



# Cambridge IGCSE™

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## COMBINED SCIENCE

0653/23

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)

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### 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.

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



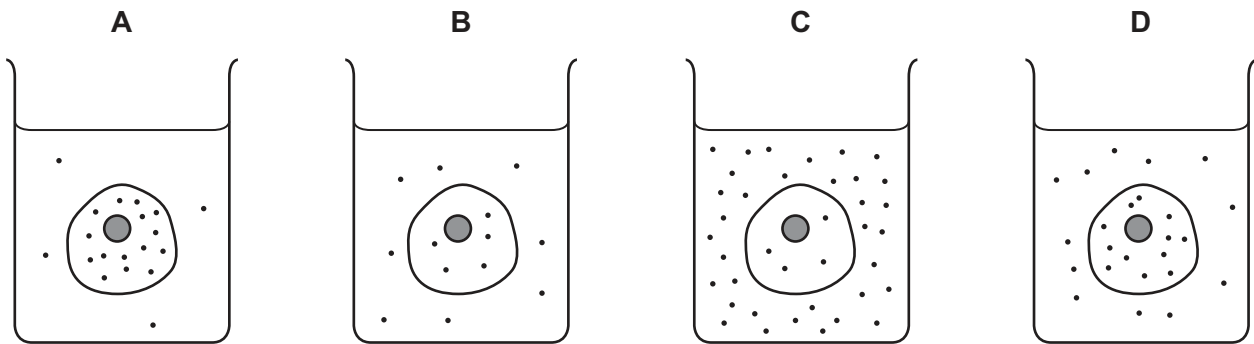
1 Which row links a specialised cell to its correct function?

	specialised cell	function
<b>A</b>	ciliated cell	photosynthesis
<b>B</b>	palisade cell	movement of mucus
<b>C</b>	red blood cell	blood clotting
<b>D</b>	sperm cell	reproduction

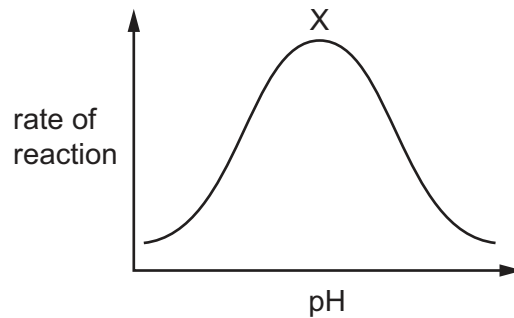
2 The diagrams represent four similar animal cells immersed in blood plasma.

The black dots represent molecules of dissolved oxygen.

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



3 The diagram shows the effect of increasing the pH of an enzyme-controlled reaction.



What is happening at point X?

- 1 denaturation
- 2 greatest number of enzyme–substrate complexes
- 3 increased kinetic energy

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

- 4 The leaves of plants produce carbohydrates during photosynthesis.

How are these carbohydrates used by the plants?

	for respiration	to make other substances	for storage
<b>A</b>	✓	x	x
<b>B</b>	x	x	✓
<b>C</b>	✓	x	✓
<b>D</b>	✓	✓	✓

- 5 A person has a low level of haemoglobin.

Which row identifies the blood cell that transports oxygen and the nutrient the person is deficient in?

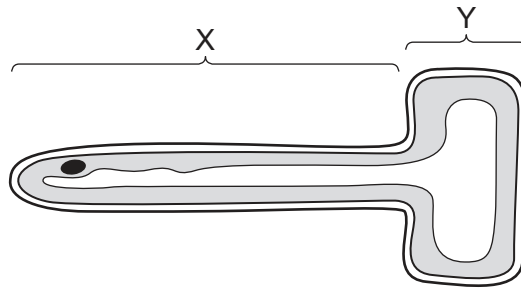
	type of blood cell	nutrient deficiency
<b>A</b>	red	calcium
<b>B</b>	red	iron
<b>C</b>	white	calcium
<b>D</b>	white	iron

- 6 Most food molecules need to be digested to allow them to be absorbed into the blood.

