**Cambridge International Examinations**
Cambridge International General Certificate of Secondary Education

**CO-ORDINATED SCIENCES** **0654/23**

Paper 2 Multiple Choice (Extended) **October/November 2017**

**45 minutes**

Additional Materials: Multiple Choice Answer Sheet
Soft clean eraser
Soft pencil (type B or HB is recommended)



**READ THESE INSTRUCTIONS FIRST**

Write in soft pencil.
Do not use staples, paper clips, glue or correction fluid.
Write your name, Centre number and candidate number on the Answer Sheet in the spaces provided unless this has been done for you.
DO **NOT** WRITE IN ANY BARCODES.

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 separate Answer Sheet.

**Read the instructions on the Answer Sheet very carefully.**

Each correct answer will score one mark. A mark will not be deducted for a wrong answer.
Any rough working should be done in this booklet.
A copy of the Periodic Table is printed on page 20.
Electronic calculators may be used.

This document consists of **17** printed pages and **3** blank pages.

**1** What is homeostasis?

**A** the maintenance of the body's external environment

**B** the maintenance of the body's internal environment

**C** the processes that produce heat in the body

**D** the removal of wastes from the body

**2** What is excretion?

**A** breakdown of materials in kidney cells

**B** chemical reactions in liver cells

**C** removal of undigested food from the gut

**D** removal of waste products

**3** Aerobic respiration is summarised below.

glucose + oxygen → carbon dioxide + water

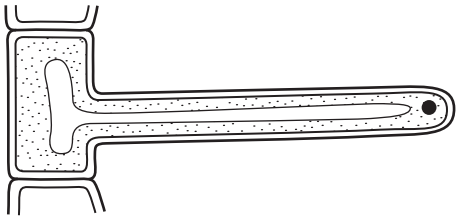
How many molecules of carbon dioxide will be produced from the breakdown of four molecules of glucose?

**A** 4 **B** 8 **C** 16 **D** 24

**4** Which statements about X chromosomes in humans are correct?

| | present in body cells in males | present in body cells of females | carry genes |
|---|---|---|---|
| **A** | ✓ | ✓ | ✓ |
| **B** | ✓ | ✗ | ✓ |
| **C** | ✓ | ✗ | ✗ |
| **D** | ✗ | ✓ | ✗ |

**5** The diagram shows a section through a root hair cell.



How is the structure of the root hair cell related to its function?

**A** The nucleus is not at the centre of the cell.

**B** The shape helps to support the plant.

**C** The surface area is large.

**D** The volume of the vacuole is small.

**6** What is meant by fertilisation?

**A** combining of male and female nuclei

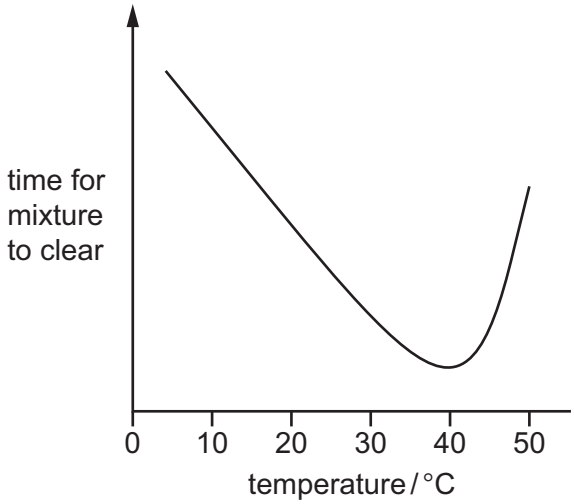
**B** joining of male and female sex organs

**C** movement of sperms through the uterus to an ovum

**D** reproduction

**7** When a suspension of powdered milk is completely digested by a protease enzyme it becomes clear.

The graph shows the time taken for a mixture of protease and powdered milk to clear at different temperatures.




What is this enzyme's optimum temperature?

