



Cambridge International Examinations
Cambridge International General Certificate of Secondary Education

COMBINED SCIENCE

Paper 2 Multiple Choice (Extended)

0653/22

February/March 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 16.

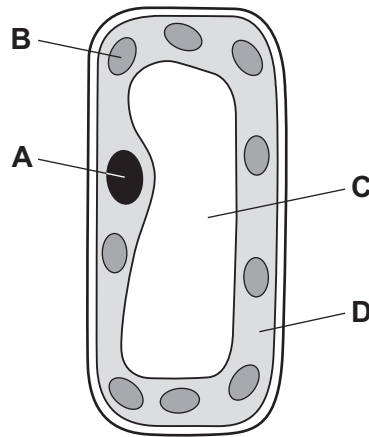
Electronic calculators may be used.

This document consists of **15** printed pages and **1** blank page.



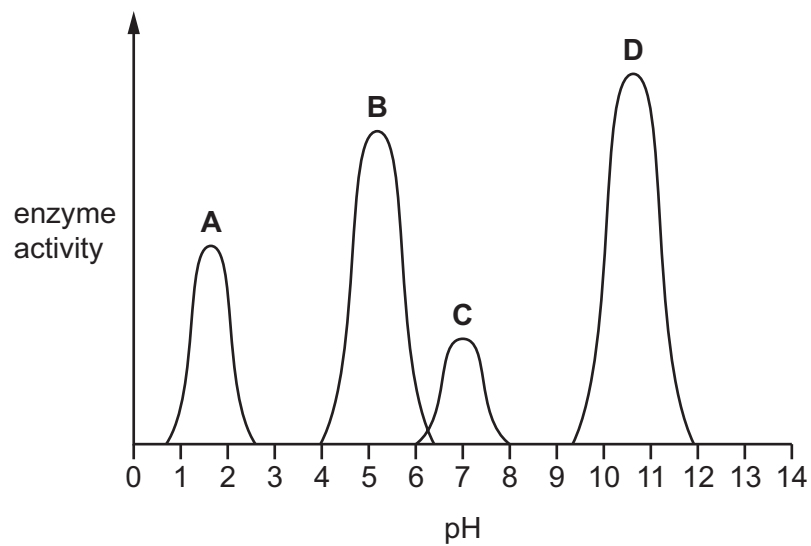
- 1 The diagram shows a palisade cell as seen under a light microscope.

Which structure converts light energy to chemical energy?



- 2 The graph shows the effect of pH on the activity of four different enzymes.

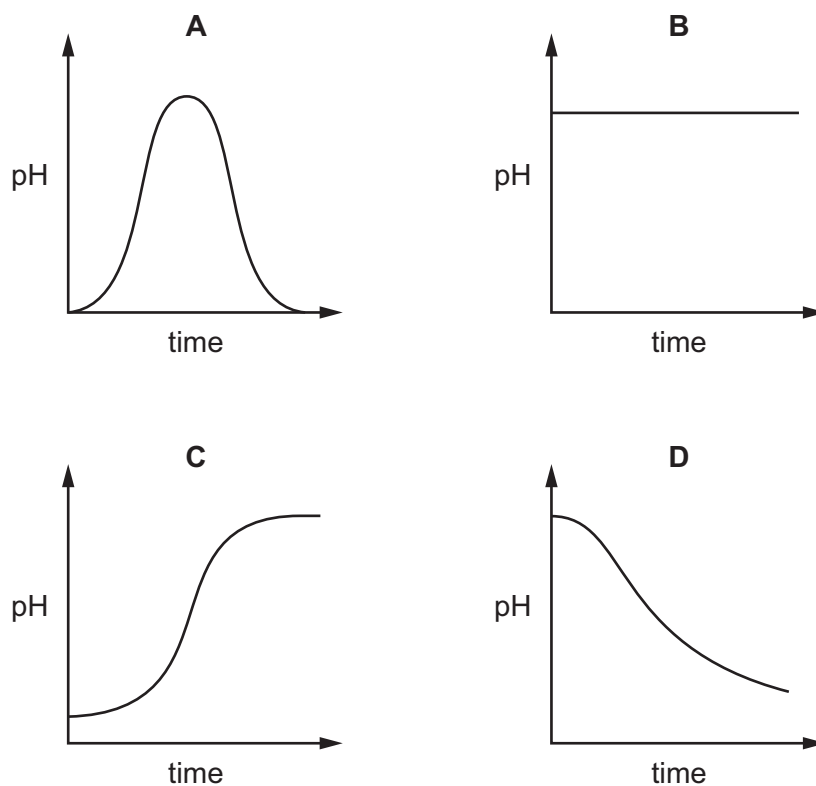
Which enzyme is most active in the stomach?



