Cambridge Assessment International Education

# Cambridge IGCSE™ (9–1)

**CO-ORDINATED SCIENCES** **0973/21**

Paper 2 Multiple Choice (Extended) **May/June 2021**

**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.



IB21 06_0973_21/FP


**[Turn over**

**1** What is respiration?

**A** breakdown of food by enzymes in the alimentary canal

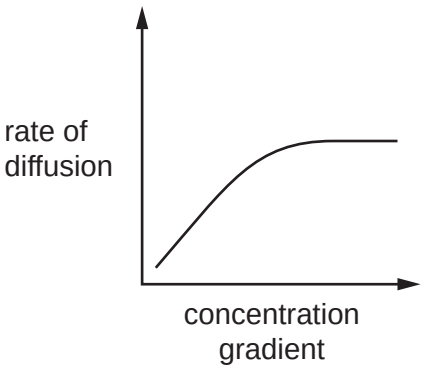
**B** breathing to supply oxygen to cells

**C** release of carbon dioxide from the lungs

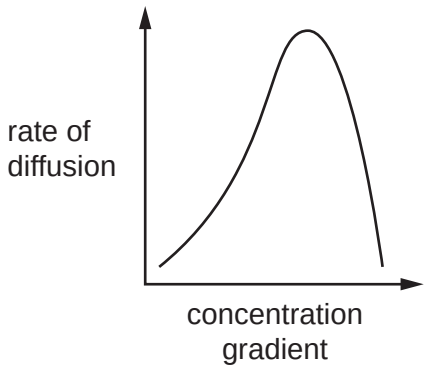
**D** release of energy for body activities

**2** What is the effect of increasing the concentration gradient on the rate of diffusion?

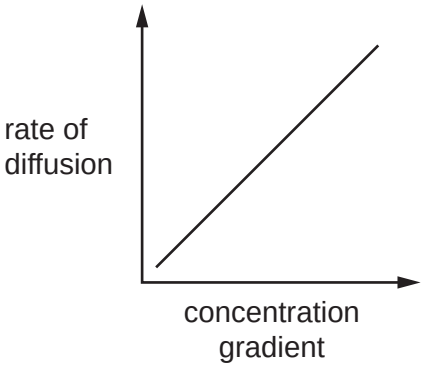
**A**



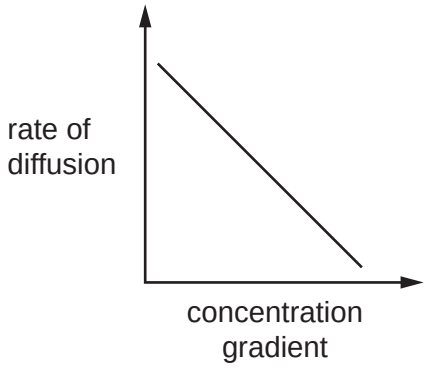

**B**




**C**




**D**



**3** Three food tests are carried out on a sample of food. The results are shown in the table.

| food test | final colour |
|---|---|
| Benedict's | blue |
| biuret | blue |
| iodine | blue-black |

From these results, which nutrient is in the food?

**A** reducing sugar

**B** protein

**C** starch

**D** vitamin C

**4** What is an enzyme?

**A** a carbohydrate that speeds up the rate of a reaction

**B** a carbohydrate that alters the activity of a target organ

**C** a protein that alters the activity of a target organ

**D** a protein that speeds up the rate of a reaction

**5** The balanced equation for photosynthesis is shown.

$$6CO_2 + 6H_2O \xrightarrow[\text{chlorophyll}]{\text{light}} \mathbf{X} + 6O_2$$

What is **X**?

**A** $C_6H_{12}O_6$ **B** $C_6H_{12}O_{12}$ **C** $C_{12}H_6O_6$ **D** $C_{12}H_{12}O_2$

**6** Protein shakes can be used by athletes to supplement their diet. They are a drink made by dissolving protein powders in water or milk.

