



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

**COMBINED SCIENCE**

**0653/21**

Paper 2 Multiple Choice (Extended)

**May/June 2018**

**45 minutes**

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

\* 7 6 0 3 0 3 6 3 1 8 \*

**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 16.

Electronic calculators may be used.

This document consists of **16** printed pages.

1 Most cars burn fossil fuels to release energy for their movement.

Which characteristic of living organisms is similar to this?

- A excretion
- B growth
- C nutrition
- D respiration

2 Which structure controls the passage of substances into and out of a cell?

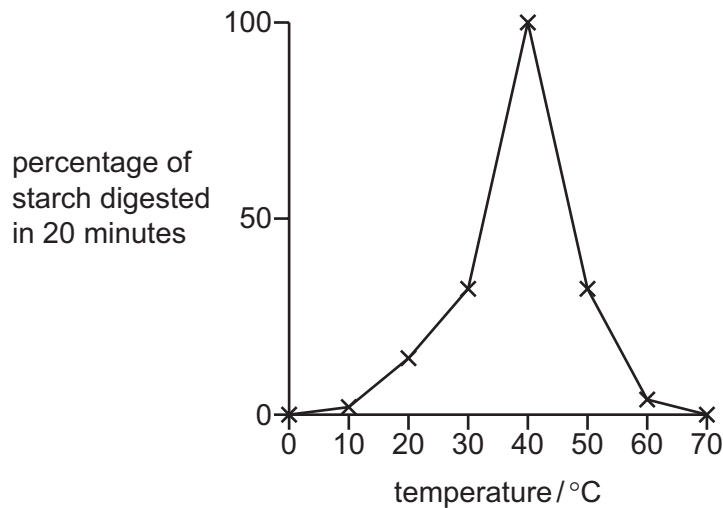
- A cell membrane
- B cell wall
- C nucleus
- D vacuole

3 Amylase is an enzyme that digests starch.

Identical mixtures of starch and amylase are kept at different temperatures.

The percentage of starch digested in 20 minutes is recorded.

The results are shown in the graph.



The mixtures that were kept at 0 °C and 70 °C are then kept at a temperature of 40 °C for one hour.

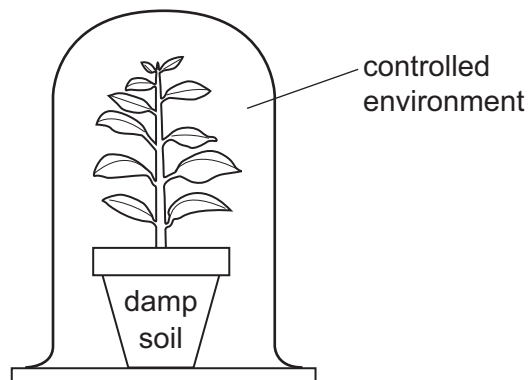
What are the results after this hour?

	percentage of starch digested	
	sample originally kept at 0 °C	sample originally kept at 70 °C
<b>A</b>	0	0
<b>B</b>	0	100
<b>C</b>	100	0
<b>D</b>	100	100

4 Which two chemical substances are required for photosynthesis?

- A** carbon dioxide and glucose
- B** glucose and oxygen
- C** oxygen and water
- D** water and carbon dioxide

- 5 The diagram shows a plant in a controlled environment.



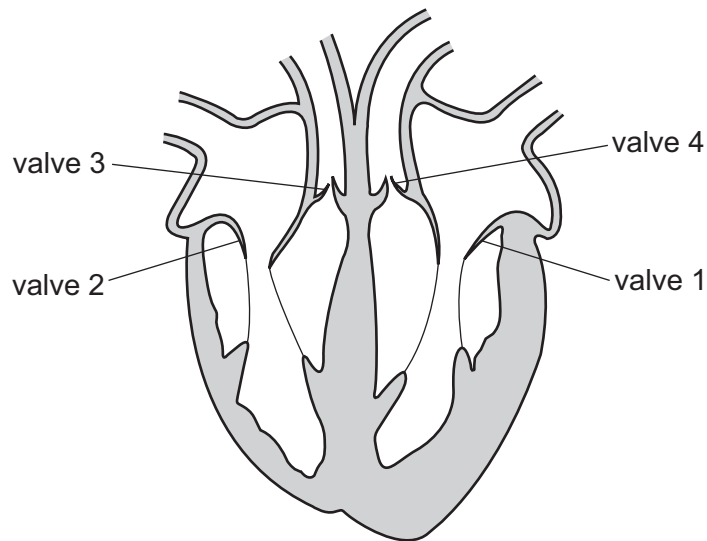
The list gives three ways in which the environment can be altered.