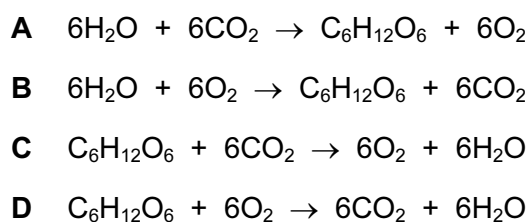
- 3 Microorganisms are used to convert milk into yoghurt.

The pH of the milk is regularly recorded as it turns into yoghurt.

Which graph shows the change in pH as the yoghurt is made?



- 4 What is the equation for photosynthesis?



- 5 Which statement describes transpiration?

- A** evaporation of water from leaf mesophyll cells
- B** intake of water from the atmosphere through the stomata
- C** transport of water through xylem tissue to the leaves
- D** uptake of water by root hairs in the soil

- 6 Oxygenated blood returns to the heart from the lungs in vessel X and leaves the heart to circulate around the body in vessel Y.

What are X and Y?

	X	Y
A	aorta	pulmonary vein
B	pulmonary artery	vena cava
C	pulmonary vein	aorta
D	vena cava	pulmonary artery

- 7 Which row is correct for aerobic respiration?

	relative amount of energy released	gas used
A	large	carbon dioxide
B	large	oxygen
C	small	carbon dioxide
D	small	oxygen

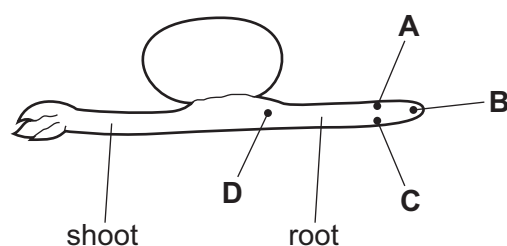
- 8 Which component of cigarette smoke reduces the oxygen-carrying capacity of the blood?

- A** carbon monoxide
- B** nicotine
- C** smoke particles
- D** tar

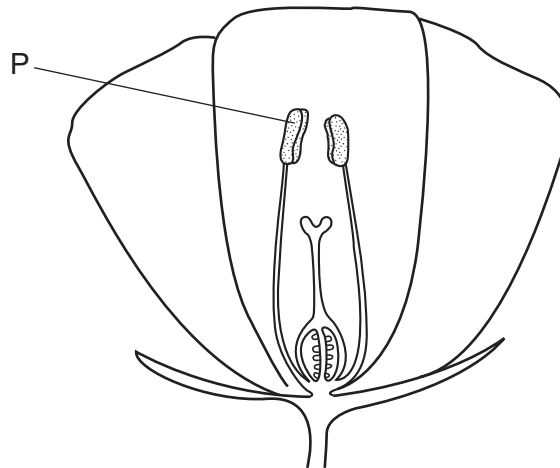
- 9 The diagram shows a seedling with its root and shoot horizontal.

The seedling is kept moist for three days.

Where will the greatest concentration of auxin be found?



10 The diagram shows a section through a flower.



Which row correctly identifies structure P and the method of pollination in the flower?

	structure P	method of pollination
A	anther	insect
B	anther	wind
C	stigma	insect
D	stigma	wind

11 How does HIV affect the immune system?

- A** It decreases the number of platelets.
- B** It destroys red blood cells.
- C** It increases the number of white blood cells.
- D** It reduces antibody formation.