Which row shows the type of digestion and the change needed to allow absorption to happen?

	type of digestion	change to food molecules
<b>A</b>	chemical	large molecules to small, insoluble molecules
<b>B</b>	chemical	large molecules to small, soluble molecules
<b>C</b>	mechanical	large molecules to small, soluble molecules
<b>D</b>	mechanical	large molecules to small, insoluble molecules

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



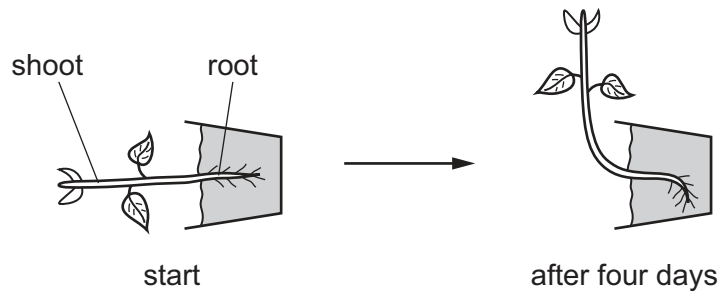
Which row identifies the part of the cell with the larger surface area and the correct function?

	part of cell	function
<b>A</b>	X	water and glucose uptake
<b>B</b>	X	water and ion uptake
<b>C</b>	Y	water and glucose uptake
<b>D</b>	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 A plant in a pot was placed on its side for four days.



Which row describes the gravitropic response in the root and shoot?

	root	shoot
<b>A</b>	positive	negative
<b>B</b>	negative	positive
<b>C</b>	negative	negative
<b>D</b>	positive	positive

10 During human reproduction an egg fuses with a sperm.

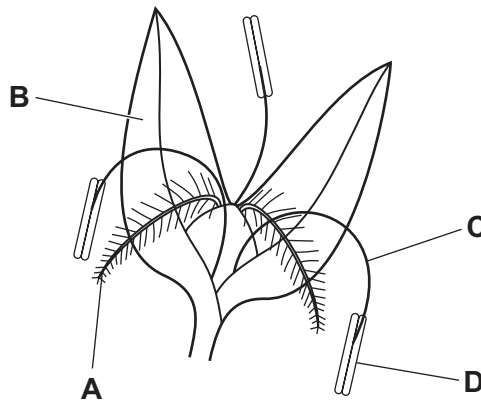
Sometimes the zygote splits into two and produces twins.

Which row describes the formation of these twins?

	original zygote produced by	twins
<b>A</b>	asexual reproduction	genetically identical
<b>B</b>	sexual reproduction	genetically identical
<b>C</b>	asexual reproduction	genetically different
<b>D</b>	sexual reproduction	genetically different

11 The diagram shows a wind-pollinated flower.

Which label identifies a stigma?



12 In which food chain does the final consumer receive the most energy from the producer?

- A** producer → primary consumer → secondary consumer → tertiary consumer → quaternary consumer
- B** producer → primary consumer → secondary consumer → tertiary consumer
- C** producer → primary consumer → secondary consumer
- D** producer → primary consumer

13 Which process takes carbon dioxide out of the air?

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

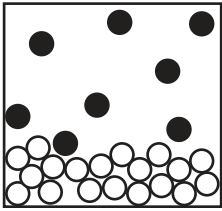
14 The melting point and boiling point of oxygen and nitrogen are shown.

	melting point /°C	boiling point /°C
oxygen	-219	-183
nitrogen	-210	-196

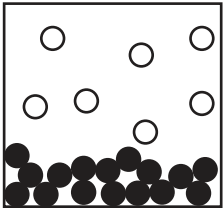
A sealed flask contains a mixture of oxygen and nitrogen.

Which diagram shows the arrangement of oxygen and nitrogen particles at  $-190^{\circ}\text{C}$ ?

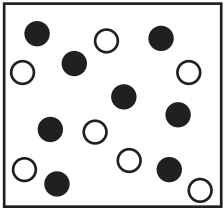
**A**



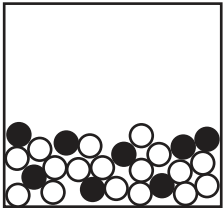
**B**



**C**



**D**



key

● = nitrogen molecules

○ = oxygen molecules

15 During a chromatography investigation, colour X moves 4.5 cm up the chromatography paper from the base line.

The  $R_f$  value of colour X is 0.59.

What is the distance moved by the solvent in this experiment?

- A** 2.7 cm      **B** 4.5 cm      **C** 7.6 cm      **D** 10.3 cm

16 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

17 Water has the chemical formula  $\text{H}_2\text{O}$ .

Which statement is correct?

- A** Pure water is a mixture because it contains hydrogen and oxygen.
- B** Pure water is an element because it contains only one type of molecule.
- C** Salt water is a compound because it contains salt and water.
- D** Salt water is a mixture because it contains salt and water.

18 When water boils it changes from a liquid to a gas.

Which statement about this process is correct?

- A It is endothermic because it requires energy to break covalent bonds.
- B It is endothermic because energy is needed to break attractive forces between molecules.
- C It is exothermic because it requires energy to break attractive forces between atoms.
- D It is exothermic because energy is given out when bonds form.