Which types of digestion will be required before they can be absorbed?

| | chemical digestion | mechanical digestion |
|---|---|---|
| **A** | ✓ | ✓ |
| **B** | ✓ | ✗ |
| **C** | ✗ | ✓ |
| **D** | ✗ | ✗ |

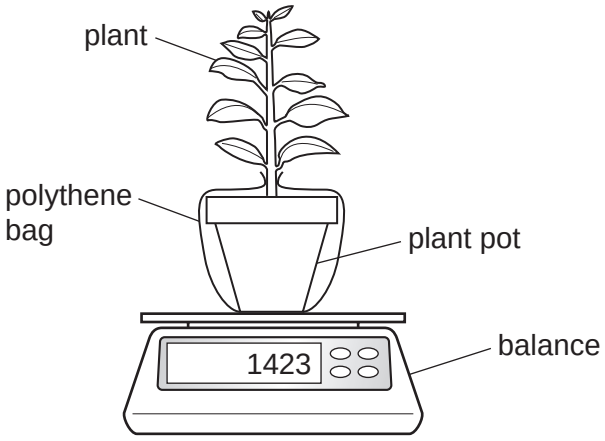
key

✓ = yes

✗ = no

**7** A student investigates the effect of humidity on transpiration rate.

A plant is placed on a balance as shown for one hour. The mass of the plant decreases.




The student repeats the experiment in air of higher humidity.

What is the effect of increasing humidity?

**A** larger decrease in mass due to a steeper diffusion gradient of water

**B** larger decrease in mass due to a less steep diffusion gradient of water

**C** smaller decrease in mass due to a steeper diffusion gradient of water

**D** smaller decrease in mass due to a less steep diffusion gradient of water

**8** A child blows into a rubber balloon.

What is the percentage of oxygen inside the balloon?

**A** 0% **B** 4% **C** 16% **D** 21%

**9** What is homeostasis?

**A** keeping internal conditions constant

**B** keeping the body at the same temperature as the environment

**C** sweating to keep the body warm

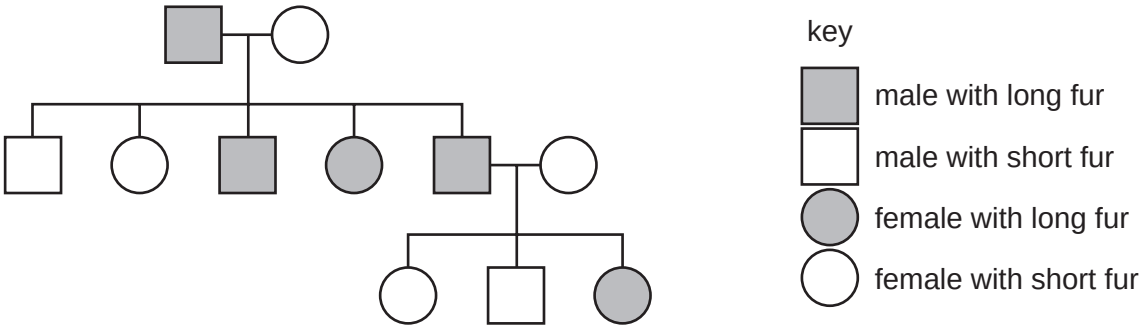
**D** vasoconstriction of arterioles to increase heat loss

**10** Which row about these human cells is correct?

| | type of human cell | chromosome number | description |
|---|---|---|---|
| **A** | gamete | 23 | diploid |
| **B** | gamete | 46 | haploid |
| **C** | zygote | 46 | diploid |
| **D** | zygote | 23 | haploid |

**11** The allele for long fur in cats is recessive to the allele for short fur.

The pedigree diagram shows the inheritance of long and short fur in a family of cats.




How many cats in the pedigree diagram are heterozygous for fur length?

