Cambridge Assessment
International Education

Cambridge IGCSE™

COMBINED SCIENCE **0653/21**

Paper 2 Multiple Choice (Extended) **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.

**[Turn over**

1   Which row correctly matches a named cell with its feature and function?

	cell	feature	function
A	ciliated cell	flagellum	absorbs water
B	palisade mesophyll cell	chloroplasts	transports oxygen
C	red blood cell	large surface area	phagocytosis
D	sperm cell	flagellum	reproduction

2   The diagrams represent four similar animal cells immersed in blood plasma.
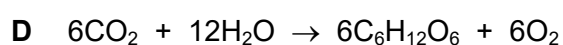
The black dots represent molecules of dissolved oxygen.
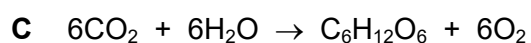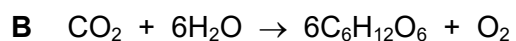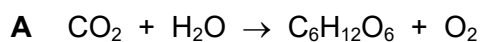
Which cell will have oxygen molecules diffusing into it most rapidly?
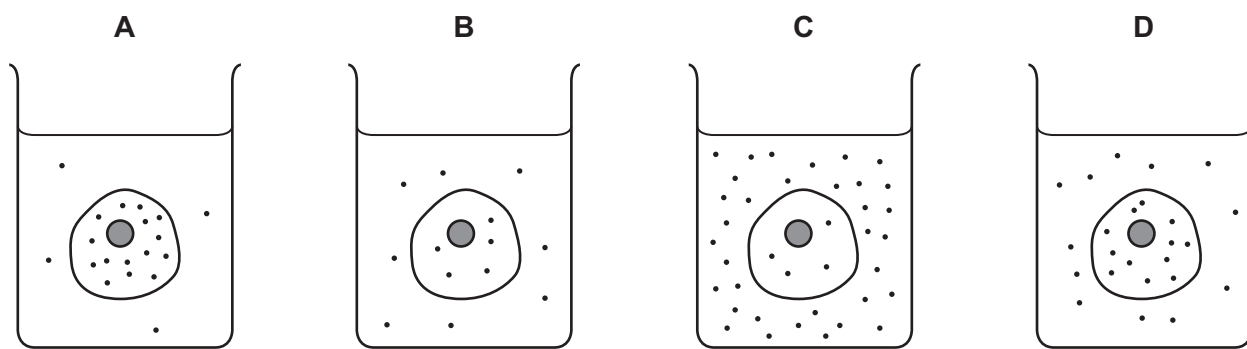
3   Which row shows the elements that occur in all proteins?

	carbon	hydrogen	nitrogen	oxygen
A	yes	yes	yes	no
B	yes	yes	no	yes
C	yes	no	yes	yes
D	yes	yes	yes	yes

4   What is the balanced equation for photosynthesis?

A $CO_2 + H_2O \rightarrow C_6H_{12}O_6 + O_2$

B $CO_2 + 6H_2O \rightarrow 6C_6H_{12}O_6 + O_2$

C $6CO_2 + 6H_2O \rightarrow C_6H_{12}O_6 + 6O_2$

D $6CO_2 + 12H_2O \rightarrow 6C_6H_{12}O_6 + 6O_2$

5 Which description of mechanical digestion is correct?

    A breakdown of food into smaller pieces with chemical change to the food molecules

    B breakdown of food into smaller pieces without chemical change to the food molecules

    C breakdown of large insoluble food molecules into small soluble food molecules

    D breakdown of large soluble food molecules into small soluble food molecules

**6** The diagram shows a cross-section of a root hair cell.
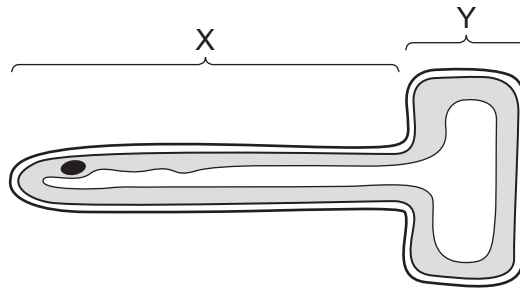
Which row identifies the part of the cell with the larger surface area and the correct function?

	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

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 What are effects of increased adrenaline production in humans?