- 1 humidity increased
- 2 light intensity increased
- 3 temperature increased

Which changes will cause an increase in the rate of transpiration of the plant?

	1	2	3
<b>A</b>	✓	✓	x
<b>B</b>	✓	x	x
<b>C</b>	x	x	✓
<b>D</b>	x	✓	✓

- 6 The diagram shows a section through the human heart.

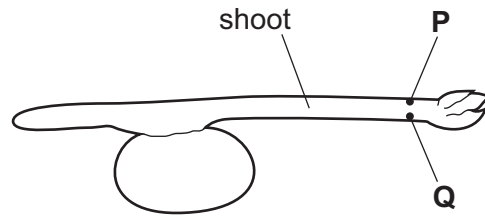


What happens to the valves as blood is being pumped to the lungs?

	valve 1	valve 2	valve 3	valve 4
<b>A</b>	closed	closed	open	closed
<b>B</b>	closed	closed	open	open
<b>C</b>	open	open	closed	closed
<b>D</b>	open	open	closed	open

- 7 What is the maximum number of carbon dioxide molecules produced when four glucose molecules are used in aerobic respiration?
- A** 6                      **B** 12                      **C** 24                      **D** 48
- 8 Why is tar in cigarette smoke a harmful chemical?
- A** It causes addiction.
- B** It causes cancer.
- C** It makes platelets stick together.
- D** It sticks to blood vessel walls.

9 The diagram shows a seedling with its shoot horizontal.



Gravity is the stimulus acting on the seedling.

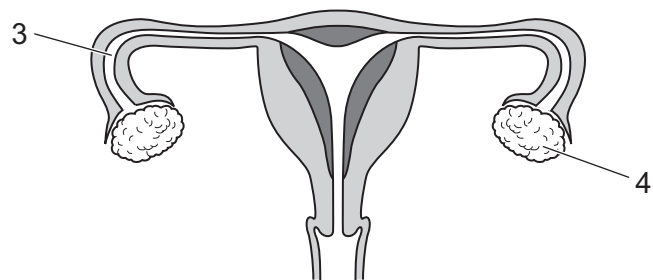
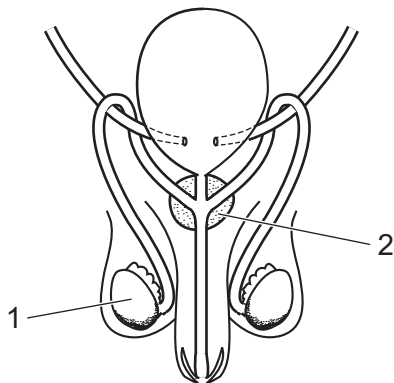
Where will the greatest concentrations of auxin be found in the shoot and what effect will this have on the rate of cell elongation?

	greatest concentration of auxin	effect of auxin on rate of cell elongation
<b>A</b>	<b>P</b>	increases
<b>B</b>	<b>P</b>	decreases
<b>C</b>	<b>Q</b>	increases
<b>D</b>	<b>Q</b>	decreases

10 Why are many flowers brightly coloured?

- A** to attract insects to pollinate the flower
- B** to encourage birds to eat insects on the flower
- C** to frighten animals away from the flower
- D** to help with wind-pollination of the flower

11 The diagrams show the human male and female reproductive systems.



Which numbered parts produce gametes?