**A** 2 **B** 4 **C** 5 **D** 6

**12** Why do food chains usually have fewer than five trophic levels?

**A** All the carnivores consume herbivores.

**B** The energy passed on reduces from one trophic level to the next.

**C** There is less protein in each individual higher up the chain.

**D** There is only one producer in each chain.

**13** What decreases as a result of deforestation?

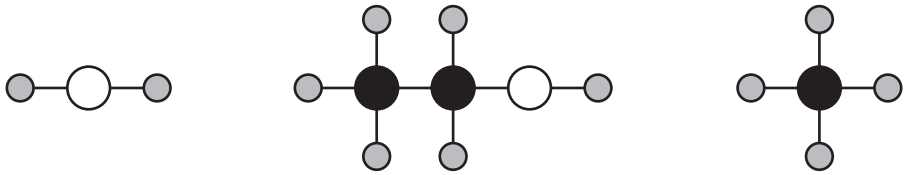
**A** available habitats

**B** atmospheric carbon dioxide

**C** flooding

**D** soil loss

**14** The structures of some substances are shown.



water ethanol methane

Which row shows the total number of different elements and the total number of atoms in the three structures?

| | total number of different elements | total number of atoms |
|---|---|---|
| **A** | 3 | 9 |
| **B** | 3 | 17 |
| **C** | 7 | 9 |
| **D** | 7 | 17 |

**15** Pure substance X has a melting point of 110 °C.

The melting point ranges of four impure samples of substance X are measured.

What is the melting point range of the most impure sample of substance X?

| | melting point / °C |
|---|---|
| **A** | 81–85 |
| **B** | 86–92 |
| **C** | 98–99 |
| **D** | 102–110 |

**16** Which row explains why the melting points of covalent compounds are lower than those of ionic compounds?

| | covalent compound | ionic compound |
|---|---|---|
| **A** | strong attractive forces between molecules | strong attraction between oppositely charged ions |
| **B** | strong attractive forces between molecules | weak attraction between oppositely charged ions |
| **C** | weak attractive forces between molecules | strong attraction between oppositely charged ions |
| **D** | weak attractive forces between molecules | weak attraction between oppositely charged ions |

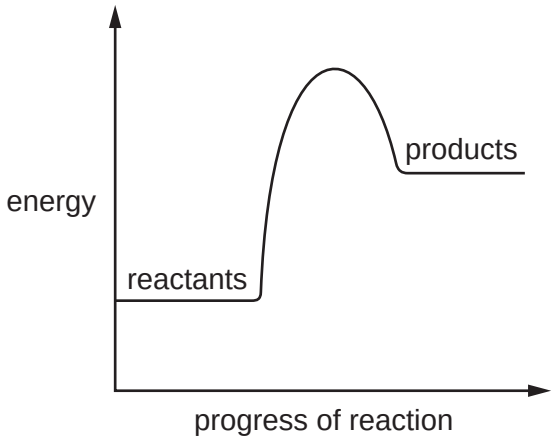
**17** The charges on some ions are shown.

| positive ions | negative ions |
|---|---|
| $Al^{3+}$ | $N^{3-}$ |
| $Li^{+}$ | $NO_3^{-}$ |
| $Mg^{2+}$ | $O^{2-}$ |
| $Zn^{2+}$ | $SO_4^{2-}$ |

Which formula is correct?

| | compound | formula |
|---|---|---|
| **A** | aluminium sulfate | $Al_2(SO_4)_3$ |
| **B** | lithium nitrate | $Li_2NO_3$ |
| **C** | magnesium nitride | $Mg_2N_3$ |
| **D** | zinc oxide | $ZnO_2$ |

**18** An energy level diagram for a chemical reaction is shown.




Which row describes the energy change and the type of reaction?

| | energy change | type of reaction |
|---|---|---|
| **A** | energy is given out to the surroundings | endothermic |
| **B** | energy is given out to the surroundings | exothermic |
| **C** | energy is taken in from the surroundings | endothermic |
| **D** | energy is taken in from the surroundings | exothermic |