**A** 5 °C **B** 37 °C **C** 40 °C **D** 50 °C

**8** Which row correctly matches the form of malnutrition with its possible outcome?

| | form of malnutrition | possible outcome |
|---|---|---|
| **A** | energy intake is greater than energy use | obesity |
| **B** | high fat intake | constipation |
| **C** | lack of dietary fibre | starvation |
| **D** | lack of fat intake | coronary heart disease |

**9** Which organisms obtain energy directly from every trophic level?

**A** carnivores

**B** decomposers

**C** herbivores

**D** producers

**10** In the geotropic and phototropic responses of a plant shoot, does the shoot grow towards or away from the stimulus?

| | geotropism | phototropism |
|---|---|---|
| **A** | away from | away from |
| **B** | away from | towards |
| **C** | towards | away from |
| **D** | towards | towards |

**11** Which part of a seed is **not** part of a plant embryo?

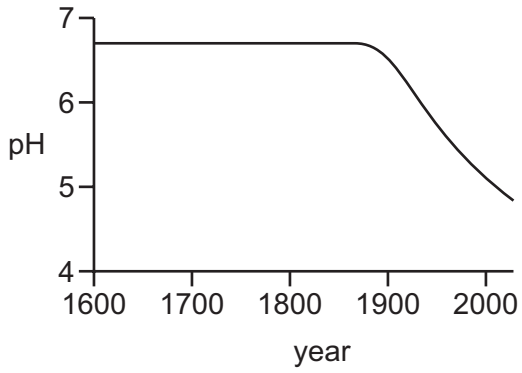
**A** cotyledon

**B** plumule

**C** radicle

**D** testa

**12** The graph shows how the pH of a lake has changed from 1600 to 2000.




What would have contributed to the change from 1900 onwards?

**A** burning of coal in nearby power stations

**B** increasing global temperatures

**C** increased growth of algae in the lake

**D** the use of pesticides on nearby fields

**13** In a species of plant, the allele for yellow flowers is dominant to the allele for red flowers.

Two heterozygous yellow-flowered plants are crossed.

Which offspring are produced?

**A** 25% with yellow flowers, 75% with red flowers

**B** 50% with yellow flowers, 50% with red flowers

**C** 75% with yellow flowers, 25% with red flowers

**D** 100% with yellow flowers

**14** Which row describes the melting point and boiling point of salt water?

| | melting point / °C | boiling point / °C |
|---|---|---|
| **A** | 0 | less than 100 |
| **B** | 0 | 100 |
| **C** | less than 0 | more than 100 |
| **D** | more than 0 | 100 |



**[Turn over**

**15** When solid zinc carbonate is heated, a different solid and a gas are formed.

Which type of change occurs?

**A** chemical

**B** exothermic

**C** physical

**D** separation

**16** Dilute hydrochloric acid is added to aqueous sodium hydroxide in a non-insulated beaker. The temperature of the mixture increases.

Which statement is **not** correct?

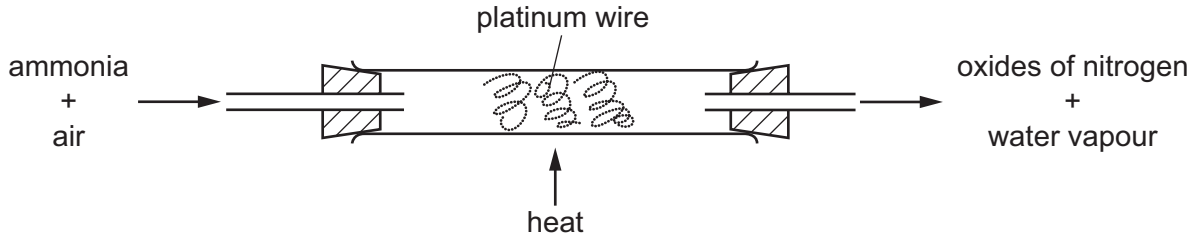
**A** The reaction is exothermic.

