



Cambridge IGCSE™

COMBINED SCIENCE

Paper 2 Multiple Choice (Extended)

0653/22

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.

This document has **16** pages. Any blank pages are indicated.



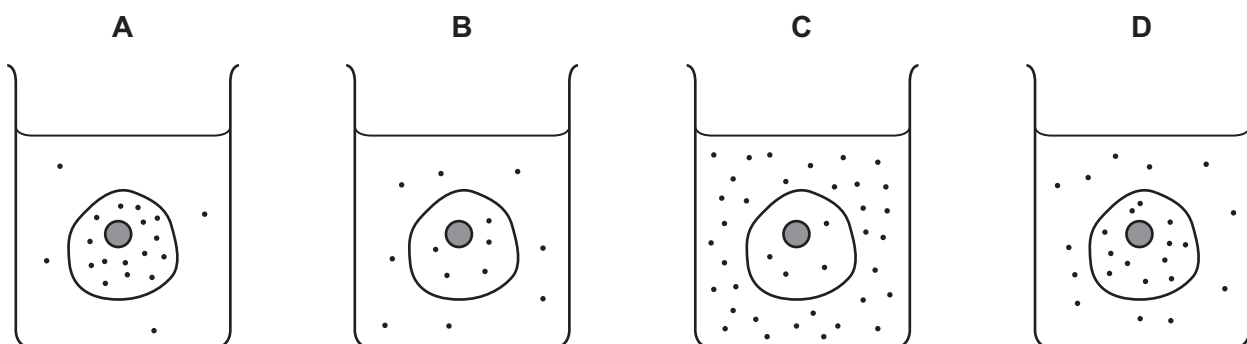
- 1 Which row correctly identifies the function of a ciliated cell in the bronchus of a healthy human?

	substance being moved	direction of movement
A	air	towards bronchioles
B	air	towards trachea
C	mucus	towards bronchioles
D	mucus	towards trachea

- 2 The diagrams represent four similar animal cells immersed in blood plasma.

The black dots represent molecules of dissolved oxygen.

Which cell will have oxygen molecules diffusing into it most rapidly?



- 3 Which name is given to biological catalysts?

- A** antibodies
- B** enzymes
- C** hormones
- D** platelets

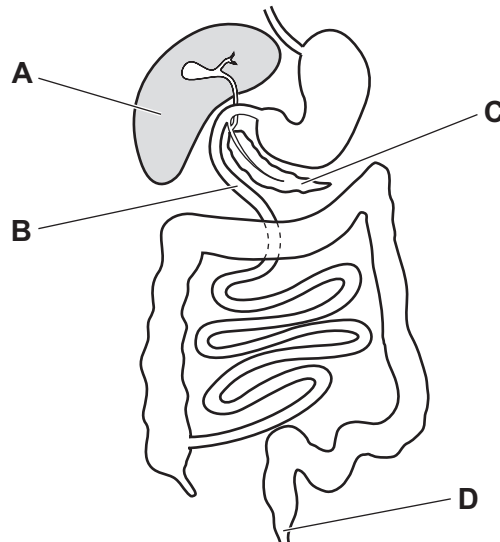
- 4 Which row is correct for photosynthesis?

	substrates	products	cells where photosynthesis occurs
A	$C_6H_{12}O_6 + 6O_2$	$6H_2O + 6CO_2$	palisade mesophyll
B	$C_6H_{12}O_6 + 6O_2$	$6H_2O + 6CO_2$	upper epidermis
C	$6H_2O + 6CO_2$	$C_6H_{12}O_6 + 6O_2$	palisade mesophyll
D	$6H_2O + 6CO_2$	$C_6H_{12}O_6 + 6O_2$	upper epidermis

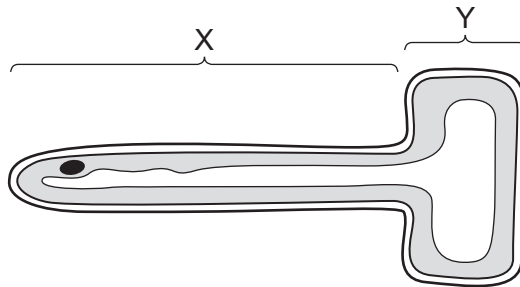
5 Which disease is associated with malnutrition?