**19** Which equation represents a redox reaction?

**A** $Ca(OH)_2 + CO_2 \rightarrow CaCO_3 + H_2O$

**B** $CuCO_3 \rightarrow CuO + CO_2$

**C** $Mg + CuSO_4 \rightarrow MgSO_4 + Cu$

**D** $Pb(NO_3)_2 + 2KI \rightarrow PbI_2 + 2KNO_3$

**20** What reacts with ammonia gas?

| | hydrochloric acid | sodium hydroxide |
|---|---|---|
| **A** | ✓ | ✓ |
| **B** | ✓ | ✗ |
| **C** | ✗ | ✓ |
| **D** | ✗ | ✗ |

key

✓ = reacts

✗ = does not react

**21** Substance Q is added to cold water. It floats on the water and hydrogen gas is made.

What is Q?

**A** iodine

**B** lithium

**C** magnesium

**D** zinc

**22** Four metals W, X, Y and Z are added to different solutions of metal nitrates.

The results are shown.

| | | metal nitrate solution | | | |
|---|---|---|---|---|---|
| | | W | X | Y | Z |
| metal | W | | ✗ | ✗ | ✗ |
| | X | ✓ | | ✓ | ✗ |
| | Y | ✓ | ✗ | | ✗ |
| | Z | ✓ | ✓ | ✓ | |

key

✓ = reacts

✗ = no reaction

Which statements are correct?

1 Metal Z is the most reactive.

2 Metal W has the lowest tendency to form positive ions.

3 Metal X is less reactive than metal W.

4 Metal Y is more reactive than metal X.

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

**23** Which statement explains how oxides of nitrogen are formed in a car engine?

**A** Nitrogen from the air reacts with the fuel.

**B** Oxygen and nitrogen from the air react together.

**C** Oxygen from the air reacts with sulfur impurities in the fuel.

**D** Oxygen from the air reacts with the fuel.

**24** Other than hydrogen and oxygen, which substance provides only **one** of the essential elements for plant growth?

**A** $K_3PO_4$ **B** $KNO_3$ **C** $(NH_4)_3PO_4$ **D** $NH_4NO_3$

**25** What is the chemical name for lime?

**A** calcium carbonate

**B** calcium hydroxide

**C** calcium oxide

**D** calcium sulfate

**26** Which row about the Contact process is correct?

| | temperature / °C | catalyst |
|---|---|---|
| **A** | 200 | iron |
| **B** | 200 | vanadium(V) oxide |
| **C** | 450 | iron |
| **D** | 450 | vanadium(V) oxide |

**27** Which reaction produces only one product?

**A** combustion of ethanol

**B** cracking of alkanes

**C** fermentation of sugar solution

**D** reaction of ethene and steam

**28** A car accelerates with constant acceleration from a speed of 3.0 m/s to a speed of 9.0 m/s in 3.0 s.

What is the acceleration of the car?

**A** 1.0 m/s$^2$ **B** 2.0 m/s$^2$ **C** 3.0 m/s$^2$ **D** 4.0 m/s$^2$

**29** Which two quantities can be used to calculate the acceleration of a rocket?

**A** the mass of the rocket and its speed

**B** the mass of the rocket and its weight

**C** the resultant force on the rocket and its mass

**D** the resultant force on the rocket and its speed

**30** Which statement applies to a system in equilibrium?

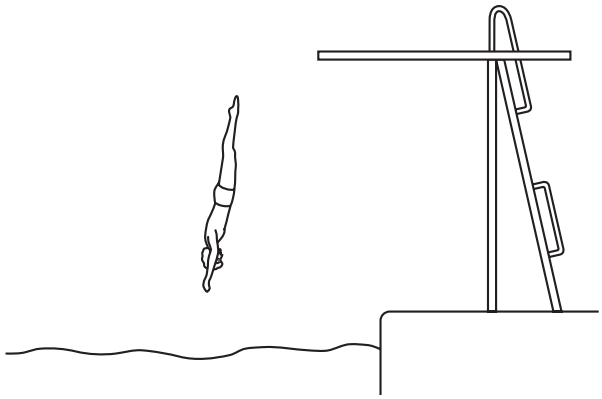
**A** There is a resultant force and there is a resultant turning effect on the system.