**B** There is a reduction in the amount of chemical energy.

**C** There is an increase in the amount of thermal energy.

**D** There is no energy loss from the mixture.

**17** Ammonia is oxidised as shown.




The platinum is chemically unchanged at the end of the reaction.

What is the reason for using platinum?

**A** to absorb the heat from the reaction

**B** to filter out oxygen from the air

**C** to increase the rate of the reaction

**D** to neutralise the ammonia

**18** The ionic equation for the formation of chromium(III) ions is shown.

$$Cr \rightarrow Cr^{3+} + 3e^{-}$$

Which statement about chromium atoms is correct?

**A** They are oxidised by gaining electrons.

**B** They are oxidised by losing electrons.

**C** They are reduced by gaining electrons.

**D** They are reduced by losing electrons.

**19** Which substances react with dilute sulfuric acid to form a salt?

| | magnesium | magnesium oxide | magnesium carbonate | magnesium chloride |
|---|---|---|---|---|
| **A** | ✓ | ✓ | ✓ | ✗ |
| **B** | ✓ | ✓ | ✗ | ✓ |
| **C** | ✓ | ✗ | ✓ | ✓ |
| **D** | ✗ | ✓ | ✓ | ✓ |

**20** Element X has two outer-shell electrons.

Element Y has seven outer-shell electrons.

Which statement about X and Y is **not** correct?

**A** Element X combines with element Y to form an ionic compound.

**B** Element X combines with element Y to form a solid compound which conducts electricity.

**C** Element X conducts electricity and element Y is in Group VII of the Periodic Table.

**D** Element X is in Group II of the Periodic Table and element Y does not conduct electricity.

**21** The melting points of three elements in Group I and of three elements in Group VII are shown.

| element | group | melting point (°C) |
|---|---|---|
| lithium | I | 179 |
| sodium | I | 98 |
| potassium | I | 64 |
| chlorine | VII | –101 |
| bromine | VII | –7 |
| iodine | VII | 114 |

What is the trend in reactivity in each group as melting point increases?

| | change in Group I reactivity | change in Group VII reactivity |
|---|---|---|
| **A** | less reactive | less reactive |
| **B** | less reactive | more reactive |
| **C** | more reactive | less reactive |
| **D** | more reactive | more reactive |

**22** Underwater pipes made from steel are prevented from rusting by sacrificial protection.

Sacrificial protection uses a ……1…… reactive metal attached to the pipes which is ……2…… in preference to the steel.

Which words complete gaps 1 and 2?

| | 1 | 2 |
|---|---|---|
| **A** | less | oxidised |
| **B** | less | reduced |
| **C** | more | oxidised |
| **D** | more | reduced |

**23** Which row describes how hydrogen and nitrogen are obtained for use in the Haber process?

| | hydrogen | nitrogen |
|---|---|---|
| **A** | electrolysis of sulfuric acid | catalytic reduction of nitrogen oxides |
| **B** | electrolysis of sulfuric acid | distillation of air |
| **C** | reaction of methane and steam | catalytic reduction of nitrogen oxides |
| **D** | reaction of methane and steam | distillation of air |

**24** In the Contact process, sulfur trioxide is absorbed by concentrated sulfuric acid and then diluted with water.

Which statement about the reaction between sulfur trioxide and water explains why sulfur trioxide is **not** dissolved directly in water?

**A** A catalyst is required.

**B** It is a slow reaction.

**C** It is endothermic and produces a sulfuric acid mist.

**D** It is exothermic and produces a sulfuric acid mist.

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

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

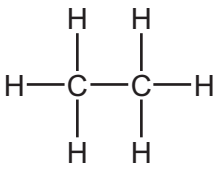
**B** calcium carbonate $\rightarrow$ calcium oxide + carbon dioxide

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

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

**26** The structures of four compounds are shown.

1



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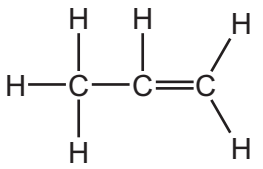