- A AIDS
- B COPD
- C lung cancer
- D scurvy

6 Which part of the alimentary canal carries out digestion **and** absorption?



7 The diagram shows a cross-section of a root hair cell.



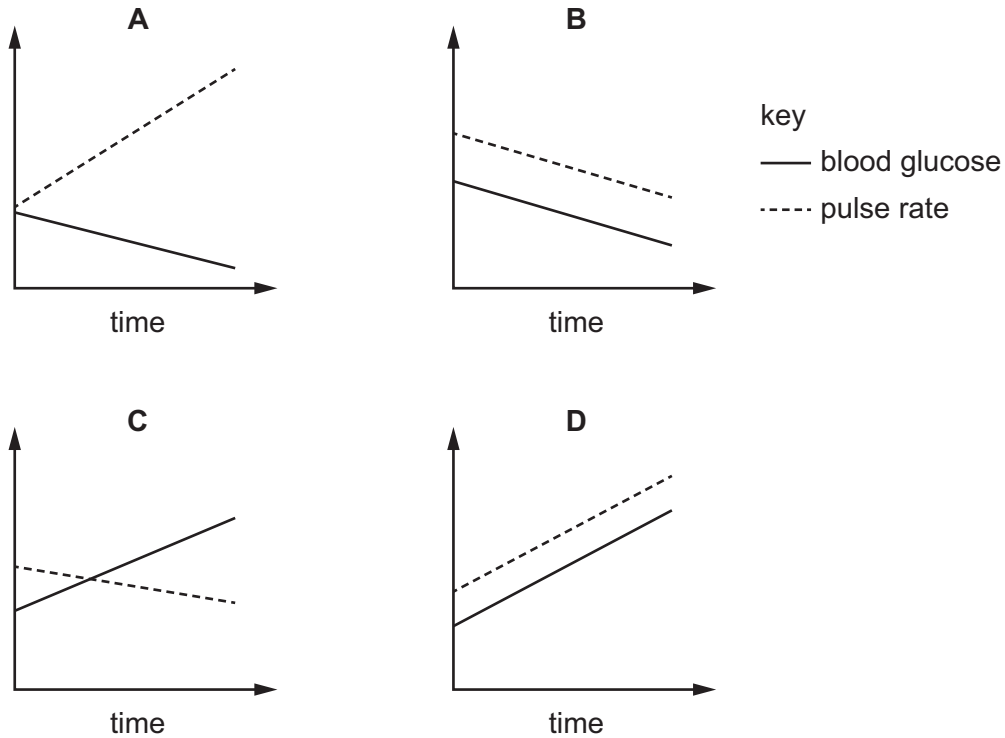
Which row identifies the part of the cell with the larger surface area and the correct function?

	part of cell	function
A	X	water and glucose uptake
B	X	water and ion uptake
C	Y	water and glucose uptake
D	Y	water and ion uptake

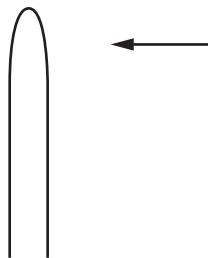
- 8 What is the maximum number of carbon dioxide molecules produced when four glucose molecules are used in aerobic respiration?

