



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.

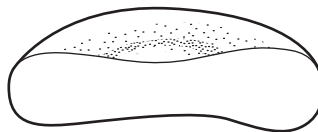


1 A person throws a ball which their dog runs after and brings back to them.

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.



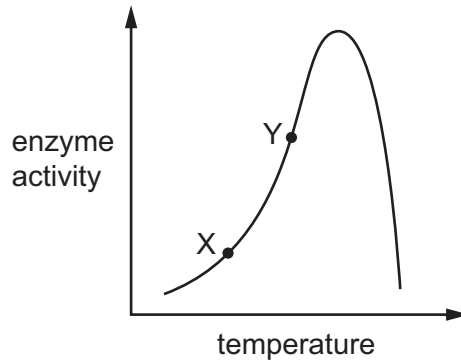
Which statement is correct for red blood cells?

- 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?

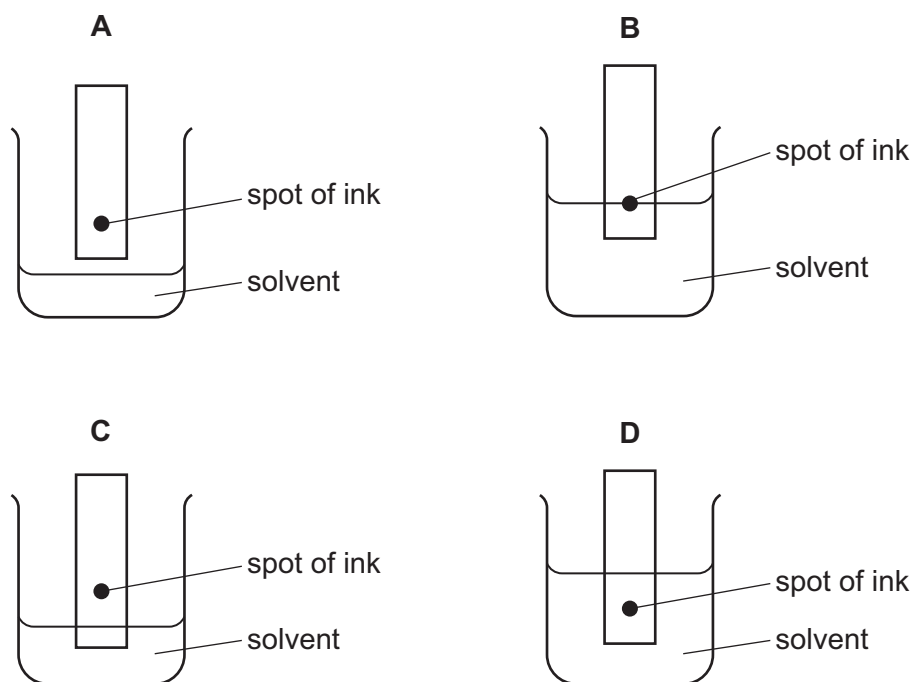
- A a network of interconnected food chains in a given area
- B all the members of one species in a given habitat
- C all the organisms and their environment interacting together in a given area
- D all the transfer of energy in a given habitat

13 Which row describes the effects of deforestation?

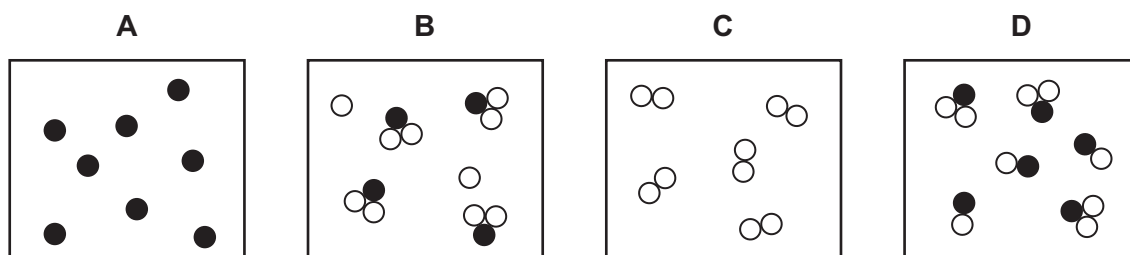
	level of carbon dioxide in the air	risk of flooding
A	decreases	decreases
B	decreases	increases
C	increases	decreases
D	increases	increases

14 The colours in an ink are separated by chromatography.

Which diagram shows the assembled apparatus?



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



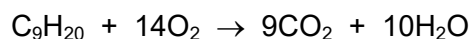
16 X and Y are isotopes of the same element.