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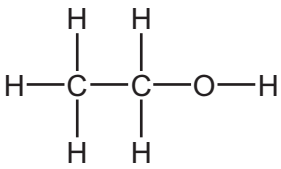

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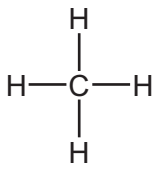


Which types of compound do these structures represent?

| | 1 | 2 | 3 | 4 |
|---|---|---|---|---|
| **A** | alcohol | alkene | alkane | alcohol |
| **B** | alkane | alcohol | alkene | alkane |
| **C** | alkane | alkene | alcohol | alkane |
| **D** | alkene | alkane | alcohol | alkene |

**27** Which process is used to make ethanol?

**A** Addition of oxygen to ethene in the presence of a catalyst.

**B** Addition of oxygen to ethene with no catalyst.

**C** Addition of steam to ethene in the presence of a catalyst.

**D** Addition of steam to ethene with no catalyst.

**28** A car moves with a constant speed of 15 m / s along a road for 20 s.

After this, the car is 100 m from where it started, measured in a straight line.

Which statement about the car is correct?

**A** It has travelled a distance of 100 m along the road.

**B** It has travelled a distance of 300 m along the road.

**C** Its direction was constant.

**D** Its velocity was constant.

**29** A worker carries bricks up a ladder.

The following quantities are known.

- the height the bricks are lifted up
- the time taken for the worker to lift the bricks
- the volume of the bricks
- the weight of the bricks

Which quantities are needed to calculate the useful power produced by the worker as he carries the bricks up the ladder?

**A** height, time and volume

**B** height, time and weight

**C** height, volume and weight

**D** time, volume and weight

**30** The pressure $P$ of a fixed mass of gas at constant temperature depends on its volume $V$.

What is the relationship between $P$ and $V$?

**A** $P$ is directly proportional to $V$.

**B** $P$ is directly proportional to $V^2$.

**C** $P$ is inversely proportional to $V$.

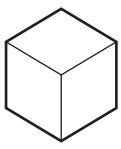
**D** $P$ is inversely proportional to $V^2$.

**31** Four blocks are made from different materials. The blocks are heated and the thermal energy of each block increases by the same amount.

The temperature increase of each block is shown in the diagrams.

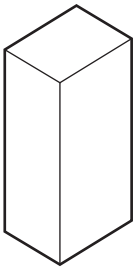
Which block has the smallest thermal capacity?

**A**



temperature increase = 3 °C

**B**

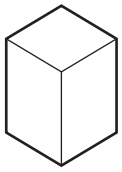


temperature increase = 6 °C

**C**

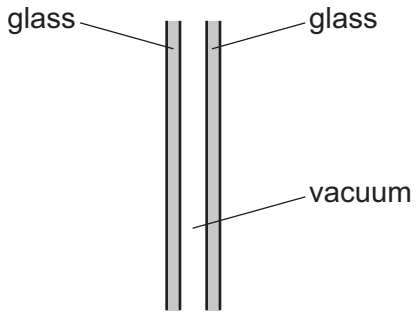
temperature increase = 9 °C

**D**



temperature increase = 12 °C

**32** One type of double glazing consists of two panes of glass separated by a vacuum.




Which methods of energy transfer are prevented by the vacuum?

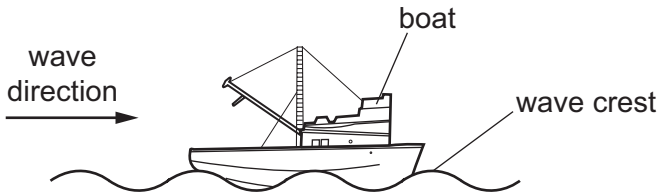
**A** conduction and convection only

**B** conduction and radiation only

**C** convection and radiation only

**D** conduction, convection and radiation

**33** A water wave travels at a steady speed of 4.0 m / s and passes a stationary boat.




Four wave crests pass the boat every 2.0 seconds.

