **A**   aqueous copper chloride

    **B**   copper wire

    **C**   dilute sulfuric acid

    **D**   molten lead(II) bromide

**18** To extract a metal from its ore, a metal oxide is mixed with carbon and heated as shown.
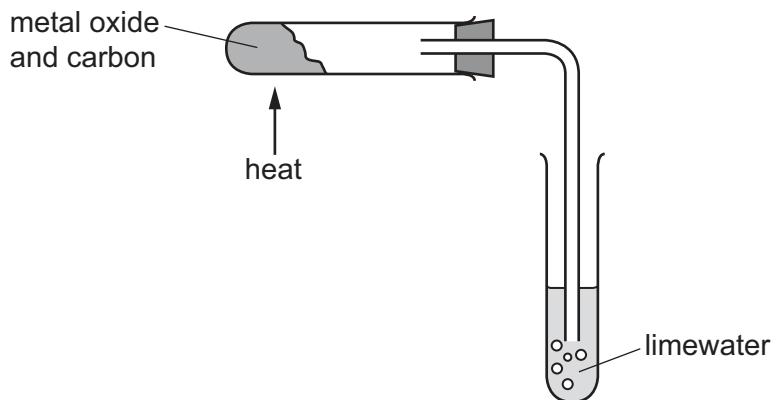


The limewater turns cloudy.

Which term describes what happens to the metal oxide?

    **A**   combustion

    **B**   neutralisation

    **C**   oxidation

    **D**   reduction

**19** Solid S is added to dilute hydrochloric acid in the apparatus shown.



solid S + dilute
hydrochloric acid

universal indicator
solution
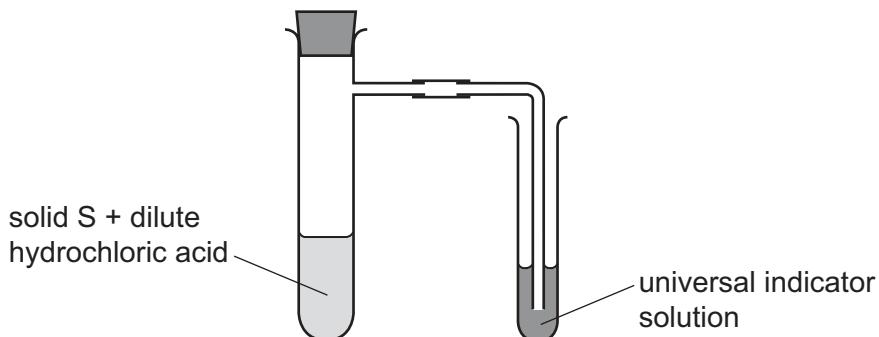
The universal indicator solution shows the pH decreases.

What is solid S?

**A** zinc

**B** zinc carbonate

**C** zinc hydroxide

**D** zinc oxide

**20** Which substance is a basic oxide?

**A** calcium oxide

**B** carbon dioxide

**C** nitrogen dioxide

**D** sulfur dioxide

**21** Which statements about the halogens are correct?

  1 They are diatomic metals.

  2 Their atoms have seven outer-shell electrons.

  3 Going down the group, they change from solid to liquid to gas.

  4 Going down the group, they become darker in colour.

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

**22** Which statement explains why argon is used to fill lamps?

**A** It is a gas.

**B** It is colourless.

**C** It is reactive.

**D** It is unreactive.

23 Aluminium is a ......1...... resource. It is found in the ore bauxite where it is present in aluminium oxide.

Pure aluminium is extracted from aluminium oxide by ......2...... .

Which words complete gaps 1 and 2?

| | 1 | 2 |
|---|---|---|
| **A** | finite | electrolysis |
| **B** | finite | heating with carbon |
| **C** | renewable | electrolysis |
| **D** | renewable | heating with carbon |

24 Which gas is an air pollutant?

**A** argon

**B** carbon dioxide

**C** nitrogen

**D** sulfur dioxide

25 Which word equation describes the manufacture of lime from limestone?

**A** calcium carbonate $\rightarrow$ calcium hydroxide + carbon dioxide

**B** calcium carbonate $\rightarrow$ calcium oxide + carbon dioxide

**C** calcium hydroxide $\rightarrow$ calcium oxide + water

**D** calcium oxide + carbon dioxide $\rightarrow$ calcium carbonate

26 Which process is used to separate petroleum into useful products?

**A** cracking

**B** filtration

**C** fractional distillation

**D** thermal decomposition

**27** Polymers are long chain molecules made from smaller molecules.

What are these smaller molecules called?