    A increased rate of breathing and increased pulse rate

    B increased rate of breathing and narrower pupils

    C slower pulse rate and narrower pupils

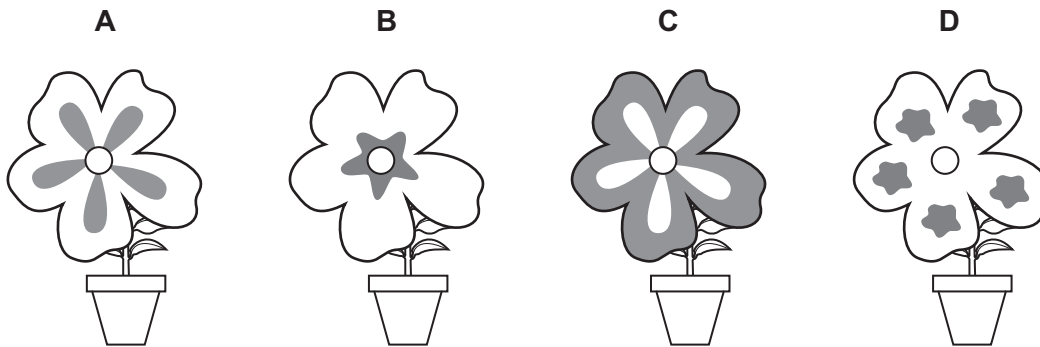   **D** slower pulse rate and wider pupils

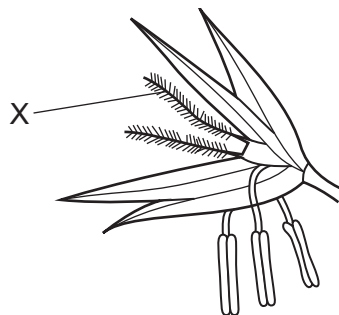**9** The diagram shows a parent plant.
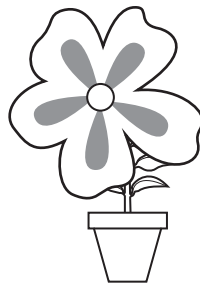
parent plant

Which offspring has been produced by asexual reproduction from this plant?

| A | B | C | D |

10 The diagram shows a flower.

What is structure X?

A anther of an insect-pollinated flower

B anther of a wind-pollinated flower

C stigma of an insect-pollinated flower

D stigma of a wind-pollinated flower

11 Materials are exchanged between the blood of the mother and embryo in the placenta.
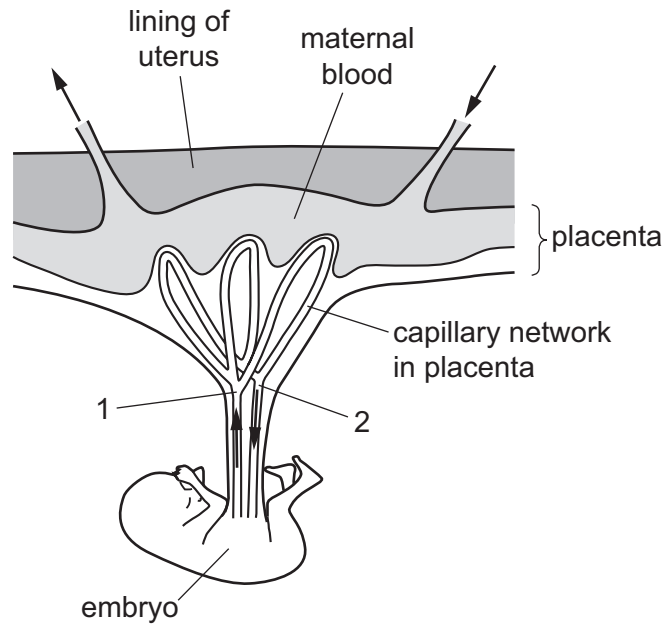
Which row shows the blood vessels with higher concentrations of carbon dioxide and glucose?

	higher concentration of carbon dioxide	higher concentration of glucose
A	1	1
B	2	2
C	2	1
D	1	2