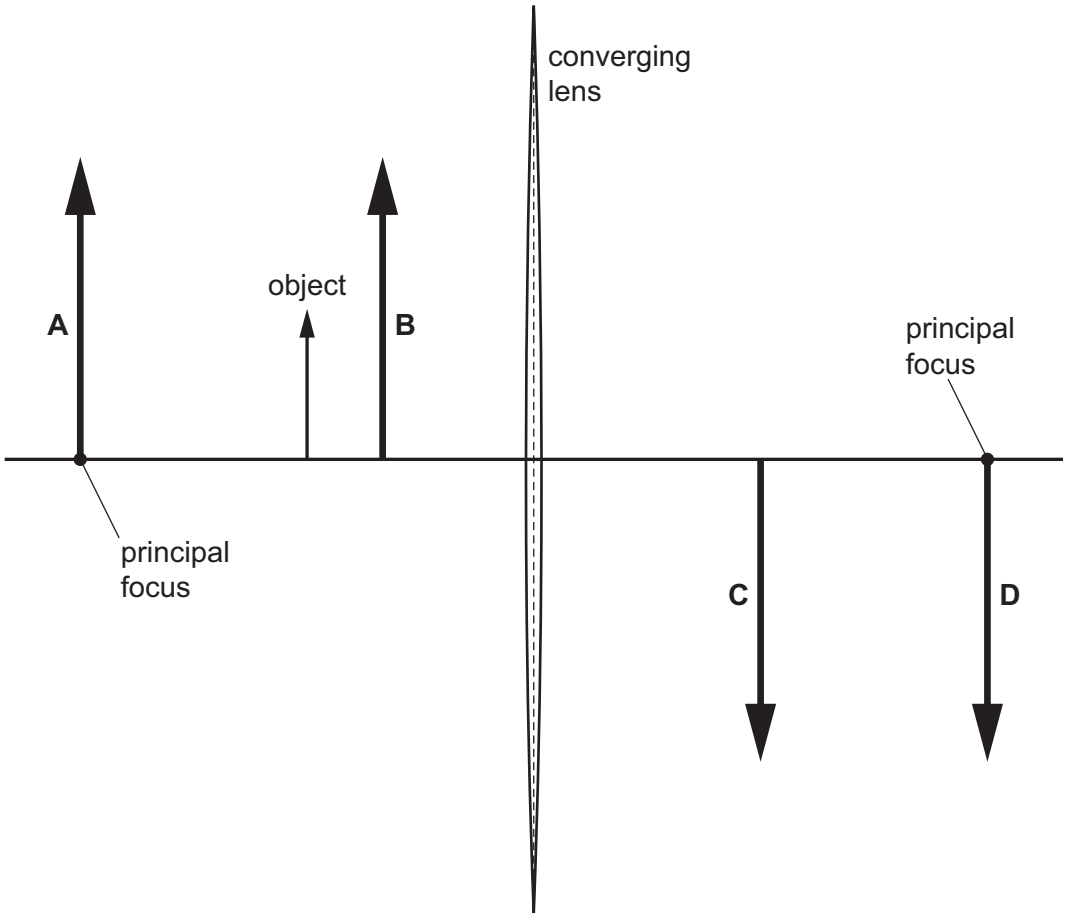
What is the wavelength of the waves?

**A** 0.5 m **B** 1.0 m **C** 2.0 m **D** 8.0 m

**34** A student uses a converging lens to obtain a magnified, virtual image of an object. The object is in the position shown in the diagram.

A principal focus of the lens is also shown on each side of the lens.

At which labelled position is the image formed?