12 Energy flows along a food chain.

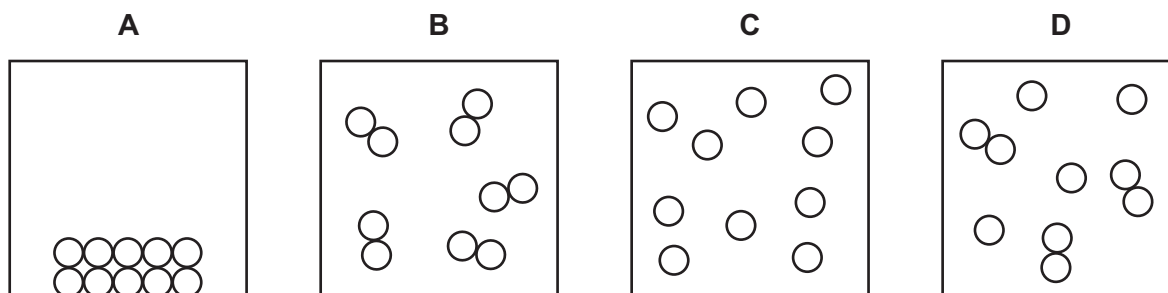
What does every food chain start with?

- A** carnivore
- B** consumer
- C** herbivore
- D** producer

13 Which two gases contribute most to global warming?

- A carbon dioxide and methane
- B carbon monoxide and carbon dioxide
- C methane and oxygen
- D oxygen and carbon monoxide

14 Which diagram represents molecules of hydrogen gas?



15 Magnesium reacts with sulfur, to form magnesium sulfide.

Magnesium sulfide is an ionic compound.

Which statement is **not** correct?

- A Electrons are shared between sulfur and magnesium.
- B Electrons are transferred from magnesium to sulfur.
- C The magnesium ions are positively charged.
- D The sulfur atoms gain electrons.

16 Which row shows the formulae of sodium hydroxide and of potassium hydroxide?

	sodium hydroxide	potassium hydroxide
A	NaOH	KOH
B	NaOH	POH
C	SOH	KOH
D	SOH	POH

17 Molten sodium chloride can be electrolysed.

Which row describes what happens at each electrode?

	anode	cathode
A	chloride ions gain electrons	sodium ions lose electrons
B	chloride ions lose electrons	sodium ions gain electrons
C	sodium ions gain electrons	chloride ions lose electrons
D	sodium ions lose electrons	chloride ions gain electrons

18 In which change is chemical energy transformed into heat (thermal energy)?

- A** combustion of refinery gas
- B** cracking of alkanes into alkenes
- C** distillation of seawater
- D** electrolysis of molten lead(II) bromide

19 The rate of reaction between magnesium and dilute hydrochloric acid is measured. The reaction is repeated at a different temperature and the rate of reaction increases.

Which statement describes the second reaction?

- A** A higher temperature is used and the particles collide less often.
- B** A higher temperature is used and the particles collide more often.
- C** A lower temperature is used and the particles collide less often.
- D** A lower temperature is used and the particles collide more often.

20 Copper oxide is 1..... in water. Excess copper oxide reacts with warm dilute sulfuric acid. When the reaction is complete, the mixture is 2..... to obtain copper sulfate solution.

Which words correctly complete gaps 1 and 2?

	1	2
A	insoluble	distilled
B	insoluble	filtered
C	soluble	distilled
D	soluble	filtered

21 Which aqueous reagents give a white precipitate when added to aqueous zinc chloride?

	sodium hydroxide	barium nitrate	silver nitrate
A	✓	✓	✓
B	✓	✓	x
C	✓	x	✓
D	x	✓	✓

22 Which statements about elements in the Periodic Table are correct?

- 1 The higher the group number, the more metallic an element is.
- 2 The group number is equal to the number of electrons in the outer shell.
- 3 Elements on the left of the Periodic Table form ions by losing electrons.