A 6 B 12 C 24 D 48

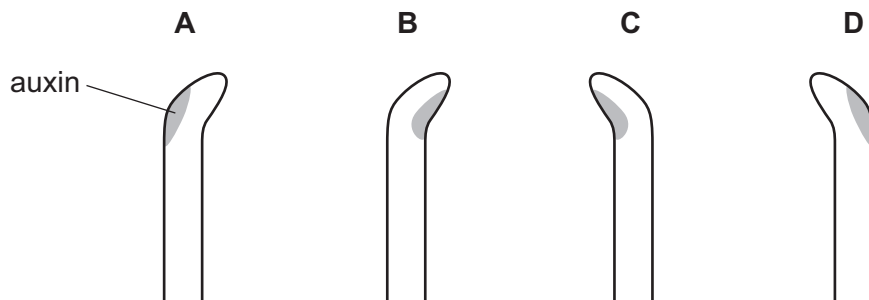
- 9 Which graph shows the correct changes in blood glucose concentration and pulse rate shortly after adrenaline is released into the blood stream?



- 10 A shoot tip receives light from one direction only, as shown.

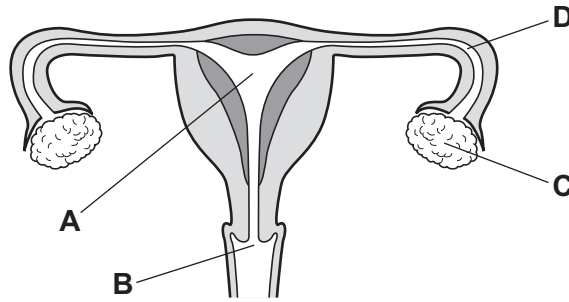


Which diagram shows how auxin will distribute and how the shoot will respond?

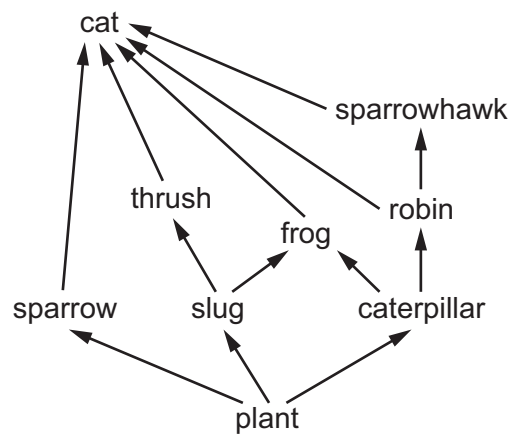


11 The diagram shows the human female reproductive system.

Where does fertilisation usually take place?



12 The diagram shows a food web.



Which row shows the correct organism for each trophic level?

	trophic level 1	trophic level 2	trophic level 3
A	cat	sparrow	plant
B	caterpillar	robin	sparrowhawk
C	plant	sparrow	cat
D	sparrowhawk	robin	caterpillar

13 Which process takes carbon dioxide out of the air?

- A** combustion
- B** decomposition
- C** photosynthesis
- D** plant respiration

14 Which statement about the particles is correct?

- A ${}^1_1\text{H}$ has the same number of protons as neutrons.
- B ${}^2_1\text{H}^+$ has the same number of electrons as neutrons.
- C OH^- contains more protons than electrons.
- D NH_3 has the same number of protons as electrons.

15 What is an example of a physical change?

- A carbon dioxide turning limewater milky
- B the crystallisation of copper(II) sulfate from solution
- C the electrolysis of molten lead(II) bromide
- D the thermal decomposition of calcium carbonate