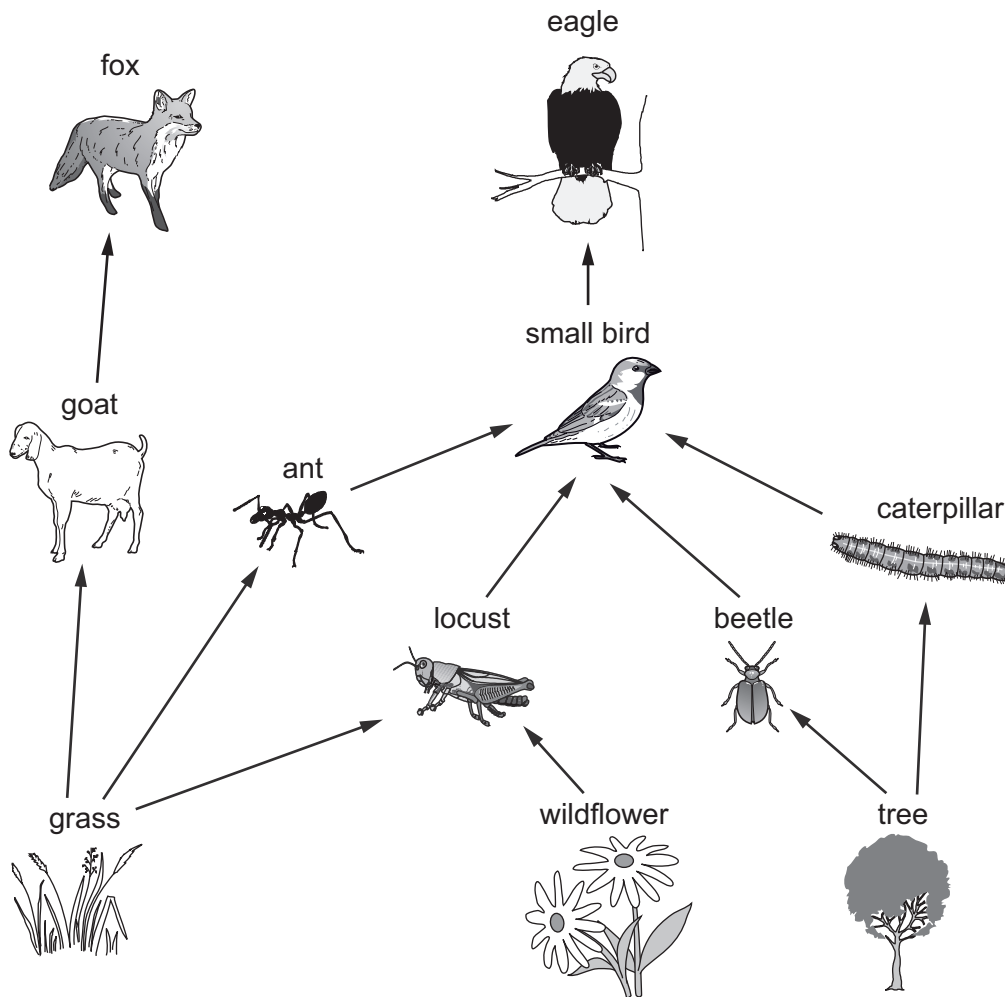**12** The diagram shows a food web.

fox

eagle

small bird

goat

ant

caterpillar

locust

beetle

grass

wildflower

tree

Which row states the number of species of each category in this food web?

	number of primary consumer species	number of secondary consumer species	number of tertiary consumer species
A	6	1	1
B	5	2	1
C	5	2	2
D	3	4	3

13 Which process takes carbon dioxide out of the air?

A combustion

B decomposition

C photosynthesis

D plant respiration

14 A fixed mass of argon gas in a sealed container is heated.

The pressure inside the container increases.

Which statement explains why the pressure increases?

A There is an increase in the number of gaseous particles inside the container.

B There is an increase in the number of collisions per second between the particles of gas and the walls of the container.

C The particles of gas have less energy and collide with the wall of the container more frequently.

D There is a decrease in the space that the particles have to move in.

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 row about elements and compounds is correct?

	elements	compounds
A	are metals only	contain ionic or covalent bonds
B	are non-metals only	contain covalent bonds only
C	are metals or non-metals	contain ionic bonds only
D	are metals or non-metals	contain ionic or covalent bonds

 [Turn over

17 The symbols and charges of some ions are shown.

- aluminium, Al^{3+}
- phosphate, PO_4^{3-}
- sodium, Na^+
- sulfate, SO_4^{2-}

What are the formulae of aluminium sulfate and sodium phosphate?

	aluminium sulfate	sodium phosphate
A	$Al_2(SO_4)_3$	Na_3PO_4
B	$Al_2(SO_4)_3$	$Na(PO_4)_3$
C	$Al_3(SO_4)_2$	Na_3PO_4
D	$Al_3(SO_4)_2$	$Na(PO_4)_3$

18 Two substances are electrolysed separately using inert electrodes.

Which two substances form the same product at one of the electrodes?