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

23 Element X is a very soft solid.

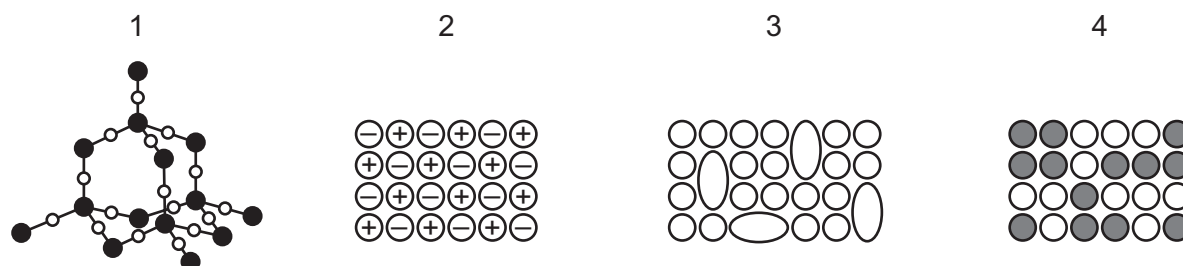
It reacts violently with water.

A purple flame is seen as it reacts with water.

What is X?

- A** iodine
B potassium
C sodium
D zinc

24 Which diagrams represent alloys?



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

25 Iron occurs in the ground as iron oxide.

Gold occurs in the ground as the element.

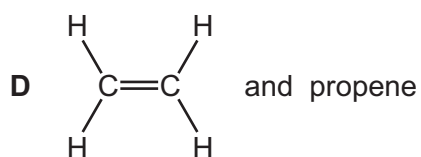
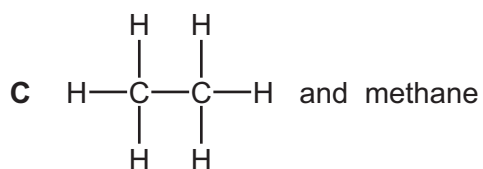
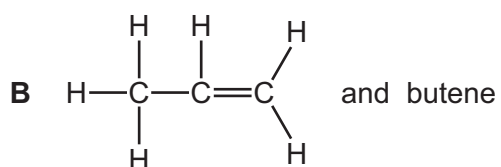
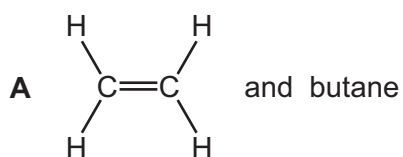
Which statement explains this observation?

- A** Gold is more reactive than iron.
- B** Gold oxide is more reactive than iron oxide.
- C** Iron is more reactive than gold.
- D** Iron oxide is more reactive than gold oxide.

26 Which chemical test shows the presence of water?

- A** Water has a boiling point of 100 °C.
- B** Water has a freezing point of 0 °C.
- C** Water turns anhydrous cobalt chloride from blue to pink.
- D** Water turns anhydrous copper sulfate from blue to white.

27 Which pair of hydrocarbons can be distinguished from each other by the addition of bromine water?



28 Diagrams 1 and 2 show a distance-time graph and a speed-time graph.

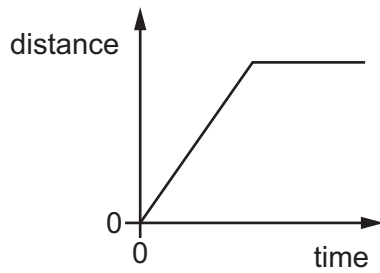


diagram 1

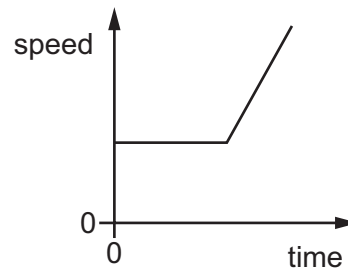
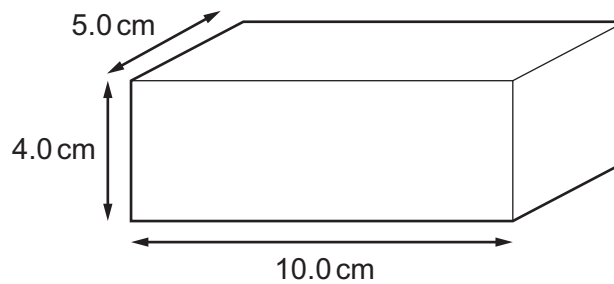


diagram 2

Which of the diagrams represents the motion of an object that is moving with constant acceleration and then with constant speed?