16 Which substances are mixtures?

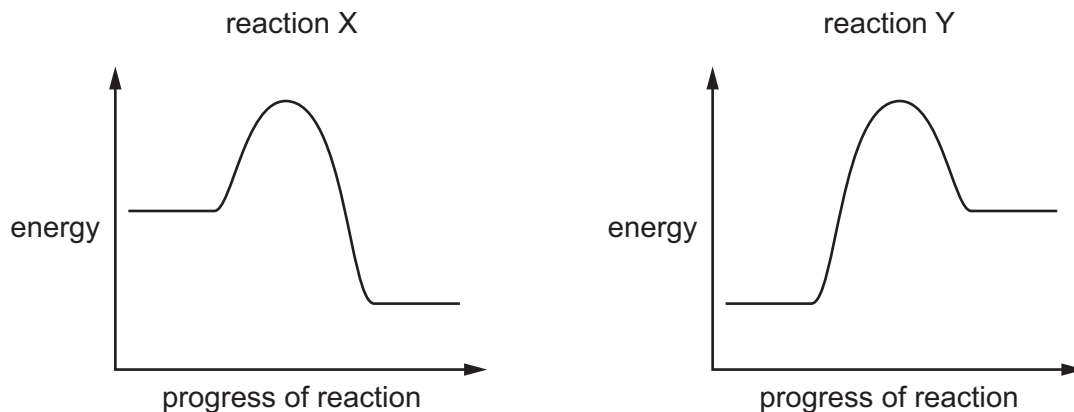
- 1 air
- 2 brass
- 3 sodium chloride

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

17 Which products are formed when molten sodium chloride is electrolysed using inert electrodes?

	at the anode	at the cathode
A	chlorine	hydrogen
B	chlorine	sodium
C	oxygen	hydrogen
D	oxygen	sodium

18 The energy level diagrams for reaction X and for reaction Y are shown.



Which statement about the reactions is correct?

- A** Reaction X has a greater activation energy than reaction Y.
- B** Reaction X is endothermic and reaction Y is exothermic.
- C** The overall energy change in reaction X is much greater than in reaction Y.
- D** The temperature increases during reaction X and decreases during reaction Y.

19 In the reaction between an acid and a metal, the rate of reaction decreases as the reaction proceeds.

A student suggests three reasons why the rate of this reaction decreases.

- 1 The concentration of the acid decreases as it gets used up.
- 2 The energy needed to break bonds is used up as the products form.
- 3 The surface area of the metal decreases as it gets smaller.

Which reasons are correct?

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

20 Which statements about redox reactions are correct?

- 1 An oxidising agent is reduced in a reaction.
- 2 A reducing agent is oxidised in a reaction.
- 3 An oxidising agent gains oxygen in a reaction.
- 4 A reducing agent loses oxygen in a reaction.

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

- 21** Excess insoluble solid copper carbonate is mixed with dilute nitric acid.

Aqueous copper nitrate is formed.

Which row shows the processes used to obtain pure solid copper nitrate from the reaction mixture?

	process 1	process 2	process 3
A	filter the mixture	dry the solid on the filter paper	warm in an oven
B	filter the mixture	heat the solution and crystallise	filter the mixture and dry
C	heat the solution	cool to crystallise	filter the mixture and dry
D	heat the solution	filter the mixture	dry the solid

- 22** Which two substances form a white precipitate when they are mixed?

- A** barium chloride and hydrochloric acid
- B** barium chloride and nitric acid
- C** silver nitrate and hydrochloric acid
- D** silver nitrate and nitric acid

- 23** Which statement describes how the elements change across a period in the Periodic Table from left to right?

- A** They change from elements to compounds.
- B** They change from metals to non-metals.
- C** They change from gases to solids.
- D** They change from non-metals to metals.

- 24** Which equation represents a correct displacement reaction involving halogens?

- A** $2\text{NaBr} + \text{I}_2 \rightarrow \text{Br}_2 + 2\text{NaI}$
- B** $2\text{NaCl} + \text{Br}_2 \rightarrow \text{Cl}_2 + 2\text{NaBr}$
- C** $2\text{NaF} + \text{I}_2 \rightarrow \text{F}_2 + 2\text{NaI}$
- D** $2\text{NaI} + \text{Cl}_2 \rightarrow \text{I}_2 + 2\text{NaCl}$

25 Element X is a metal.

X is more reactive than aluminium.

Which method is used to obtain X?

- A** electrolysis of a molten salt of X
- B** electrolysis of an aqueous solution of a salt of X
- C** heating the oxide of X with carbon
- D** heating the oxide of X with hydrogen

26 Which statement about greenhouse gases is correct?

- A** They are gases in Group VIII of the Periodic Table.
- B** They cause acid rain.
- C** They contribute to climate change.
- D** They make up most of the atmosphere.

