Cambridge Assessment International Education

# Cambridge IGCSE™

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

Paper 2 Multiple Choice (Extended) **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.




**[Turn over**

**1** A person throws a ball which their dog runs after and brings back to them.

Which characteristics of living things is the dog showing by this action?

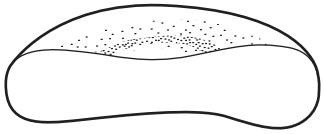
**A** growth and nutrition

**B** movement and nutrition

**C** movement and sensitivity

**D** sensitivity and growth

**2** The diagram shows a section through a red blood cell.



Which statement is correct for red blood cells?

**A** The cell has no nucleus to minimise oxygen binding.

**B** The cell membrane has a small surface area in relation to volume.

**C** The cytoplasm contains haemoglobin.

**D** The flat structure makes it easier to be carried through arteries.

**3** Which food test requires heating?

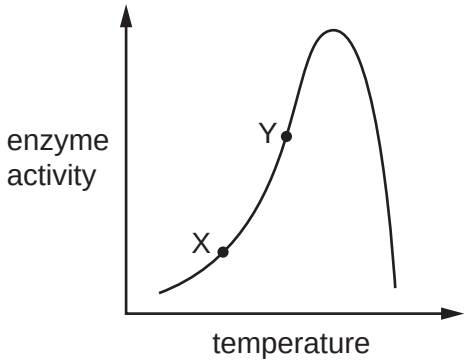
**A** fat

**B** protein

**C** reducing sugar

**D** starch

**4** The diagram shows the effect of temperature on enzyme activity.




What has increased the enzyme activity between points X and Y?

**A** decreased denaturation

**B** decreased kinetic energy

**C** increased denaturation

**D** increased kinetic energy

**5** Plants need magnesium ions and nitrate ions.

Which statements correctly show what the plants make using these ions?

1 Magnesium ions are needed for making amino acids.

2 Nitrate ions are needed for making amino acids.

3 Magnesium ions are needed for making chlorophyll.

4 Nitrate ions are needed for making chlorophyll.

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

**6** Which statements about mechanical digestion are correct?

1 Food is broken down into smaller pieces.

2 Food molecules do not undergo chemical changes.

3 Soluble molecules are formed from insoluble ones.

4 Large molecules are broken down to smaller ones.

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

**7** Which row names the substances carried by xylem vessels and the direction of travel?

| | substances | direction of travel |
|---|---|---|
| **A** | sucrose only | leaves to roots |
| **B** | sucrose only | roots to leaves |
| **C** | water and dissolved minerals | leaves to roots |
| **D** | water and dissolved minerals | roots to leaves |

**8** What is the expected concentration of oxygen and the water vapour content in expired air?

| | oxygen / % | water vapour |
|---|---|---|
| **A** | 16 | saturated |
| **B** | 16 | variable |
| **C** | 21 | saturated |
| **D** | 21 | variable |

**9** Which statement about the role of blood vessels in the skin is correct?

**A** If the environment is too cold, vasoconstriction of capillaries occurs.

**B** If the environment is too cold, vasodilation of arterioles occurs.

**C** If the environment is too hot, vasoconstriction of capillaries occurs.

**D** If the environment is too hot, vasodilation of arterioles occurs.

**10** The table shows some features of insect-pollinated flowers and wind-pollinated flowers.

Which rows are correct?

| | insect-pollinated flowers | wind-pollinated flowers |
|---|---|---|
| 1 | anthers dangle outside the flower | anthers are inside the flower |
| 2 | large petals | small petals |
| 3 | not scented | scented |
| 4 | stigma inside the flower | stigma dangles outside the flower |

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

**11** What is a difference between a haploid nucleus and a diploid nucleus from the same plant?

**A** The diploid nucleus has more chromosomes.

**B** The diploid nucleus is the result of meiosis.

**C** The haploid nucleus is the result of mitosis.

**D** The haploid nucleus has more alleles.

**12** What is an ecosystem?

**A** a network of interconnected food chains in a given area

**B** all the members of one species in a given habitat

**C** all the organisms and their environment interacting together in a given area

**D** all the transfer of energy in a given habitat

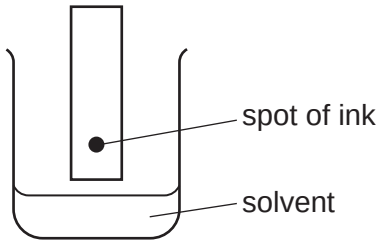
**13** Which row describes the effects of deforestation?