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

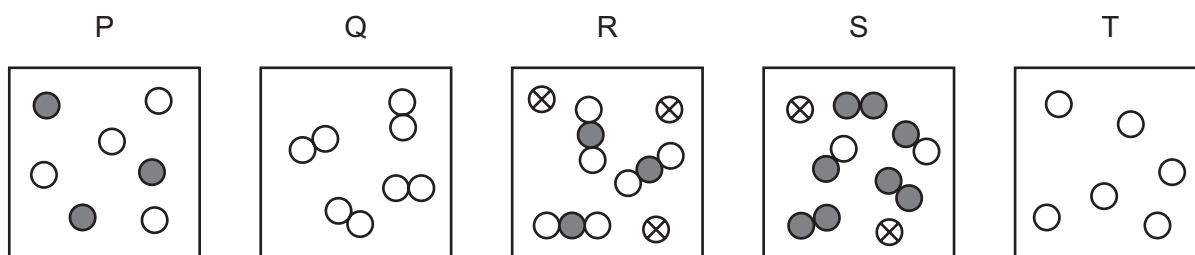
12 At which trophic level in a food chain does transpiration occur?

- A trophic level 1
- B trophic level 2
- C trophic level 3
- D trophic level 4

13 Which statement about greenhouse gases is correct?

- A They are caused by acid rain.
- B They are produced by photosynthesis.
- C They generate heat when they react with sunlight.
- D They reduce the loss of heat from the Earth.

14 The diagrams represent different substances.



Which row describes the substances?

	only separate atoms	only molecules	mixture of atoms and molecules
<b>A</b>	P	Q	S
<b>B</b>	Q	T	R
<b>C</b>	T	P	R
<b>D</b>	T	Q	P

15 Which row describes the method used to obtain salt from salt water and petrol from petroleum?

	salt from salt water	petrol from petroleum
<b>A</b>	crystallisation	distillation
<b>B</b>	crystallisation	fractional distillation
<b>C</b>	filtration	distillation
<b>D</b>	filtration	fractional distillation

16 Some changes are listed.

- 1 boiling
- 2 decomposing
- 3 evaporating
- 4 oxidising

Which changes are physical changes?

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

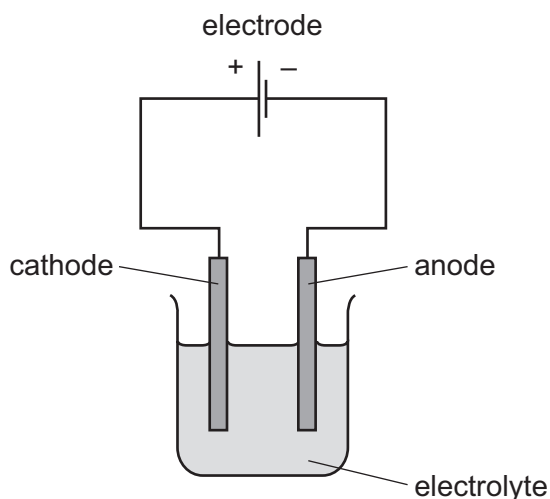
17 The formula of a sodium ion is  $\text{Na}^+$ . The formula of an oxide ion is  $\text{O}^{2-}$ .

What is the formula of sodium oxide?

- A**  $\text{NaO}$       **B**  $\text{NaO}_2$       **C**  $\text{Na}_2\text{O}$       **D**  $\text{Na}_2\text{O}_3$

18 The diagram shows apparatus for electrolysis.

Only one label is correct.



Which label on the diagram is correct?

- A** anode  
**B** cathode  
**C** electrode  
**D** electrolyte



19 Molten sodium chloride is electrolysed.

Which row shows the product and the equation for the reaction at the stated electrode?

	electrode	product	equation for reaction at the electrode
<b>A</b>	negative	chlorine	$2Cl^- \rightarrow Cl_2 + 2e^-$
<b>B</b>	negative	sodium	$Na^+ + e^- \rightarrow Na$
<b>C</b>	positive	chlorine	$2Cl^{2-} \rightarrow Cl_2 + 4e^-$
<b>D</b>	positive	sodium	$Na^+ + 2e^- \rightarrow Na$