**B** There is a resultant force but there is no resultant turning effect on the system.

**C** There is no resultant force but there is a resultant turning effect on the system.

**D** There is no resultant force and there is no resultant turning effect on the system.

**31** The diagram shows a man diving into water.



Which form of energy is increasing as he accelerates downwards through the air?

**A** chemical

**B** elastic potential (strain)

**C** gravitational potential

**D** kinetic

**32** The Sun is an important energy resource.

Which energy source powers the Sun?

**A** chemical

**B** geothermal

**C** nuclear fission

**D** nuclear fusion

**33** Which example of thermal conduction involves energy transfer by electrons?

**A** A person's feet become warm when walking on hot sand.

**B** Chocolate becomes warm if it is held in a hand.

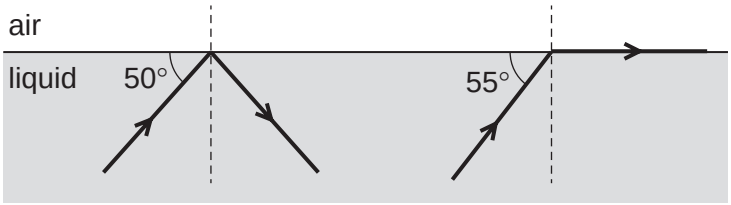
**C** One end of a metal spoon becomes hot when the other end is placed in hot water.

**D** The outside of a plastic mug filled with hot water becomes hot.

**34** Which colour of outer clothing helps to keep the wearer cool on a hot, sunny day, and why is this clothing effective?

| | colour of clothing | why it is effective |
|---|---|---|
| **A** | black | it is a good absorber of radiation from the Sun |
| **B** | black | it is a poor absorber of radiation from the Sun |
| **C** | white | it is a good absorber of radiation from the Sun |
| **D** | white | it is a poor absorber of radiation from the Sun |

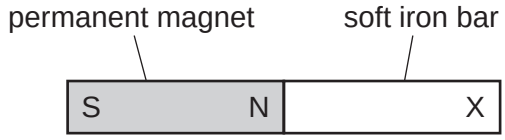
**35** The diagram represents the surface of a transparent liquid. Two rays of light are travelling in the liquid. They both reach the surface. The path of each ray is shown.




What is the critical angle for this liquid?

**A** 35° **B** 40° **C** 50° **D** 55°

**36** An unmagnetised soft iron bar is held close to a permanent magnet and becomes attached to the magnet. The soft iron bar is then moved a large distance from the magnet.

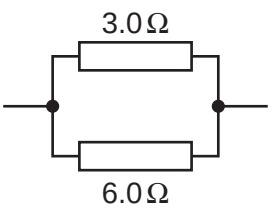



What happens at point X when the soft iron bar is attached to the magnet, and what happens when the bar is moved a large distance from the magnet?

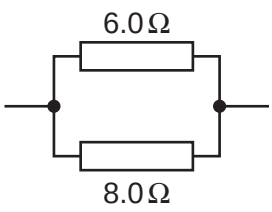
| | attached to magnet | bar moved away |
|---|---|---|
| **A** | X becomes an N pole | no pole at X |
| **B** | X becomes an N pole | remains an N pole |
| **C** | X becomes an S pole | no pole at X |
| **D** | X becomes an S pole | remains an S pole |

**37** Which combination of resistors has a combined resistance of 2.0 Ω?

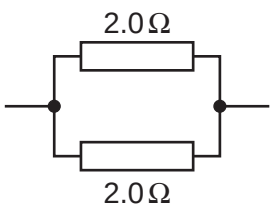
**A**



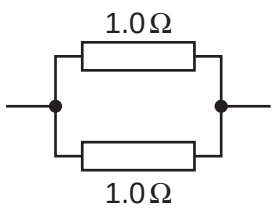

**B**



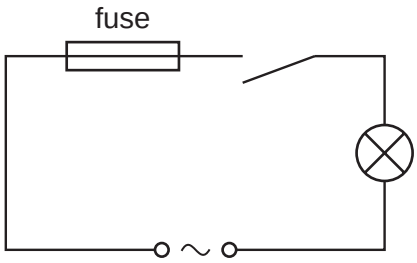

**C**




**D**




**38** A student connects the circuit shown.




When the switch is closed the fuse blows and stops the current.

