



# Cambridge IGCSE™

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## CO-ORDINATED SCIENCES

0654/22

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.

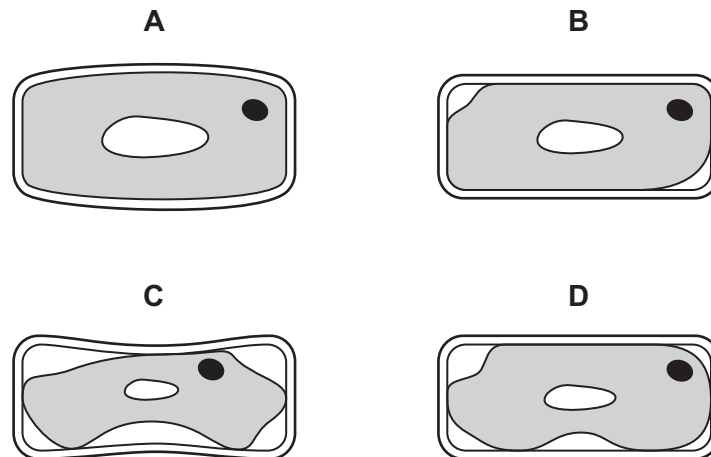
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This document has **16** pages. Any blank pages are indicated.



- 1 What is respiration?
- A breakdown of food by enzymes in the alimentary canal
  - B breathing to supply oxygen to cells
  - C release of carbon dioxide from the lungs
  - D release of energy for body activities

- 2 Which cell is most flaccid?



- 3 Which row matches the nutrient to the chemical elements that it contains?

	nutrient	carbon	hydrogen	oxygen	nitrogen
<b>A</b>	fat	✓	✓	X	X
<b>B</b>	protein	✓	✓	✓	✓
<b>C</b>	starch	✓	X	✓	✓
<b>D</b>	sugar	X	✓	✓	✓

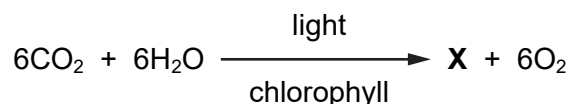
key

✓ = contains element

X = does not contain element

- 4 Which type of molecule are enzymes?
- A fat
  - B carbohydrate
  - C protein
  - D DNA

- 5 The balanced equation for photosynthesis is shown.

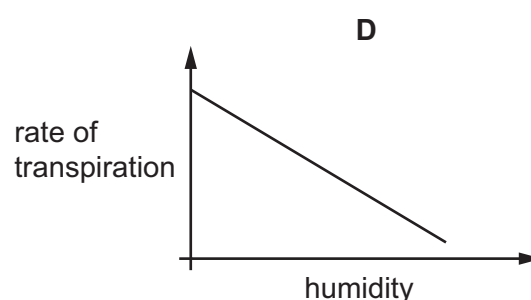
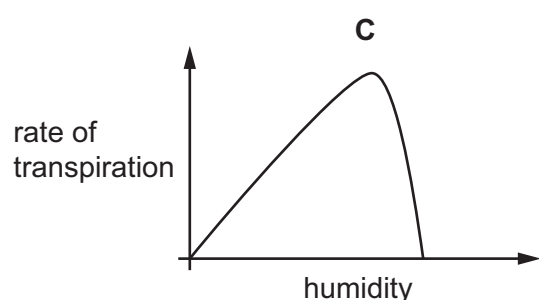
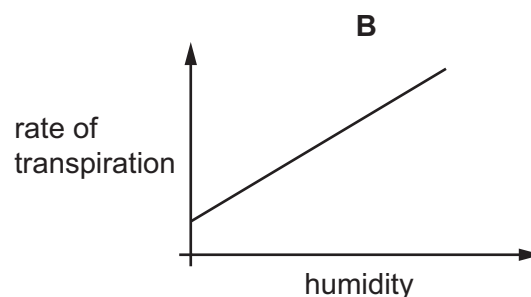
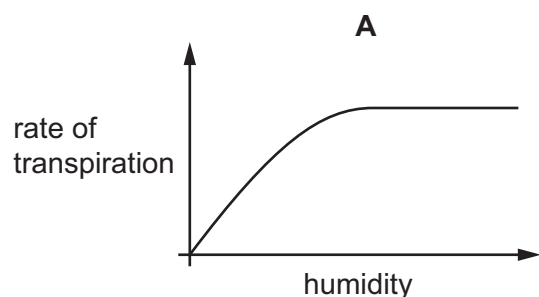


What is **X**?