**35** Which radiations are included in the electromagnetic spectrum?

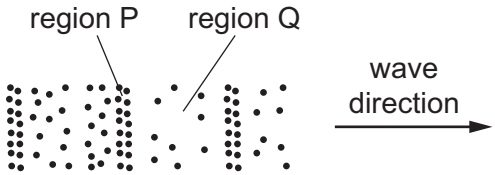
**A** $\alpha$-particle radiation and $\beta$-particle radiation

**B** $\alpha$-particle radiation and $\gamma$-rays

**C** $\beta$-particle radiation and infra-red radiation

**D** $\gamma$-rays and infra-red radiation

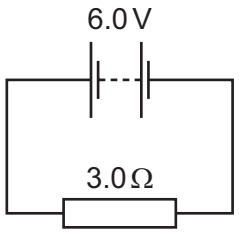
**36** The diagram represents a wave in air. Molecules are closer together in region P than they are in region Q.




Which type of wave is represented, and in which direction do the molecules vibrate?

| | type of wave | direction of vibration |
|---|---|---|
| **A** | longitudinal | ↔ |
| **B** | longitudinal | ↕ |
| **C** | transverse | ↔ |
| **D** | transverse | ↕ |

**37** The diagram shows a 3.0 Ω resistor connected to a 6.0 V battery.

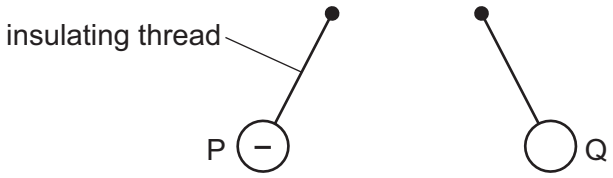



How much energy is transferred in the 3.0 Ω resistor in 30 seconds?

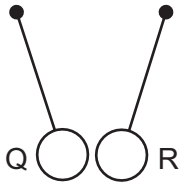
**A** 15 J **B** 60 J **C** 360 J **D** 540 J

**38** Three charged balls P, Q and R are suspended by insulating threads. Ball P is negatively charged.

Ball Q is brought close to ball P. The balls move away from each other.




Ball Q is now brought close to ball R. The balls move closer to each other.




What are the signs of the charges on ball Q and ball R?

| | ball Q | ball R |
|---|---|---|
| **A** | negative | negative |
| **B** | negative | positive |
| **C** | positive | negative |
| **D** | positive | positive |

**39** An engineer wishes to make a d.c. circuit that will switch on a lamp automatically at night.

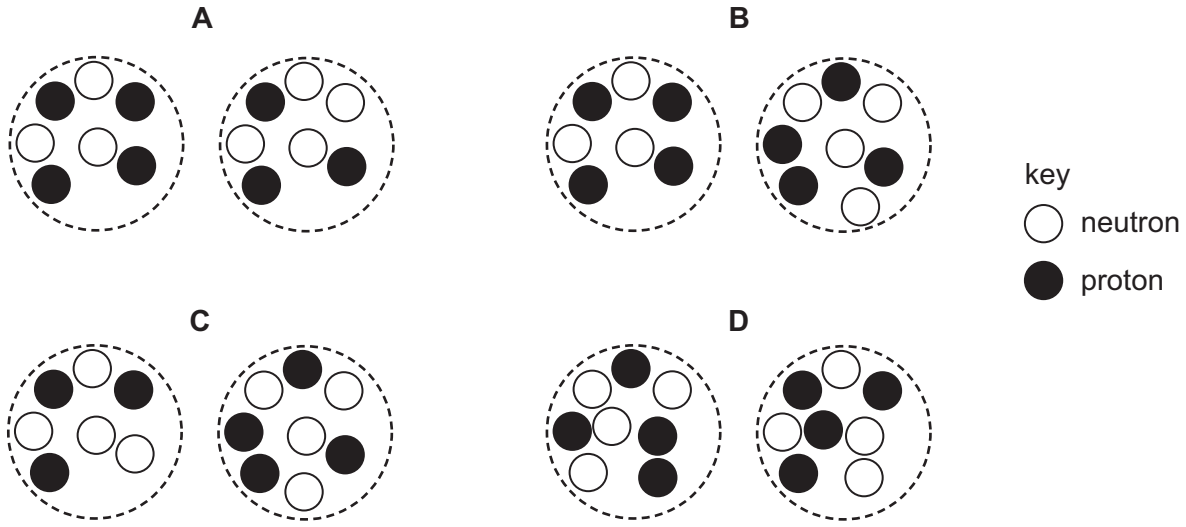
She uses a light-dependent resistor (LDR) in the circuit, and a component that allows a large current to be controlled by a small current.