A molten sodium bromide and concentrated aqueous sodium chloride

B molten sodium bromide and dilute sulfuric acid

C molten aluminium oxide and concentrated aqueous sodium chloride

D molten aluminium oxide and dilute sulfuric acid

19 An energy diagram for a reaction is shown.
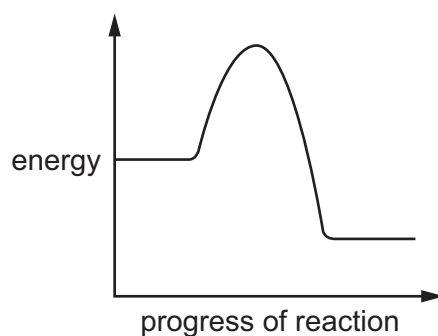
Which statement about the reaction is **not** correct?

A Activation energy is needed to start the reaction.

B The overall energy change is endothermic.

C The surroundings increase in temperature during the reaction.

D The reaction could be a combustion reaction.

20 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

21 The solubilities of some copper compounds are shown.

copper compound	solubility in water
copper nitrate	soluble
copper sulfate	soluble
copper oxide	insoluble
copper hydroxide	insoluble

Which method is used to make copper sulfate?

A   Mix aqueous copper hydroxide and dilute sulfuric acid.

B   Mix aqueous copper nitrate with aqueous sodium sulfate and filter off solid copper sulfate.

C   Mix excess aqueous copper nitrate with dilute sulfuric acid and filter off unreacted copper nitrate.

D   Mix excess solid copper oxide with dilute sulfuric acid and filter off unreacted copper oxide.

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 There are eight elements in Period 3 of the Periodic Table.

Na	Mg	Al	Si	P	S	Cl	Ar

Which statement about the elements in this period is correct?

A   The elements become less metallic across the period.

B   The most metallic elements are at both ends of the period.

C   The most metallic elements are in the middle of the period.

D   There is no pattern in metallic character across the period.

24 The colours of concentrated aqueous solutions of Group VII elements are shown.

element	colour of aqueous solution
fluorine	colourless
chlorine	pale yellow
bromine	orange
iodine	red-brown

Concentrated aqueous chlorine is added to colourless aqueous potassium bromide.

What is the colour of the mixture?

A   colourless

B   pale yellow

C   orange

D   red-brown

25 In the blast furnace, carbon reacts with carbon dioxide to form carbon monoxide.

$$C + CO_2 \rightarrow 2CO$$
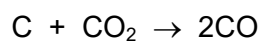
Why is this reaction essential in the extraction of iron from hematite?

A   Carbon monoxide is needed to reduce iron oxide.

B   Carbon monoxide neutralises impurities to make slag.

C   The reaction removes carbon impurities from the iron ore.

D   The reaction prevents the release of greenhouse gases.

26 Which gases may contribute to climate change when their concentrations in the air increase?

> 1   carbon dioxide
>
> 2   methane
>
> 3   sulfur dioxide

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

27 Which type of compound contains only carbon and hydrogen?

A   carbohydrate

B   carbonate

C   hydrocarbon

D   hydroxide

28 A boy runs up some stairs.

Which two physical quantities are used to calculate the power he develops?

A   his mass and his acceleration

B   his mass and the time taken

C   the work done and the time taken

D   the work done and the vertical distance moved

29 Diagram 1 is a distance–time graph.

Diagram 2 and diagram 3 are speed–time graphs.
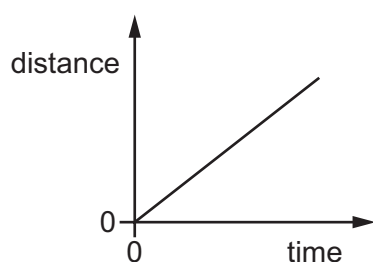