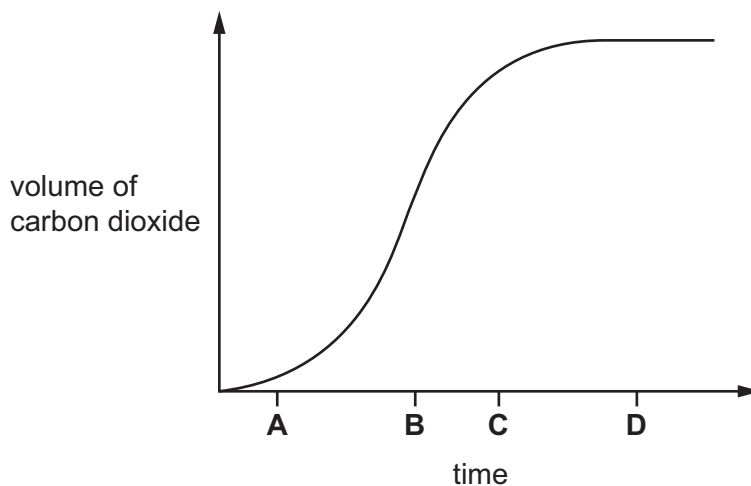
20 Which change **must** take place in an endothermic reaction?

- A** Bubbles of gas are released.
- B** The mass decreases.
- C** The temperature decreases.
- D** The temperature increases.

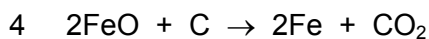
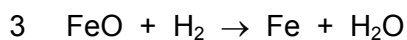
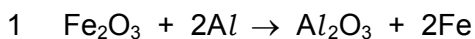
21 The volume of carbon dioxide produced in a reaction is measured.

The results are plotted on a graph.

At which time is the rate of reaction greatest?



22 Four reaction equations involving oxides of iron are listed.



Which statement is correct?

- A In reaction 1, Al is being oxidised by Fe<sub>2</sub>O<sub>3</sub>.
- B In reaction 2, FeO is being reduced by O<sub>2</sub>.
- C In reaction 3, H<sub>2</sub> is being reduced by FeO.
- D In reaction 4, FeO is being oxidised by carbon.

23 Excess solid copper oxide is added to warm dilute sulfuric acid and stirred.

How are pure copper sulfate crystals obtained from the mixture?

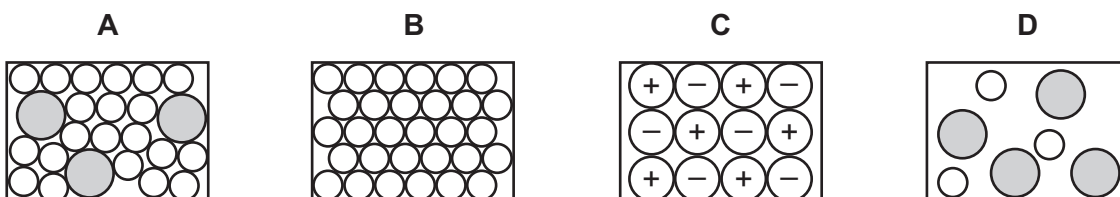
- A distil the mixture → wash the solid → dry the solid
- B filter the mixture → distil the filtrate
- C filter the mixture → heat the filtrate to saturation → cool and filter → dry the solid
- D heat the mixture to saturation → cool and filter → dry the solid

24 Which statement describes the metallic character of elements in Period 2 of the Periodic Table?

- A The first and last elements in this period are metals.
- B The metallic elements are in the centre of this period.
- C The metallic elements are on the left of this period.
- D The metallic elements are on the right of this period.

25 The arrangement of particles in four substances is shown.

Which diagram represents an alloy?



26 Which process produces a gas that contributes to climate change?

- A the electrolysis of molten lead(II) bromide
- B the reaction of calcium with water
- C the reaction of copper oxide with dilute sulfuric acid
- D the thermal decomposition of calcium carbonate

27 Butane,  $C_4H_{10}$ , and decane,  $C_{10}H_{22}$ , are alkanes.

Molecules of decane are larger than molecules of butane.