27 Which type of compound contains only carbon and hydrogen?

- A** carbohydrate
- B** carbonate
- C** hydrocarbon
- D** hydroxide

28 Which row shows apparatus used to measure length, time and volume?

	length	time	volume
A	measuring cylinder	metre rule	stop-clock
B	measuring cylinder	stop-clock	metre rule
C	metre rule	measuring cylinder	stop-clock
D	metre rule	stop-clock	measuring cylinder

29 Diagram 1 is a distance–time graph.

Diagram 2 and diagram 3 are speed–time graphs.

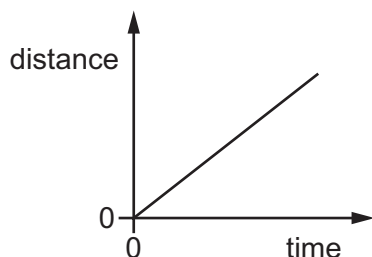


diagram 1

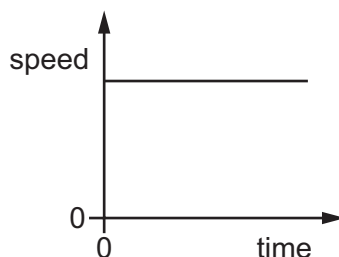


diagram 2

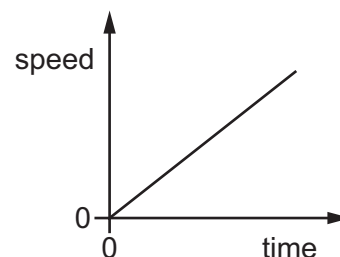


diagram 3

Which of the diagrams represents the motion of an object moving with a non-zero constant acceleration?

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

30 An athlete of mass 62 kg jumps through a vertical height of 1.25 m.

As he moves upwards, all his initial kinetic energy is transferred to gravitational potential energy.

The gravitational field strength g is 10 N/kg.

What is the initial speed of the athlete?

- A** 2.5 m/s **B** 3.5 m/s **C** 5.0 m/s **D** 12.4 m/s

31 What is the main source of the energy released from the Sun?

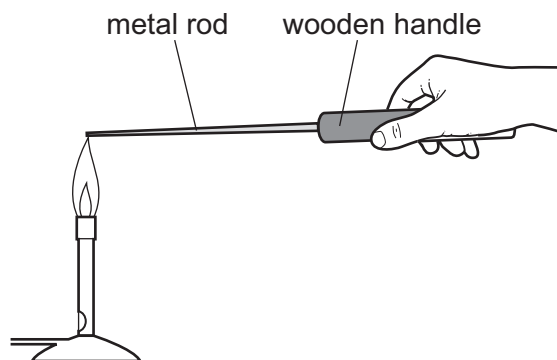
- A** fission of helium nuclei to form hydrogen nuclei
B fusion of hydrogen nuclei to form helium nuclei
C hydrogen atoms combining to form hydrogen molecules
D hydrogen atoms reacting with oxygen atoms to form water molecules

32 Cold water evaporates as molecules leave it.

Which molecules leave the water and from which part of the water do they leave?

	molecules that leave the water	where they leave from
A	least energetic	the surface only
B	least energetic	throughout the water
C	most energetic	the surface only
D	most energetic	throughout the water

- 33** A metal rod with a wooden handle is placed with the end of the metal rod in a flame.



How does heat pass through the metal and how does heat pass through the wood?

	heat passes through the metal	heat passes through the wood
A	by movement of electrons and by molecular vibrations	by molecular vibrations only
B	by movement of electrons and by molecular vibrations	by movement of electrons and by molecular vibrations
C	by molecular vibrations only	by molecular vibrations only
D	by movement of electrons only	by movement of electrons and by molecular vibrations

- 34** Which equation relates wave speed v , frequency f and wavelength λ ?