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

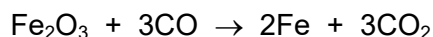
A student suggests three reasons why the rate of this reaction decreases.

- 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 Iron is extracted from its oxide using carbon monoxide. The equation is shown.



Which row identifies the reducing agent and explains how it acts as a reducing agent?

	reducing agent	explanation
A	$\text{Fe}_2\text{O}_3$	it loses mass to become Fe
B	$\text{Fe}_2\text{O}_3$	it loses oxygen to become Fe
C	CO	it gains mass to become $\text{CO}_2$
D	CO	it removes oxygen from $\text{Fe}_2\text{O}_3$

21 Substances that react together to make zinc salts are listed.

- 1 zinc carbonate and hydrochloric acid
- 2 zinc oxide and sulfuric acid
- 3 zinc and nitric acid
- 4 zinc hydroxide and hydrochloric acid

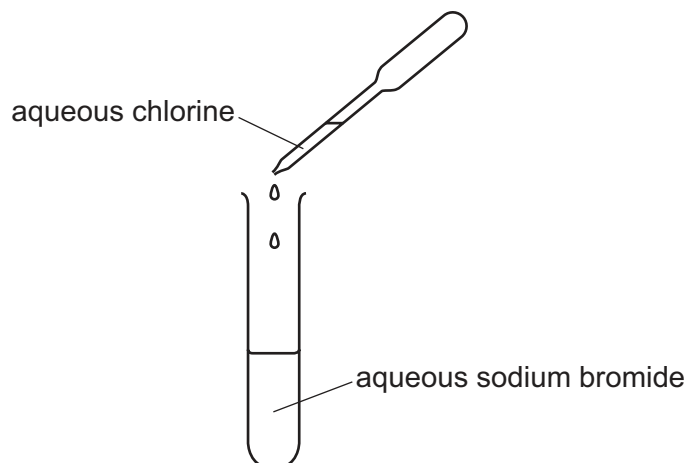
Which substances produce water when they react?

- A 1, 2 and 3      B 1, 2 and 4      C 1 and 2 only      D 3 and 4

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 Aqueous chlorine is added to aqueous sodium bromide.



Which statement about the reaction is correct?

- A The solution turns orange because bromine is formed.
  - B The solution turns orange because bromide ions are reduced.
  - C The solution remains colourless because bromine is less reactive than chlorine.
  - D The solution remains colourless because chlorine is reduced.
- 24 How does the character of the elements change across a period of the Periodic Table from left to right?
- A acidic to basic
  - B basic to acidic
  - C metallic to non-metallic
  - D non-metallic to metallic



25 Four metals, W, X, Y and Z, are added to aqueous solutions of their salts.

W displaces Y.

Y displaces X.

Z displaces Y but does not displace W.

Which row shows the reactivity order of the metals?

	least reactive	→		most reactive
<b>A</b>	X	Y	Z	W
<b>B</b>	X	Z	Y	W
<b>C</b>	W	Y	Z	X
<b>D</b>	W	Z	Y	X

26 Which statement about greenhouse gases is correct?

**A** Greenhouse gases cause acid rain.

**B** The combustion of fossil fuels produces greenhouse gases.

**C** Nitrogen is a greenhouse gas.

**D** Greenhouse gases are removed from the atmosphere by respiration.

27 Which type of compound contains only carbon and hydrogen?

**A** carbohydrate

**B** carbonate

**C** hydrocarbon

**D** hydroxide

28 Which change **cannot** be caused by a force acting on an object?

**A** change of mass

**B** change of motion

**C** change of shape

**D** change of size

29 Diagram 1 is a distance–time graph.

Diagram 2 and diagram 3 are speed–time graphs.

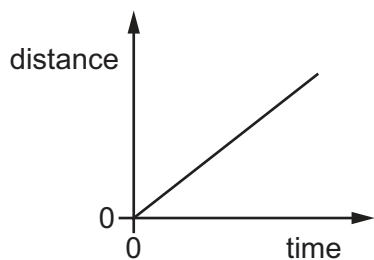


diagram 1

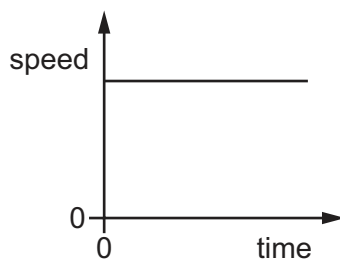


diagram 2

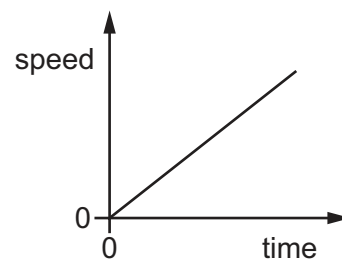


diagram 3

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 A student does 10 J of work when lifting an object through a vertical distance of 2.0 m.