- A diagram 1 and diagram 2
- B diagram 1 only
- C diagram 2 only
- D neither of the diagrams

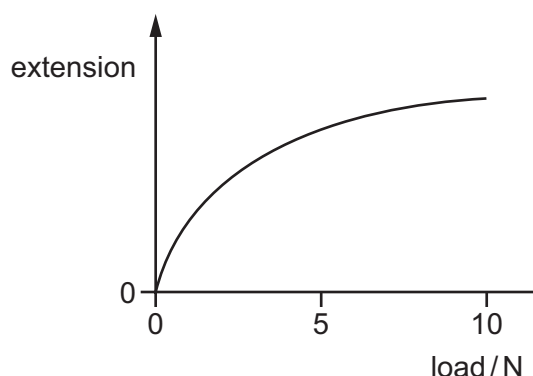
29 A solid rectangular metal block has the dimensions shown. The density of the metal is 8.0 g/cm^3 .



What is the mass of the metal block?

- A 160g
- B 320g
- C 400g
- D 1600g

- 30 The extension-load graph for a rubber band is shown.



Which statement about the rubber band is correct?

- A** An increase in the load from 1.0 N to 2.0 N has a smaller effect on the extension than an increase from 5.0 N to 6.0 N.
- B** The extension is directly proportional to the load for loads greater than 5.0 N.
- C** The rubber band could be used as a spring balance with a linear (evenly spaced) scale.
- D** The rubber band is more difficult to stretch as the load becomes greater.
- 31 A lifting system contains an electric motor with an input power of 500 W. The system has an efficiency of 60%.

How much power is wasted by the lifting system?

- A** 200 W **B** 300 W **C** 20 000 W **D** 30 000 W
- 32 A container with fixed volume is filled with a substance. The atoms in the substance are far apart and move in straight lines until they strike something.

The substance is now heated without changing state.

Which row gives the state of the substance and the effect of heating on its atoms?

	state of substance	effect on atoms when heated
A	gas	expand
B	gas	move more quickly
C	liquid	expand
D	liquid	move more quickly

33 Diagram 1 shows a force F lifting a weight through a height h .

Diagram 2 shows the same force F lifting the same weight through a height $2h$.

In both cases, air resistance and friction are negligible.

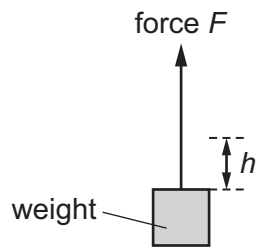


diagram 1

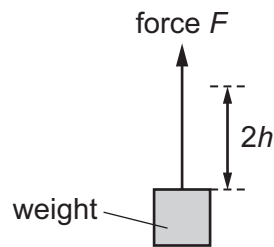


diagram 2

Each lift can take either 1 s or 10 s.

Which row shows the greatest power being developed when the weight is lifted?

	height lifted	time taken for the lift / s
A	h	1
B	h	10
C	$2h$	1
D	$2h$	10

34 In which states of matter is convection the main heat transfer process?

- A** gases and solids only
- B** liquids and gases only
- C** solids and liquids only
- D** solids, liquids and gases

35 A vibrating object hits the surface of a liquid every 0.050 s. This causes a wave to spread out over the surface at a speed of 30 cm/s.

What is the wavelength of the wave?

- A** 0.0017 cm **B** 0.67 cm **C** 1.5 cm **D** 600 cm

- 36 A man walks towards a large plane mirror at a constant speed of 2.0 m/s. An image of the man is produced by reflection.

Which statement about the man and his image is correct?

- A The distance between them decreases at 2.0 m/s.
- B The distance between them decreases at 4.0 m/s.
- C The distance between them remains constant.
- D They approach each other at an increasing speed.

- 37 A distant star emits a short pulse containing light waves, microwaves and radio waves. The waves travel to Earth *in vacuo* (in a vacuum).