| | level of carbon dioxide in the air | risk of flooding |
|---|---|---|
| **A** | decreases | decreases |
| **B** | decreases | increases |
| **C** | increases | decreases |
| **D** | increases | increases |

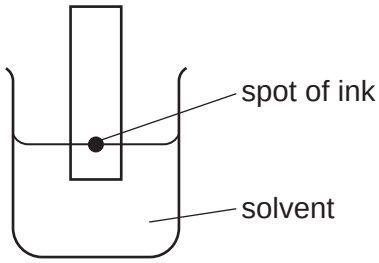
**14** The colours in an ink are separated by chromatography.

Which diagram shows the assembled apparatus?

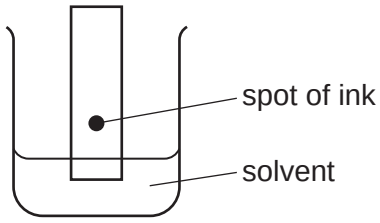
**A**



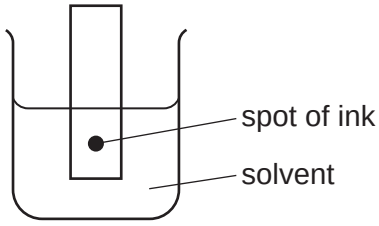

**B**




**C**

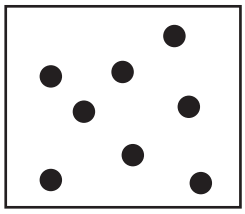



**D**

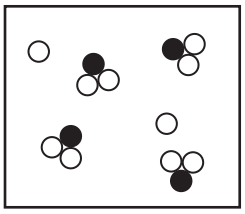



**15** Which diagram represents a mixture of an element and a compound?

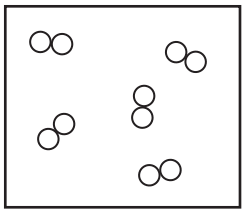
**A**



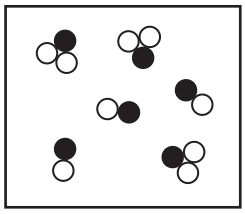
**B**



**C**



**D**



**16** X and Y are isotopes of the same element.

Which statement about X and Y is correct?

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

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

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

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

**17** Nonane, $C_9H_{20}$, burns in oxygen to form carbon dioxide and water.

The equation for this reaction is shown.

$$C_9H_{20} + 14O_2 \rightarrow 9CO_2 + 10H_2O$$

What is the mass of oxygen required for the complete combustion of 64 g of nonane?

**A** 32 g **B** 224 g **C** 396 g **D** 448 g

**18** Which statement correctly describes how aluminium is changed during the electrolysis of aluminium oxide?

**A** At the anode, aluminium ions gain electrons and so are oxidised.

**B** At the anode, aluminium ions lose electrons and so are oxidised.

**C** At the cathode, aluminium ions gain electrons and so are reduced.

**D** At the cathode, aluminium ions lose electrons and so are reduced.

**19** Dilute hydrochloric acid is reacted with magnesium. The reaction is repeated using a higher concentration of acid.

Which statement about the second reaction is **not** correct?

**A** The rate of reaction is greater.

**B** The particles have more energy.

**C** There are more frequent collisions between reacting particles.

**D** There are more reacting particles.

**20** A piece of damp blue litmus paper is put in a test-tube of a gas. The litmus paper turns red and then changes to white.

What is the gas?

**A** ammonia

**B** carbon dioxide

**C** chlorine

**D** oxygen

**21** The elements in Group I of the Periodic Table are metals.

What are the trends as the group is descended?