What is the size of the force that the student exerts on the object?

- A** 0.20 N      **B** 5.0 N      **C** 12 N      **D** 20 N

31 Which source of energy is non-renewable?

- A** chemical energy stored in fossil fuels  
**B** energy stored in waves  
**C** energy stored in water behind a hydroelectric dam  
**D** wind energy

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
<b>A</b>	least energetic	the surface only
<b>B</b>	least energetic	throughout the water
<b>C</b>	most energetic	the surface only
<b>D</b>	most energetic	throughout the water

33 A heater creates a convection current in a room.

What happens to air as it is heated?

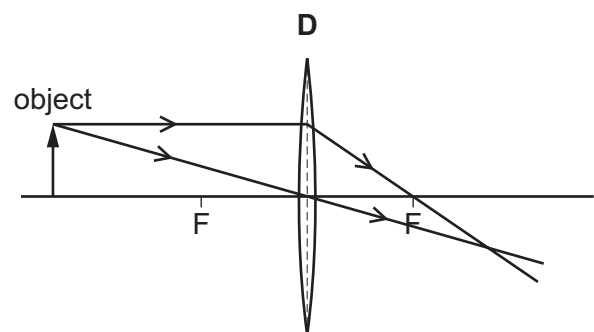
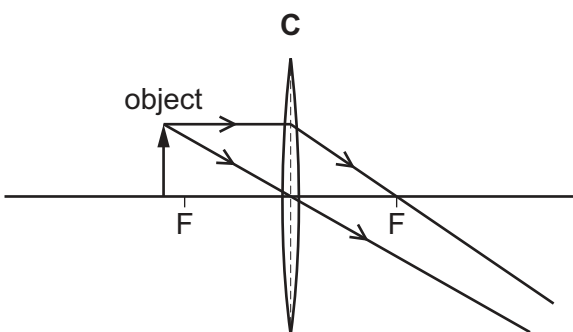
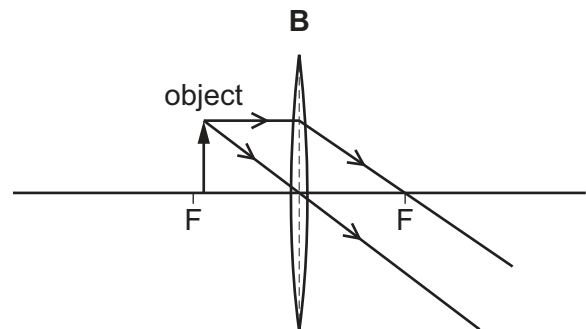
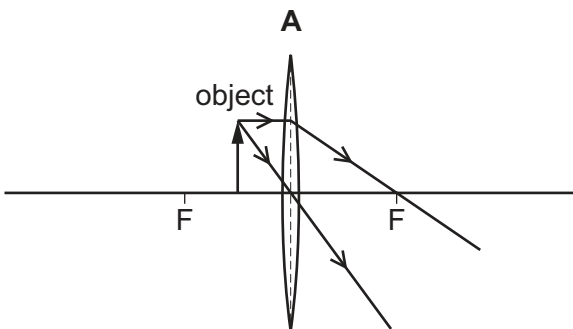
- A It contracts and its density decreases.
- B It contracts and its density increases.
- C It expands and its density decreases.
- D It expands and its density increases.

34 Which row gives an example of a transverse wave and a longitudinal wave?

	transverse	longitudinal
<b>A</b>	light wave	radio wave
<b>B</b>	radio wave	sound wave
<b>C</b>	sound wave	light wave
<b>D</b>	sound wave	radio wave

35 Which diagram shows a converging lens being used to produce the largest virtual image?

(Every point labelled F is a principal focus.)



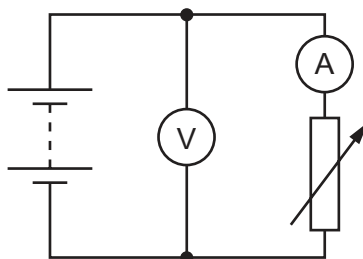
- 36 The speed of sound in air is approximately 330 m/s.

The speed of sound in water is approximately 1500 m/s.

What is a possible speed of sound in solid iron?