Which row describes the properties of decane compared to those of butane?

	boiling point	intermolecular attractive forces
<b>A</b>	higher	stronger
<b>B</b>	higher	weaker
<b>C</b>	lower	stronger
<b>D</b>	lower	weaker

28 Diagrams 1, 2 and 3 show two distance-time graphs and one speed-time graph.

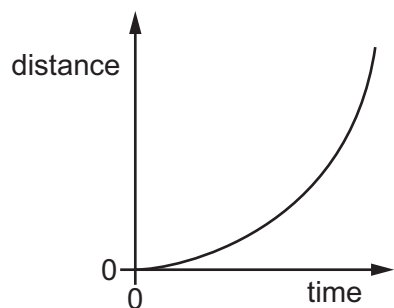


diagram 1

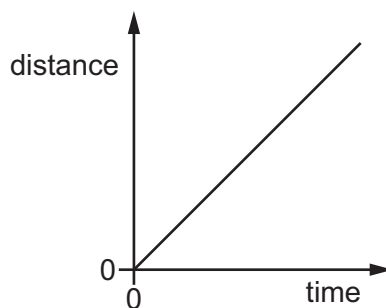


diagram 2

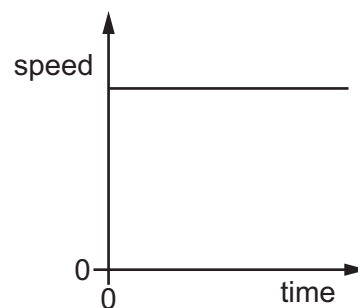


diagram 3

Which of the diagrams represent the motion of an object that is accelerating?

- A 1 and 2
- B 1 only
- C 2 only
- D 3 only

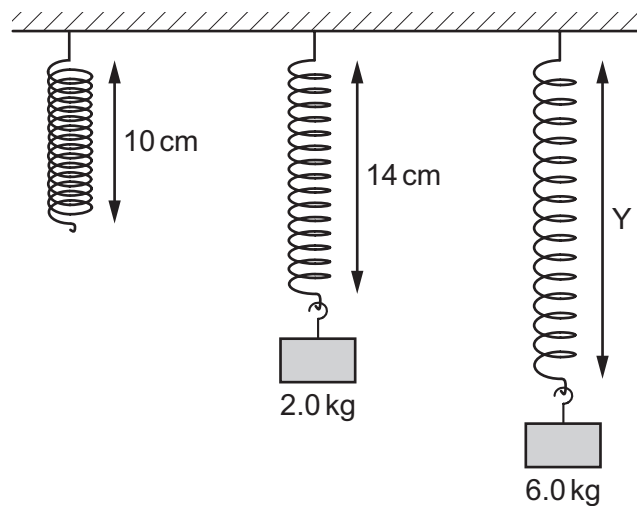
- 29 A student takes an object from one place on Earth to another place where the gravitational field is weaker.

Which property of the object has a smaller value at the second location?

- A density
- B mass
- C volume
- D weight

- 30 An unstretched spring obeys Hooke's law and has a length of 10 cm. A load with a mass of 2.0 kg is hung from it, and its length becomes 14 cm.

The load is now increased to 6.0 kg, and the new length of the spring is Y. The limit of proportionality is not reached.



What is Y?

- A 22 cm
  - B 26 cm
  - C 30 cm
  - D 42 cm
- 31 Electricity can be obtained from the energy in water behind a hydroelectric dam.

Is this energy resource renewable, and in which form is its energy stored?

	renewable	form of energy
A	no	chemical
B	no	gravitational potential
C	yes	chemical
D	yes	gravitational potential

32 A machine does 6.0 kJ of useful work in 20 minutes.

How much useful power does it produce?

- A 0.30 W      B 5.0 W      C 120 W      D 300 W

33 On a summer's day, hot air rises above hot roofs.

What is the name of this process?

- A concentration  
B condensation  
C conduction  
D convection

34 A radio station transmits signals at a frequency of  $9.1 \times 10^7$  Hz.

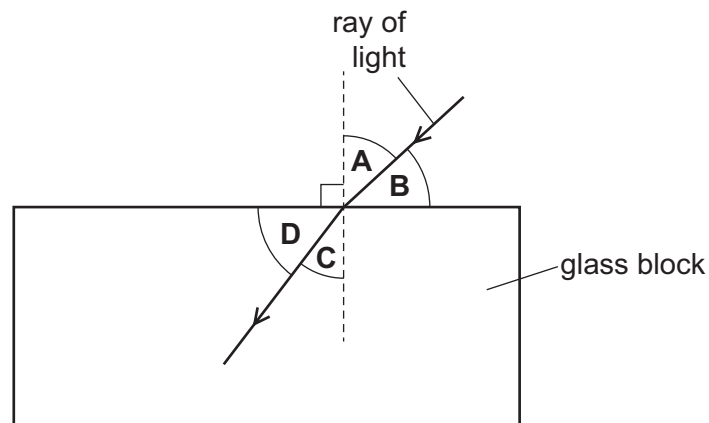
What is the wavelength of the radio waves?