**A**  alkanes

**B**  atoms

**C**  components

**D**  monomers

**28** Which row gives the units for mass $m$ and gravitational field strength $g$?

| | mass $m$ | gravitational field strength $g$ |
|---|---|---|
| **A** | kg | N/kg |
| **B** | kg | kg/N |
| **C** | N | N/kg |
| **D** | N | kg/N |

**29** A solid, rectangular piece of wood measures $8.0\,m \times 1.0\,m \times 0.10\,m$. The block has a mass of $440\,kg$.

What is the density of the wood?

**A**  $55\,kg/m^3$          **B**  $352\,kg/m^3$          **C**  $550\,kg/m^3$          **D**  $3520\,kg/m^3$

**30** The weight of a box exerts pressure on the ground.

Which pair of changes to the box **must** reduce the pressure?

**A**  decreasing the weight and decreasing the area of the base

**B**  decreasing the weight and increasing the area of the base

**C**  increasing the weight and decreasing the area of the base

**D**  increasing the weight and increasing the area of the base

**31** A horizontal force acts on a block.

The block moves in the direction of the force.

Which two quantities affect the work done by the force on the block?

**A** magnitude of force and distance moved

**B** magnitude of force and mass of block

**C** magnitude of force and volume of block

**D** magnitude of force and weight of block

**32** A gas is contained in a cylinder of constant volume.

The gas is cooled.

What happens to the speed of the molecules of the gas and to the pressure of the gas?

| | speed of molecules | pressure of gas |
|---|---|---|
| **A** | decreases | decreases |
| **B** | decreases | increases |
| **C** | increases | decreases |
| **D** | increases | increases |

**33** Which statement about the relative thermal expansion of solids, liquids and gases is correct?

**A** Solids expand least, gases expand most.

**B** Solids expand least, liquids expand most.

**C** Gases expand least, liquids expand most.

**D** Gases expand least, solids expand most.

**34** The amplitude of a sound wave increases, and the frequency of the wave decreases.

What is the effect on the loudness of the sound and on the pitch of the sound?

| | loudness | pitch |
|---|---|---|
| **A** | greater | higher |
| **B** | greater | lower |
| **C** | less | higher |
| **D** | less | lower |

**35** A plastic rod is rubbed with a cloth. The rod becomes positively charged.

Which statement describes why this happens?

    **A**    Electrons move from the cloth to the rod.

    **B**    Electrons move from the rod to the cloth.

    **C**    Protons move from the cloth to the rod.

    **D**    Protons move from the rod to the cloth.

**36** What is a current in a metal wire?

    **A**    a flow of electrons

    **B**    a flow of ions

    **C**    a flow of neutrons

    **D**    a flow of protons

**37** A lamp is connected in four circuits in turn.

The batteries are identical and the resistors are identical.

In which circuit is the lamp the brightest?
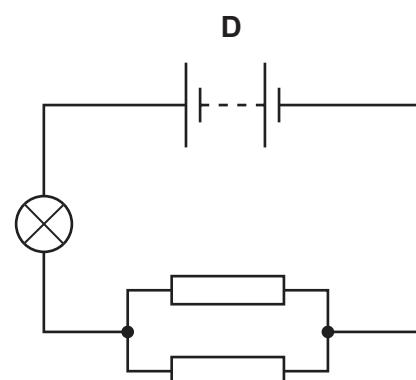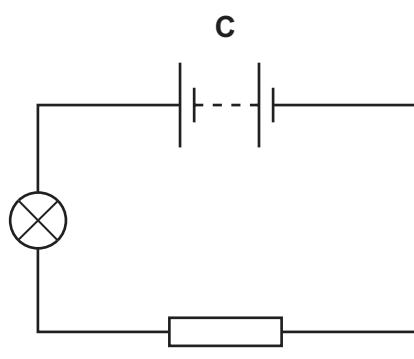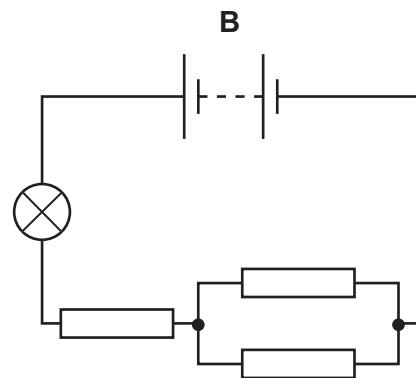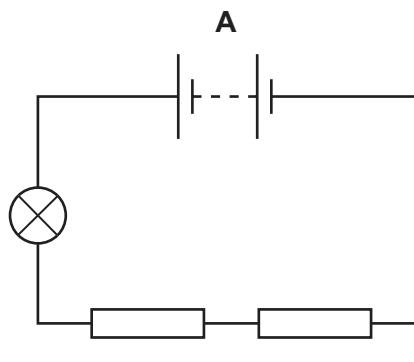
**38** The diagrams show a wire carrying a current out of the page.