**A** decrease in melting point and less reactive with water

**B** decrease in melting point and more reactive with water

**C** increase in melting point and less reactive with water

**D** increase in melting point and more reactive with water

**22** Why is argon used in lamps?

**A** It is heavier than air.

**B** It is lighter than air.

**C** It is reactive.

**D** It is unreactive.

**23** Which metal can **only** be extracted from its ore using electrolysis?

**A** calcium

**B** copper

**C** iron

**D** zinc

**24** Which row shows the conditions used for making ammonia by the Haber process?

| | pressure / atm | temperature / °C | catalyst |
|---|---|---|---|
| **A** | 250 | 450 | iron |
| **B** | 250 | 200 | vanadium pentoxide |
| **C** | 2 | 200 | iron |
| **D** | 2 | 450 | vanadium pentoxide |

**25** Four reaction equations involving sulfur and its compounds are shown.

1 $S + O_2 \rightarrow SO_2$

2 $SO_2 + H_2O \rightarrow H_2SO_3$

3 $2H_2SO_3 + O_2 \rightarrow 2H_2SO_4$

4 $H_2SO_4 + SO_3 \rightarrow H_2S_2O_7$

Which reactions take place in the manufacture of sulfuric acid by the Contact process?

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

**26** Which formula represents but-1-ene?

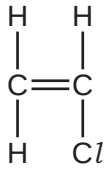
**A** $CH_3CH{=}CH_2$

**B** $CH_3CH_2CH_2CH_3$

**C** $CH_3CH_2CH{=}CH_2$

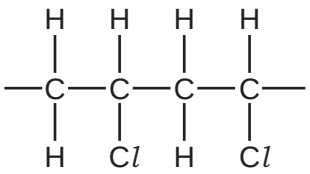
**D** $CH_3CH{=}CHCH_3$

**27** The structure of the monomer chloroethene is shown.

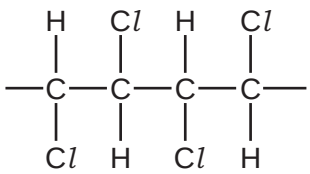


What is a part of the structure of the addition polymer formed from this monomer?

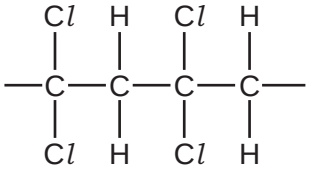
**A**



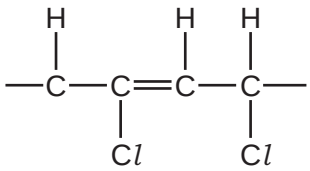
**B**



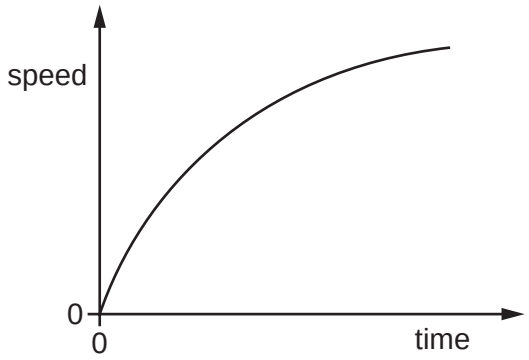
**C**



**D**



**28** The graph shows the variation of speed with time for an object moving in a straight line.




Which statement about the motion of the object is correct?

**A** At time 0, the acceleration is zero.

**B** The acceleration decreases with time.

**C** The gradient of the line is equal to the distance travelled.

**D** The velocity of the object decreases with time.

**29** Diagram 1 shows a spring with its length indicated. Diagram 2 shows the same spring with a 20 N load hung from it, and the new length of the spring.

The spring obeys Hooke's Law.

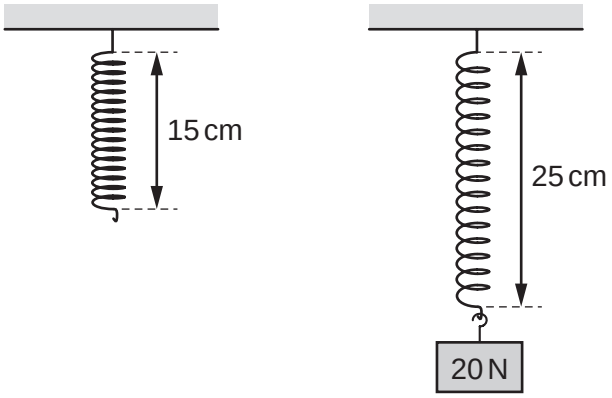
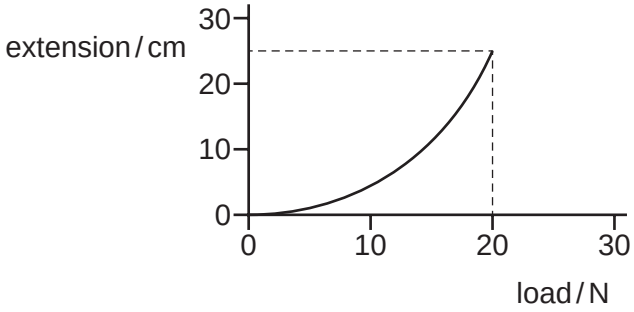