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, C₉H₂₀, burns in oxygen to form carbon dioxide and water.

The equation for this reaction is shown.



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.

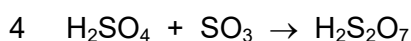
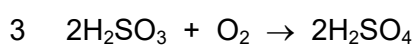
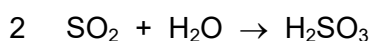
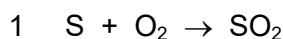
23 Which metal can **only** be extracted from its ore using electrolysis?

- 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.



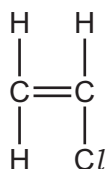
Which reactions take place in the manufacture of sulfuric acid by the Contact process?

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

26 Which formula represents but-1-ene?

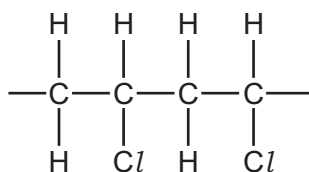
- A $\text{CH}_3\text{CH}=\text{CH}_2$
- B $\text{CH}_3\text{CH}_2\text{CH}_2\text{CH}_3$
- C $\text{CH}_3\text{CH}_2\text{CH}=\text{CH}_2$
- D $\text{CH}_3\text{CH}=\text{CHCH}_3$

27 The structure of the monomer chloroethene is shown.

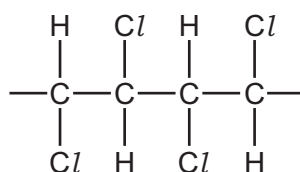


What is a part of the structure of the addition polymer formed from this monomer?

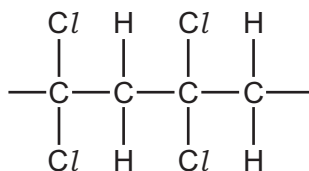
A



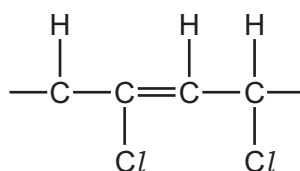
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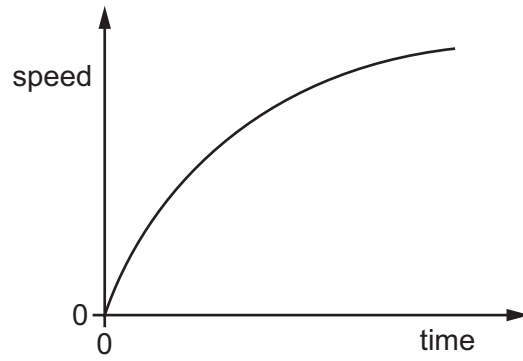
C



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.