- A** 120 m/s      **B** 330 m/s      **C** 1200 m/s      **D** 5100 m/s

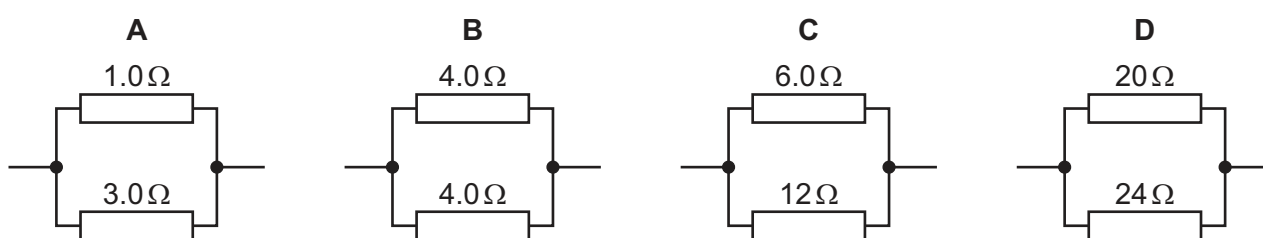
- 37 The diagram represents a circuit that includes a battery, an ammeter, a voltmeter and a variable resistor.



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

	ammeter reading	voltmeter reading
<b>A</b>	decreases	decreases
<b>B</b>	decreases	stays constant
<b>C</b>	increases	decreases
<b>D</b>	increases	stays constant

- 38 Which combination of resistors has a combined resistance of  $4.0\ \Omega$ ?

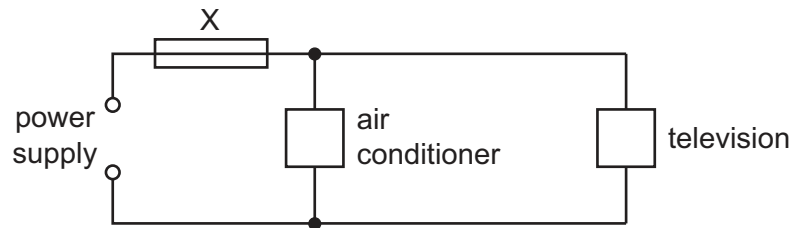


- 39 A lamp is labelled 12 V, 25 W.

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  $9.0\text{ A}$  and the current in the television is  $2.0\text{ A}$ .

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	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; text-align: center;"> <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											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
19 <b>K</b> potassium 39	20 <b>Ca</b> calcium 40	21 <b>Sc</b> scandium 45	22 <b>Ti</b> titanium 48	23 <b>V</b> vanadium 51	24 <b>Cr</b> chromium 52	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	39 <b>Y</b> yttrium 89	40 <b>Zr</b> zirconium 91	41 <b>Nb</b> niobium 93	42 <b>Mo</b> molybdenum 96	43 <b>Tc</b> technetium —	44 <b>Ru</b> ruthenium 101	45 <b>Rh</b> rhodium 103	46 <b>Pd</b> palladium 106	47 <b>Ag</b> silver 108	48 <b>Cd</b> cadmium 112	49 <b>In</b> indium 115	50 <b>Sn</b> tin 119	51 <b>Sb</b> antimony 122	52 <b>Te</b> tellurium 128	53 <b>I</b> iodine 127	54 <b>Xe</b> xenon 131
55 <b>Cs</b> caesium 133	56 <b>Ba</b> barium 137	57–71 lanthanoids	72 <b>Hf</b> hafnium 178	73 <b>Ta</b> tantalum 181	74 <b>W</b> tungsten 184	75 <b>Re</b> rhenium 186	76 <b>Os</b> osmium 190	77 <b>Ir</b> iridium 192	78 <b>Pt</b> platinum 195	79 <b>Au</b> gold 197	80 <b>Hg</b> mercury 201	81 <b>Tl</b> thallium 204	82 <b>Pb</b> lead 207	83 <b>Bi</b> bismuth 209	84 <b>Po</b> polonium —	85 <b>At</b> astatine —	86 <b>Rn</b> radon —
87 <b>Fr</b> francium —	88 <b>Ra</b> radium —	89–103 actinoids	104 <b>Rf</b> rutherfordium —	105 <b>Db</b> dubnium —	106 <b>Sg</b> seaborgium —	107 <b>Bh</b> bohrium —	108 <b>Hs</b> hassium —	109 <b>Mt</b> meitnerium —	110 <b>Ds</b> darmstadtium —	111 <b>Rg</b> roentgenium —	112 <b>Cn</b> copernicium —	114 <b>Fl</b> flerovium —	116 <b>Lv</b> livermorium —	—	—	—	—

lanthanoids	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
actinoids	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.).