Light travels at a speed of  $3.0 \times 10^8$  m/s.

- A 0.30 m      B 0.33 m      C 3.0 m      D 3.3 m

35 The diagram shows a ray of light as it enters a glass block.

Which labelled angle is the angle of refraction?



- 36 Optical fibres are used to transmit telephone conversations.

What is transmitted by the optical fibres?

- A electromagnetic waves with constant amplitude
- B pulses of electromagnetic waves
- C pulses of sound waves
- D sound waves with constant amplitude

- 37 A student writes two sentences about sound waves.

'A sound wave travels through the air as compressions and .....X......'

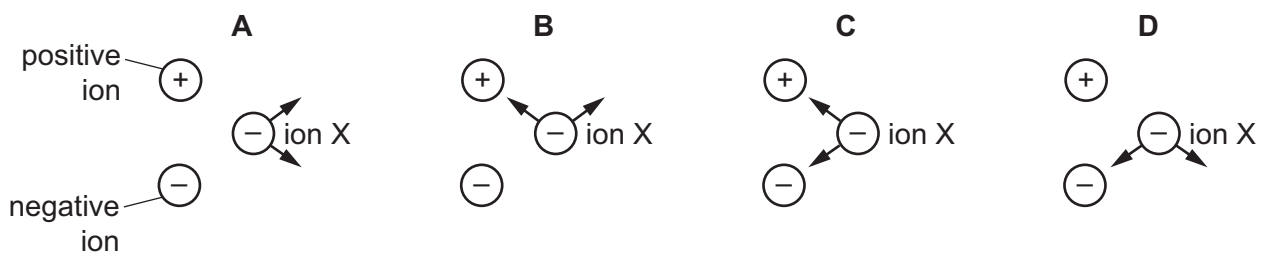
'The air at the compressions has a different .....Y..... from the air at .....X......'

What are the missing words, X and Y?

	X	Y
<b>A</b>	rarefactions	density
<b>B</b>	rarefactions	state
<b>C</b>	refractions	density
<b>D</b>	refractions	state

- 38 A negative ion X is close to a positive ion and another negative ion. Electrical forces act on ion X because of the charges in the other two ions.

Which diagram shows the directions of the two forces acting on ion X?



- 39 A 240 V mains supply causes a current of 4.00 A in a heater.

How much energy is transferred in the heater in 5.00 minutes?

- A 192 J
- B 4800 J
- C 18 000 J
- D 288 000 J

40 An electric kettle has the following label attached to its base.

current:	7.5 A
frequency:	50 Hz
power:	1800 W
voltage:	240 V

How is an appropriate fuse for the kettle labelled?

- A** 10 A                      **B** 60 Hz                      **C** 2000 W                      **D** 300 V

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The Periodic Table of Elements