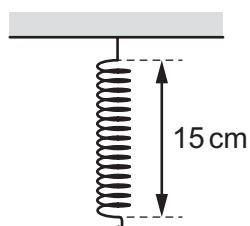


diagram 1

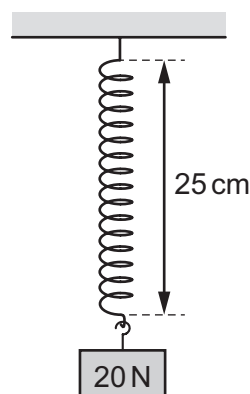
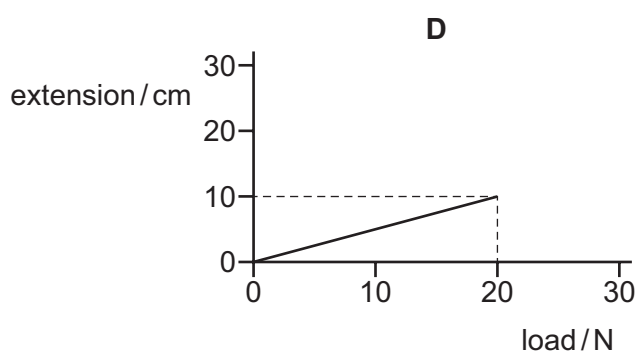
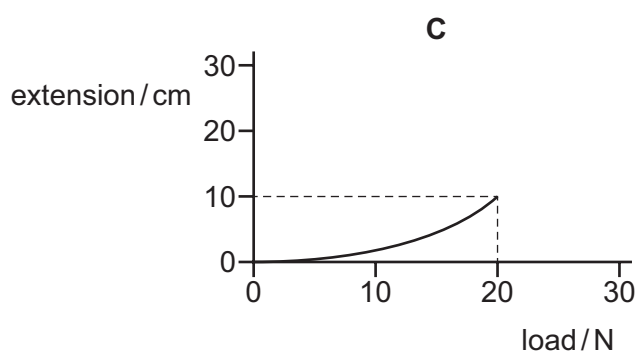
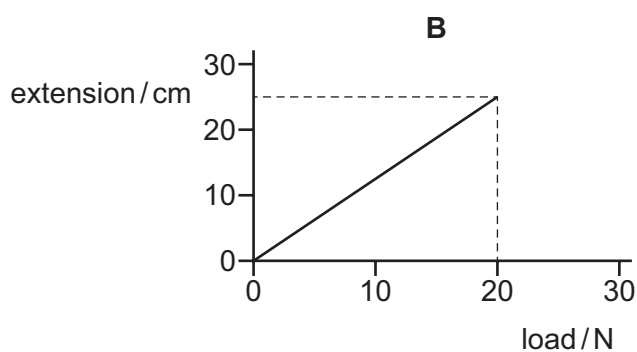
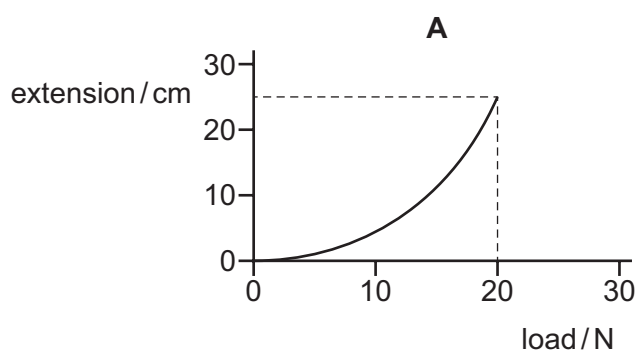


diagram 2

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



- 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?

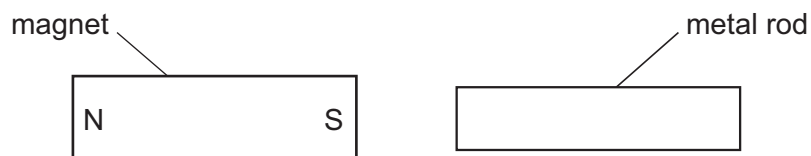
- A Atoms in metals are fixed in a lattice by bonds.
 B Atoms in metals vibrate about fixed positions.
 C Metals contain free electrons.
 D Metals contain free protons.

- 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 $2.0\ \Omega$?

	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.

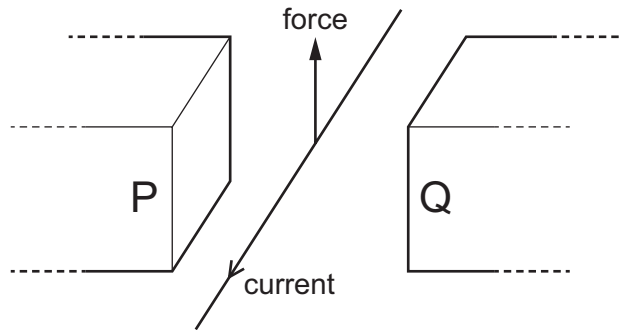
Which statement is **not** a benefit of connecting two lamps in parallel rather than in series?

- 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.



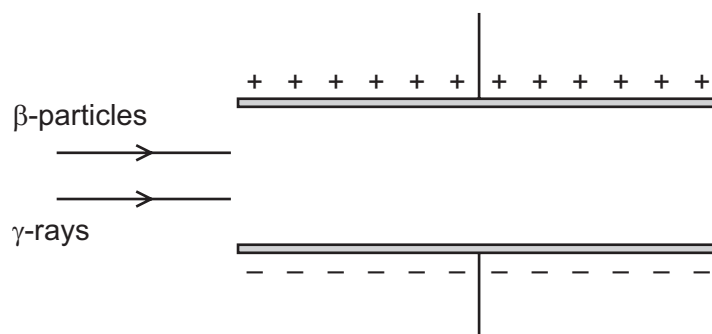
The direction of the current is shown.

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

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The Periodic Table of Elements

		Group															
I	II	III	IV	V	VI	VII	VIII										
3 Li lithium 7	4 Be beryllium 9	11 Na sodium 23	12 Mg magnesium 24	<div style="border: 1px solid black; padding: 5px; display: inline-block;"> Key atomic number atomic symbol name relative atomic mass </div>													
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 —

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 dm³ at room temperature and pressure (r.t.p.).