Which waves reach the Earth first?

- A the light waves
- B the microwaves
- C the radio waves
- D they all arrive at the same time

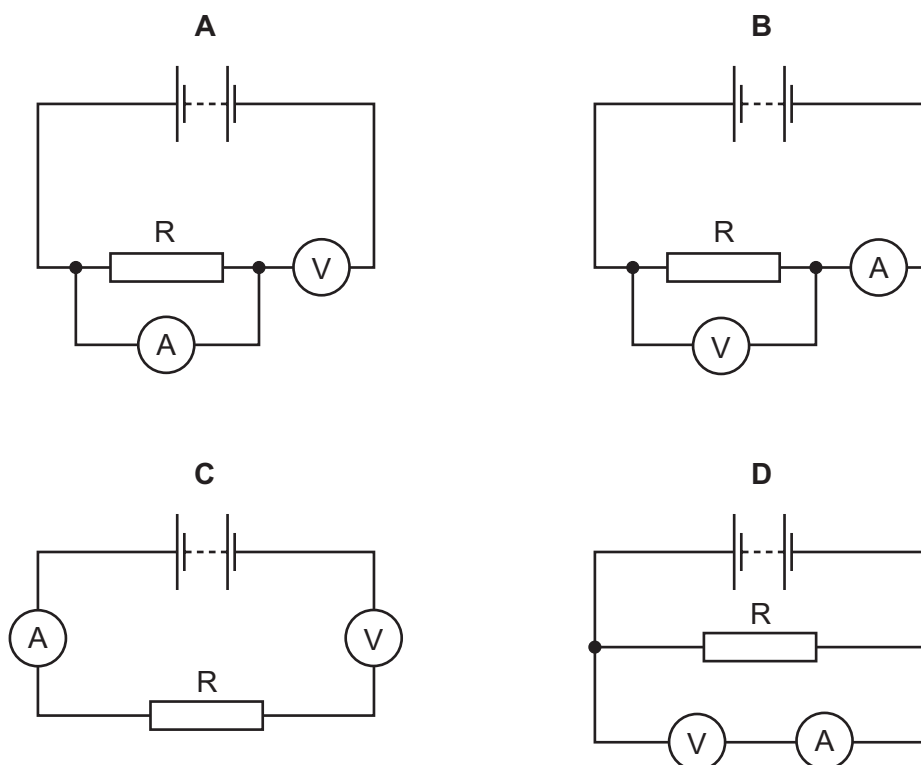
- 38 Four loudspeakers each vibrate at the frequencies shown.

Which loudspeaker produces the lowest-pitched sound that can be heard by a human?

- A 5.0 Hz B 10 Hz C 5.0×10^3 Hz D 10×10^3 Hz

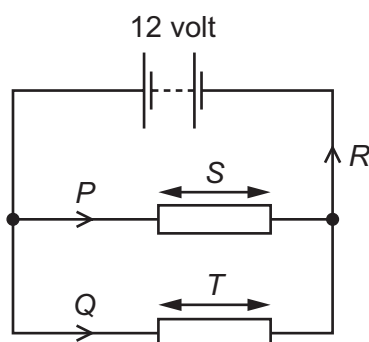
39 The diagrams show four circuits.

Which circuit can be used to find the resistance of resistor R ?



40 A 12 volt battery is connected to two resistors.

Currents P , Q and R , and potential differences S and T across the two resistors are labelled.



Which row gives the relationship between the three currents, and gives the values of S and T ?

	currents	S/volt	T/volt
A	$P = Q = R$	6.0	6.0
B	$P = Q = R$	12	12
C	$P + Q = R$	6.0	6.0
D	$P + Q = R$	12	12

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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	Key atomic number atomic symbol name relative atomic mass										1 H hydrogen 1											2 He helium 4
												5 B boron 11	6 C carbon 12	7 N nitrogen 14	8 O oxygen 16	9 F fluorine 19	10 Ne neon 20						
												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 —	—	—	—	—						

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
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 —

actinoids

The volume of one mole of any gas is 24 dm³ at room temperature and pressure (r.t.p.).