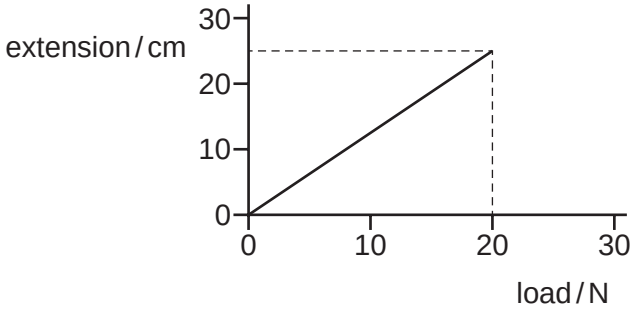

diagram 1 diagram 2

Which graph is the extension–load graph for the spring?

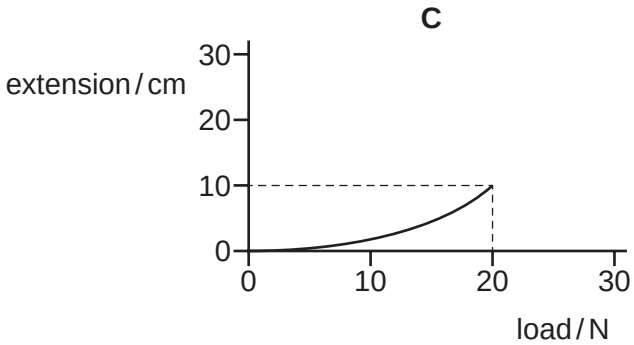
**A**



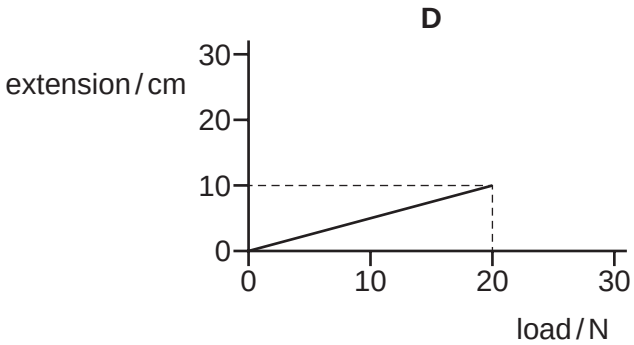

**B**




**C**




**D**




**30** A force of 4.0 N acts on an object for 4.0 s. The object moves a distance of 8.0 m in the direction of the force.

What is the work done by the force?

**A** 1.0 J **B** 2.0 J **C** 16 J **D** 32 J

**31** An electric motor transfers 4000 J of electrical energy to useful energy and 12 000 J of electrical energy is wasted.

What is the efficiency of the motor?

**A** 25% **B** 33% **C** 50% **D** 75%

**32** The pressure of a gas in a container is caused by gas molecules colliding with the walls.

The pressure can be increased by heating the gas or by reducing its volume.

Which row explains why the pressure increases in each case?

| | heating the gas | reducing the volume |
|---|---|---|
| **A** | collisions more frequent and harder | collisions more frequent and harder |
| **B** | collisions more frequent and harder | collisions more frequent only |
| **C** | collisions harder only | collisions more frequent and harder |
| **D** | collisions harder only | collisions more frequent only |

**33** Which statement explains why metals are better thermal conductors than non-metals?

**A** Atoms in metals are fixed in a lattice by bonds.

**B** Atoms in metals vibrate about fixed positions.

**C** Metals contain free electrons.

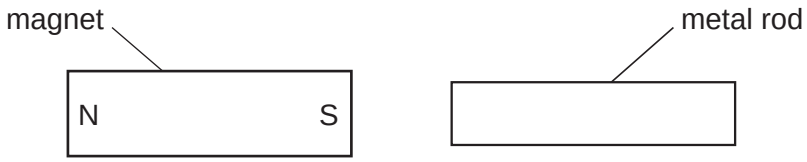
**D** Metals contain free protons.