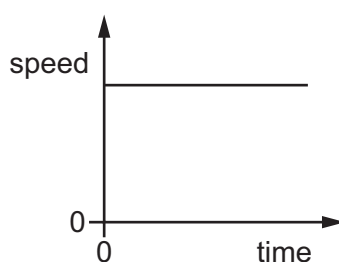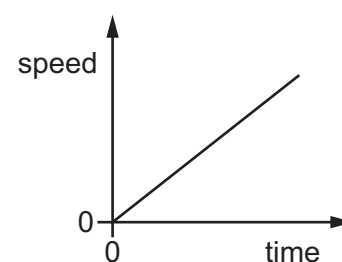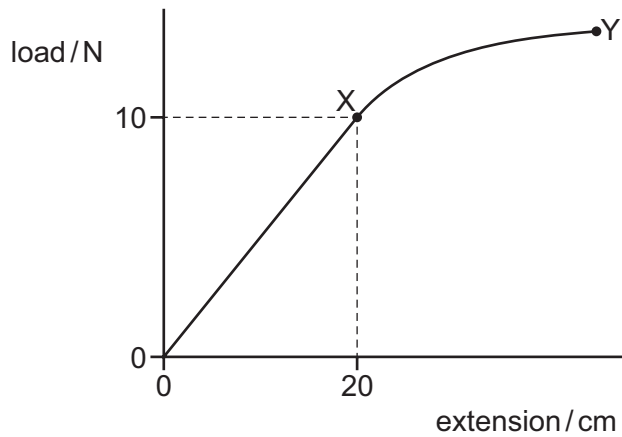diagram 1   diagram 2   diagram 3

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 The diagram shows the load–extension graph for a spring.

Two points on the graph are labelled X and Y.

What is the spring constant of the spring and which labelled point is the limit of proportionality?

	spring constant $\dfrac{}{\text{N/cm}}$	limit of proportionality
A	0.50	X
B	0.50	Y
C	2.0	X
D	2.0	Y

31 Work W is done when a force F moves an object a distance d in the direction of the force.

Which equation gives the distance d?

A $d = F + W$ **B** $d = F \times W$ **C** $d = \dfrac{F}{W}$ **D** $d = \dfrac{W}{F}$

32 Which row contains a renewable and a non-renewable energy resource in the correct column?

	renewable	non-renewable
A	geothermal	wind
B	geothermal	coal
C	oil	wind
D	oil	coal

33 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

34 Copper is a good conductor of heat.

Plastic is a bad conductor of heat.

Which statement explains this difference?

A Electrons can move freely in copper but cannot move freely in plastic.

B Electrons can move freely in plastic but cannot move freely in copper.

C Molecules can move freely in copper but cannot move freely in plastic.

D Molecules can move freely in plastic but cannot move freely in copper.

35 Which statement about waves is correct?

A In a longitudinal wave, the vibration of the particles is perpendicular to the direction of the wave.

B In a sound wave, the vibration of the particles is parallel to the direction of the wave.

C Radio waves are longitudinal waves.

D Sound waves are transverse waves.

36 A student uses a converging lens with a focal length F as a magnifying glass.

What is the distance between the object and the lens?

A less than F

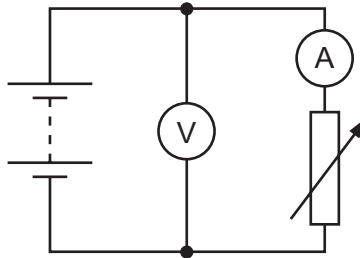**B** between F and $2F$

C $2F$

D greater than $2F$

37 There is a current of 20 mA in a resistor for a time *t*.

During this time, a charge of 600 C passes through the resistor.

What is the value of *t*?

A 3.3×10^{-5} s   **B**   12 s   **C**   30 s   **D** 3.0×10^4 s

38 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

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**   72 000 J

40 An air conditioner and a television are both connected to the same electrical circuit.
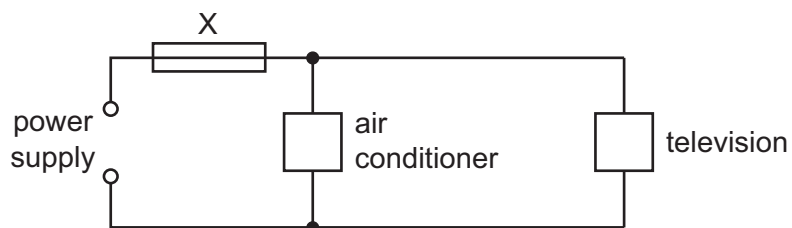
The current in the air conditioner is 9.0 A and the current in the television is 2.0 A.

Several different fuses are available.

Which fuse should be connected at X?

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

The Periodic Table of Elements

Group

Key

atomic number
atomic symbol
name
relative atomic mass

I	II	III	IV	V	VI	VII	VIII
							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

1
H
hydrogen
1

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
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.).