		Group																																																																																											
I	II							III	IV	V	VI	VII	VIII																																																																																
3 <b>Li</b> lithium 7	4 <b>Be</b> beryllium 9	<div style="border: 1px solid black; padding: 5px; display: inline-block;"> <b>Key</b>                      atomic number                      atomic symbol                      name                      relative atomic mass                 </div>										2 <b>He</b> helium 4																																																																																	
11 <b>Na</b> sodium 23	12 <b>Mg</b> magnesium 24	1 <b>H</b> hydrogen 1	5 <b>B</b> boron 11	6 <b>C</b> carbon 12	7 <b>N</b> nitrogen 14	8 <b>O</b> oxygen 16	9 <b>F</b> fluorine 19	10 <b>Ne</b> neon 20	13 <b>Al</b> aluminium 27	14 <b>Si</b> silicon 28	15 <b>P</b> phosphorus 31	16 <b>S</b> sulfur 32	17 <b>Cl</b> chlorine 35.5	18 <b>Ar</b> argon 40																																																																															
19 <b>K</b> potassium 39	20 <b>Ca</b> calcium 40	25 <b>Mn</b> manganese 55	26 <b>Fe</b> iron 56	27 <b>Co</b> cobalt 59	28 <b>Ni</b> nickel 59	29 <b>Cu</b> copper 64	30 <b>Zn</b> zinc 65	31 <b>Ga</b> gallium 70	32 <b>Ge</b> germanium 73	33 <b>As</b> arsenic 75	34 <b>Se</b> selenium 79	35 <b>Br</b> bromine 80	36 <b>Kr</b> krypton 84	37 <b>Rb</b> rubidium 85	38 <b>Sr</b> strontium 88	41 <b>Sc</b> scandium 45	42 <b>Ti</b> titanium 48	43 <b>V</b> vanadium 51	44 <b>Cr</b> chromium 52	45 <b>Mn</b> manganese 55	46 <b>Fe</b> iron 56	47 <b>Co</b> cobalt 59	48 <b>Ni</b> nickel 59	49 <b>Cu</b> copper 64	50 <b>Zn</b> zinc 65	51 <b>Ga</b> gallium 70	52 <b>Ge</b> germanium 73	53 <b>As</b> arsenic 75	54 <b>Se</b> selenium 79	55 <b>Br</b> bromine 80	56 <b>Kr</b> krypton 84	57 <b>Rb</b> rubidium 85	58 <b>Sr</b> strontium 88	59 <b>Y</b> yttrium 89	60 <b>Zr</b> zirconium 91	61 <b>Nb</b> niobium 93	62 <b>Mo</b> molybdenum 96	63 <b>Tc</b> technetium —	64 <b>Ru</b> ruthenium 101	65 <b>Rh</b> rhodium 103	66 <b>Pd</b> palladium 106	67 <b>Ag</b> silver 108	68 <b>Cd</b> cadmium 112	69 <b>In</b> indium 115	70 <b>Sn</b> tin 119	71 <b>Sb</b> antimony 122	72 <b>Te</b> tellurium 128	73 <b>I</b> iodine 127	74 <b>Xe</b> xenon 131	75 <b>Cs</b> caesium 133	76 <b>Ba</b> barium 137	77 <b>La</b> lanthanoids —	78 <b>Hf</b> hafnium 178	79 <b>Ta</b> tantalum 181	80 <b>W</b> tungsten 184	81 <b>Re</b> rhenium 186	82 <b>Os</b> osmium 190	83 <b>Ir</b> iridium 192	84 <b>Pt</b> platinum 195	85 <b>Au</b> gold 197	86 <b>Hg</b> mercury 201	87 <b>Tl</b> thallium 204	88 <b>Pb</b> lead 207	89 <b>Bi</b> bismuth 209	90 <b>Po</b> polonium —	91 <b>At</b> astatine —	92 <b>Rn</b> radon —	93 <b>Fr</b> francium —	94 <b>Ra</b> radium —	95 <b>Ac</b> actinoids —	96 <b>Rf</b> rutherfordium —	97 <b>Db</b> dubnium —	98 <b>Sg</b> seaborgium —	99 <b>Bh</b> bohrium —	100 <b>Hs</b> hassium —	101 <b>Mt</b> meitnerium —	102 <b>Ds</b> darmstadtium —	103 <b>Rg</b> roentgenium —	104 <b>Cn</b> copernicium —	105 <b>Fl</b> flerovium —	106 <b>Lv</b> livermorium —	107 <b>Uu</b> ununseptium —	108 <b>Uub</b> ununbium —	109 <b>Uut</b> ununtrium —	110 <b>Uuq</b> ununquadium —	111 <b>Uup</b> ununpentium —	112 <b>Uuq</b> ununquadium —	113 <b>Uup</b> ununpentium —	114 <b>Fl</b> flerovium —	115 <b>Mc</b> moscovium —	116 <b>Lv</b> livermorium —	117 <b>Ts</b> tennessine —	118 <b>Og</b> oganeson —

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

The volume of one mole of any gas is 24 dm<sup>3</sup> at room temperature and pressure (r.t.p.).