What is a possible reason for this?

**A** The current rating of the fuse is too high.

**B** The current is too large.

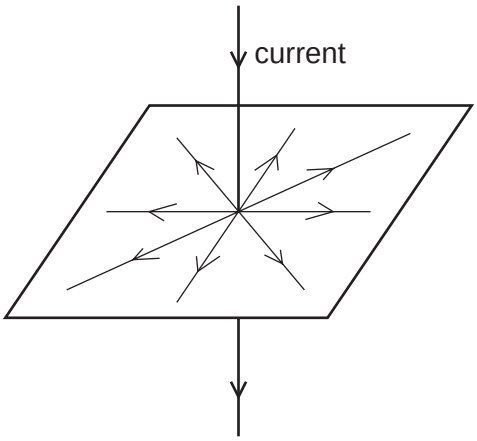
**C** The lamp is too dim.

**D** The voltage is too small.

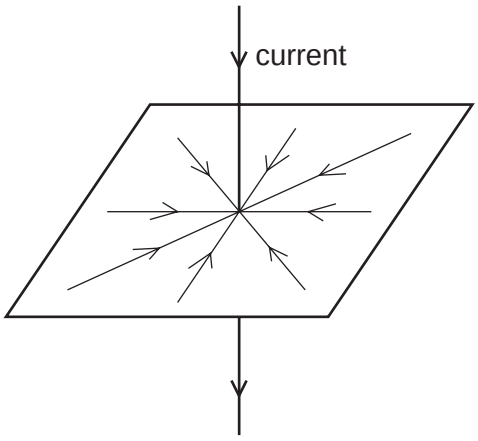
**39** The diagrams each show a wire carrying a current in the direction of the arrow.

Which diagram shows the pattern and the direction of the magnetic field around the wire?

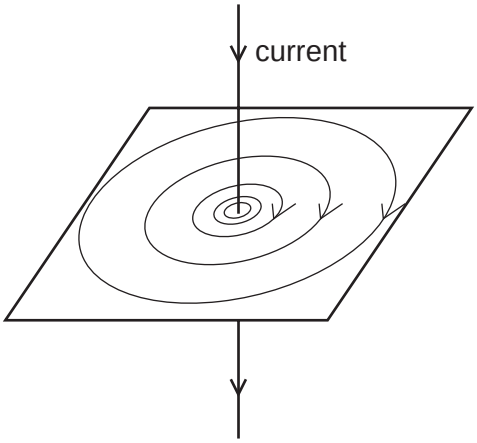
**A**



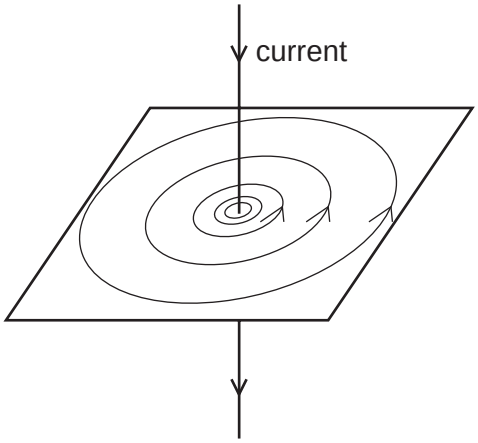

**B**




**C**




**D**




**40** A radioactive nucleus emits a β-particle.

What happens to the proton number (atomic number) of the nucleus?

**A** It stays the same.

**B** It increases by 1.

**C** It decreases by 2.

**D** It decreases by 4.

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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.).