**34** The sound heard from the siren of a police car becomes quieter and lower pitched as the car moves away from an observer.

Which row describes what happens to the amplitude and frequency of the sound wave heard by the observer?

| | amplitude | frequency |
|---|---|---|
| **A** | decreases | decreases |
| **B** | decreases | increases |
| **C** | increases | decreases |
| **D** | increases | increases |

**35** A bar magnet is brought near to a metal rod. The metal rod is attracted to the magnet.




The magnet is then turned around so that the N-pole is on the right.

The magnet is again brought near to the metal rod and is again attracted to the magnet.

What could the metal rod be?

**A** another bar magnet

**B** a piece of aluminium

**C** a piece of copper

**D** a piece of iron

**36** Four resistors are connected into circuits. The current in each resistor and the potential difference (p.d.) across each resistor are shown.

Which resistor has a resistance of 2.0 Ω?

| | current / A | p.d. / V |
|---|---|---|
| **A** | 2.0 | 1.0 |
| **B** | 4.0 | 2.0 |
| **C** | 12 | 6.0 |
| **D** | 4.0 | 8.0 |

**37** Two lamps can be connected to a battery either in series or in parallel.

Which statement is **not** a benefit of connecting two lamps in parallel rather than in series?

**A** If one lamp breaks, the other lamp stays lit.

**B** The lamps are brighter.

**C** The lamps can be controlled individually using switches.

**D** There is a smaller current in the battery.

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

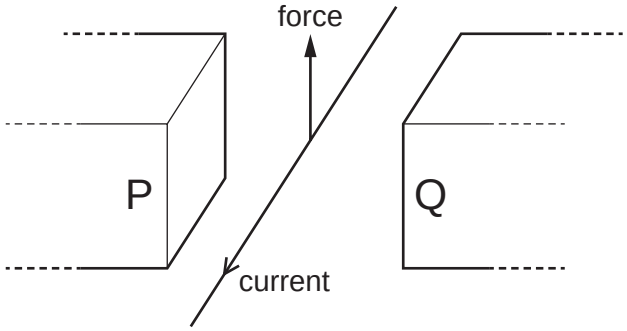
**A** to make the circuit more efficient

**B** to protect the circuit from damage by a large current

**C** to provide a constant current in the circuit

**D** to provide a constant potential difference (p.d.) across the circuit

**39** A current-carrying wire is placed between the poles P and Q of a magnet, as shown.




The direction of the current is shown.

A force acts on the wire upwards, as shown.

What is the direction of the magnetic field?

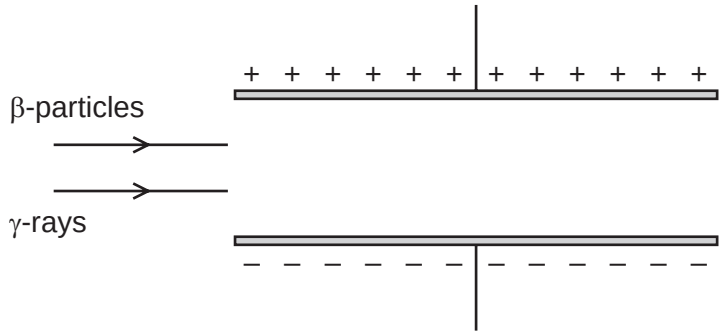
**A** from P to Q

**B** from Q to P

**C** towards the bottom of the page

**D** towards the top of the page

**40** The diagram shows a beam of β-particles and a beam of γ-rays entering the electric field between two charged plates.




What is the effect of the electric field on each of the beams?

| | β-particles | γ-rays |
|---|---|---|
| **A** | deflected to the – plate | deflected to the + plate |
| **B** | deflected to the + plate | deflected to the – plate |
| **C** | deflected to the + plate | no effect |
| **D** | no effect | deflected to the – plate |

## 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 – | 113 Nh nihonium – | 114 Fl flerovium – | 115 Mc moscovium – | 116 Lv livermorium – | 117 Ts tennessine – | 118 Og oganesson – |

**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.).