Which diagram shows the pattern of magnetic field lines near the wire?



| A | B | C | D |

current out
of the page

current out
of the page

current out
of the page

current out
of the page
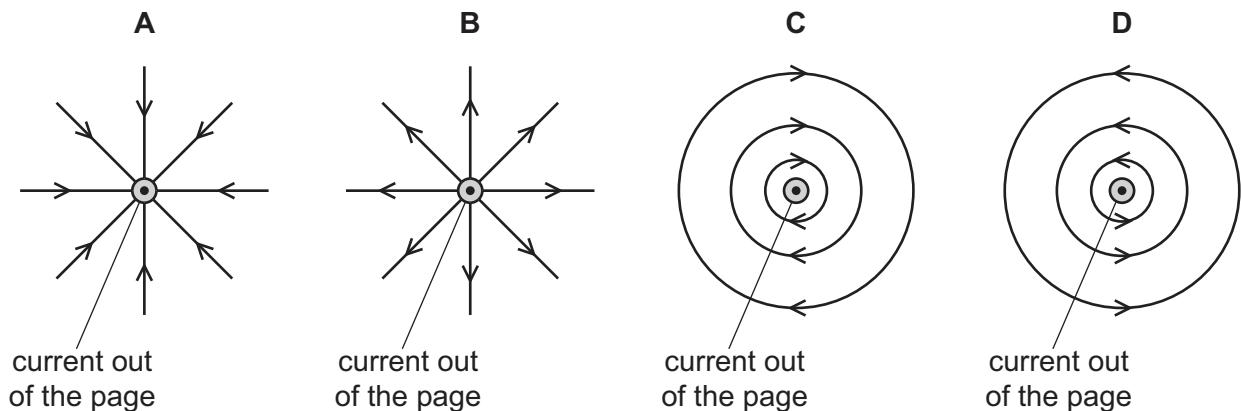
**39** Which row describes the relative ionising effect and the relative penetrating ability of alpha and gamma radiation?

| | relative ionising effect | relative penetrating ability |
|---|---|---|
| **A** | alpha is more ionising | alpha is more penetrating |
| **B** | alpha is more ionising | gamma is more penetrating |
| **C** | gamma is more ionising | alpha is more penetrating |
| **D** | gamma is more ionising | gamma is more penetrating |

**40** A radioactive isotope has a half-life of 4.0 days. A sample of the isotope emits radiation at a rate of 100 emissions per minute.

What was the rate of emission from the sample 8.0 days earlier?

**A** 25 emissions per minute

**B** 50 emissions per minute

**C** 200 emissions per minute

**D** 400 emissions per minute

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# The Periodic Table of Elements

Group

**Key**

| atomic number |
| --- |
| **atomic symbol** |
| name |
| relative atomic mass |

| I | II | III | IV | V | VI | VII | VIII |
|---|---|---|---|---|---|---|---|
| | | | | | | | 2<br>He<br>helium<br>4 |
| 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 | 10<br>Ne<br>neon<br>20 |
| 11<br>Na<br>sodium<br>23 | 12<br>Mg<br>magnesium<br>24 | 13<br>A*l*<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>C*l*<br>chlorine<br>35.5 | 18<br>Ar<br>argon<br>40 |

Transition elements:

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 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>T*l*<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>F*l*<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>– |
|---|---|---|---|---|---|---|---|

The central block of the Periodic Table:

| 1<br>H<br>hydrogen<br>1 |
|---|

**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$^3$ at room temperature and pressure (r.t.p.).