What happens to the resistance of the LDR as it becomes dark, and what is a suitable component to allow a large current to be controlled by a small current?

| | resistance of LDR | suitable component |
|---|---|---|
| **A** | decreases | relay |
| **B** | decreases | transformer |
| **C** | increases | relay |
| **D** | increases | transformer |

**40** The diagrams represent pairs of nuclei of some atoms.

Which pair shows nuclei of different isotopes of the same element?



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## The Periodic Table of Elements

| Group | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| I | II | | | | | | | | | | | III | IV | V | VI | VII | VIII |
| | | | | | | | 1 H hydrogen 1 | | | | | | | | | | 2 He helium 4 |
| 3 Li lithium 7 | 4 Be beryllium 9 | | | | | | | | | | | 5 B boron 11 | 6 C carbon 12 | 7 N nitrogen 14 | 8 O oxygen 16 | 9 F fluorine 19 | 10 Ne neon 20 |
| 11 Na sodium 23 | 12 Mg magnesium 24 | | | | | | | | | | | 13 Al aluminium 27 | 14 Si silicon 28 | 15 P phosphorus 31 | 16 S sulfur 32 | 17 Cl chlorine 35.5 | 18 Ar argon 40 |
| 19 K potassium 39 | 20 Ca calcium 40 | 21 Sc scandium 45 | 22 Ti titanium 48 | 23 V vanadium 51 | 24 Cr chromium 52 | 25 Mn manganese 55 | 26 Fe iron 56 | 27 Co cobalt 59 | 28 Ni nickel 59 | 29 Cu copper 64 | 30 Zn zinc 65 | 31 Ga gallium 70 | 32 Ge germanium 73 | 33 As arsenic 75 | 34 Se selenium 79 | 35 Br bromine 80 | 36 Kr krypton 84 |
| 37 Rb rubidium 85 | 38 Sr strontium 88 | 39 Y yttrium 89 | 40 Zr zirconium 91 | 41 Nb niobium 93 | 42 Mo molybdenum 96 | 43 Tc technetium – | 44 Ru ruthenium 101 | 45 Rh rhodium 103 | 46 Pd palladium 106 | 47 Ag silver 108 | 48 Cd cadmium 112 | 49 In indium 115 | 50 Sn tin 119 | 51 Sb antimony 122 | 52 Te tellurium 128 | 53 I iodine 127 | 54 Xe xenon 131 |
| 55 Cs caesium 133 | 56 Ba barium 137 | 57–71 lanthanoids | 72 Hf hafnium 178 | 73 Ta tantalum 181 | 74 W tungsten 184 | 75 Re rhenium 186 | 76 Os osmium 190 | 77 Ir iridium 192 | 78 Pt platinum 195 | 79 Au gold 197 | 80 Hg mercury 201 | 81 Tl thallium 204 | 82 Pb lead 207 | 83 Bi bismuth 209 | 84 Po polonium – | 85 At astatine – | 86 Rn radon – |
| 87 Fr francium – | 88 Ra radium – | 89–103 actinoids | 104 Rf rutherfordium – | 105 Db dubnium – | 106 Sg seaborgium – | 107 Bh bohrium – | 108 Hs hassium – | 109 Mt meitnerium – | 110 Ds darmstadtium – | 111 Rg roentgenium – | 112 Cn copernicium – | | 114 Fl flerovium – | | 116 Lv livermorium – | | |

**Key**

atomic number
atomic symbol
name
relative atomic mass

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

The volume of one mole of any gas is 24 $dm^3$ at room temperature and pressure (r.t.p.).