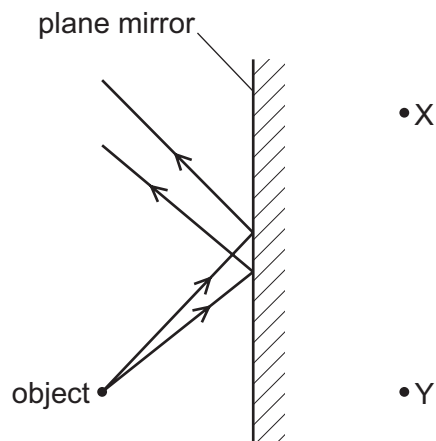
A $v = f\lambda$

B $v = \frac{f}{\lambda}$

C $v^2 = f\lambda$

D $v^2 = \frac{f}{\lambda}$

- 35 The diagram shows rays of light from an object being reflected by a plane mirror.



At which labelled point is the image formed, and is the image real or virtual?

	image	real or virtual
A	at X	real
B	at X	virtual
C	at Y	real
D	at Y	virtual

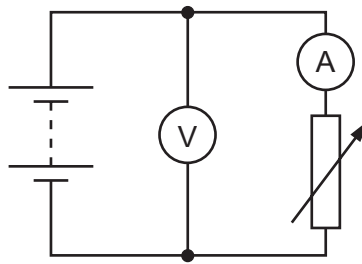
- 36 The table shows the speed of sound in three different substances X, Y and Z. One substance is a solid, one is a liquid and one is a gas.

substance	<u>speed of sound</u> m/s
X	3600
Y	1500
Z	267

Which row shows the states of the three substances?

	solid	liquid	gas
A	X	Y	Z
B	X	Z	Y
C	Z	X	Y
D	Z	Y	X

- 37 The diagram represents a circuit that includes a battery, an ammeter, a voltmeter and a variable resistor.



What happens to the readings on the meters as the resistance of the variable resistor is increased?

	ammeter reading	voltmeter reading
A	decreases	decreases
B	decreases	stays constant
C	increases	decreases
D	increases	stays constant

- 38 Four copper wires have different lengths and different cross-sectional areas.

Which wire has the smallest resistance?

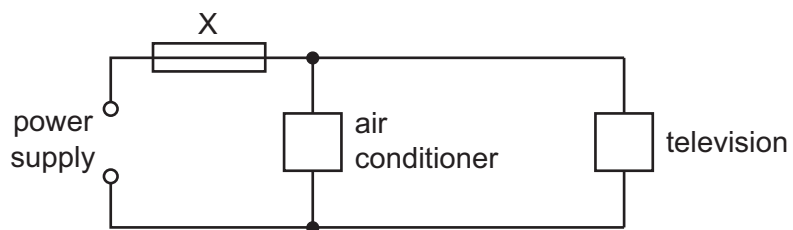
	length / cm	cross-sectional area / mm ²
A	50	0.025
B	50	0.050
C	100	0.025
D	100	0.050

- 39 A lamp is labelled 12 V, 25 W.

How much electrical energy does the lamp transfer in 4.0 minutes when it is operating at its normal brightness?

- A** 100 J **B** 1200 J **C** 6000 J **D** 72000 J

- 40 An air conditioner and a television are both connected to the same electrical circuit.



The current in the air conditioner is 9.0 A and the current in the television is 2.0 A .

Several different fuses are available.

Which fuse should be connected at X?

- A** 1 A **B** 3 A **C** 7 A **D** 13 A

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The Periodic Table of Elements

Group																	
I	II	1 H hydrogen 1										III	IV	V	VI	VII	VIII
3 Li lithium 7	4 Be beryllium 9	Key atomic number atomic symbol name relative atomic mass										5 B boron 11	6 C carbon 12	7 N nitrogen 14	8 O oxygen 16	9 F fluorine 19	2 He helium 4
	11 Na sodium 23											12 Mg magnesium 24	13 Al aluminium 27	14 Si silicon 28	15 P phosphorus 31	16 S sulfur 32	
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 —	117 Ts tennessine —	118 Og oganesson —	119 Uue unbinilium —	120 Uuh ununilium —

lanthanoids

actinoids

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 —

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