- A**  $\text{C}_6\text{H}_{12}\text{O}_6$       **B**  $\text{C}_6\text{H}_{12}\text{O}_{12}$       **C**  $\text{C}_{12}\text{H}_6\text{O}_6$       **D**  $\text{C}_{12}\text{H}_{12}\text{O}_2$
- 6 Which row about secretions in the alimentary canal is correct?

	substance secreted	action	area of alimentary canal
<b>A</b>	amylase	breaks down fats into fatty acids and glycerol	small intestine
<b>B</b>	bile	breaks down fats into fatty acids and glycerol	small intestine
<b>C</b>	hydrochloric acid	breaks down proteins to amino acids	stomach
<b>D</b>	protease	breaks down proteins to amino acids	stomach

- 7 Which graph shows the effect of atmospheric humidity on the rate of transpiration if all other factors are kept constant?



- 8 A child blows into a rubber balloon.

What is the percentage of oxygen inside the balloon?

- A** 0%      **B** 4%      **C** 16%      **D** 21%

- 9 A student is in a dangerous situation and adrenaline is released into the blood. The table shows changes to pulse rate, breathing rate and pupil diameter.

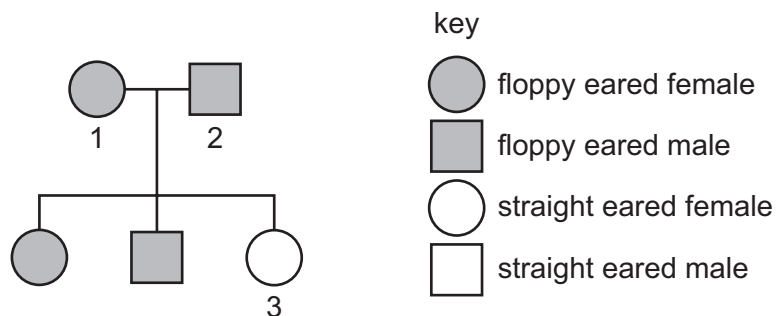
Which row correctly describes the effect of adrenaline?

	pulse rate	breathing rate	pupil diameter
<b>A</b>	decrease	increase	decrease
<b>B</b>	decrease	decrease	increase
<b>C</b>	increase	increase	increase
<b>D</b>	increase	decrease	decrease

- 10 Which row about human gametes is correct?

	gamete	flagellum present	energy store present	shows motility	
<b>A</b>	female	✓	✓	✓	key ✓ = yes x = no
<b>B</b>	female	x	✓	x	
<b>C</b>	male	✓	✓	x	
<b>D</b>	male	x	x	✓	

- 11 Two rabbits with floppy ears were crossed and produced three offspring. The pedigree diagram of the cross is shown.



Which row is correct for this cross?

	genotype of 1	genotype of 2	dominant allele
<b>A</b>	heterozygous	heterozygous	floppy ears
<b>B</b>	homozygous	homozygous	floppy ears
<b>C</b>	heterozygous	heterozygous	straight ears
<b>D</b>	homozygous	homozygous	straight ears

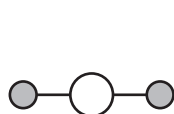
12 Why do food chains usually have fewer than five trophic levels?

- A All the carnivores consume herbivores.
- B The energy passed on reduces from one trophic level to the next.
- C There is less protein in each individual higher up the chain.
- D There is only one producer in each chain.

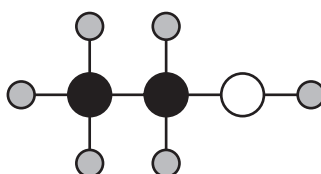
13 Which row is correct for eutrophication?

	source of nitrates	effects of nitrates on producers	result of increase in decomposers
A	fertilisers	increase growth	carbon dioxide decreases
B	fertilisers	decrease growth	oxygen increases
C	sewage	decrease growth	carbon dioxide increases
D	sewage	increase growth	oxygen decreases

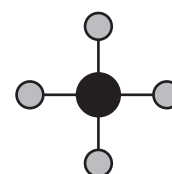
14 The structures of some substances are shown.



water



ethanol



methane

Which row shows the total number of different elements and the total number of atoms in the three structures?

	total number of different elements	total number of atoms
A	3	9
B	3	17
C	7	9
D	7	17

15 Which method can be used to separate graphite from dilute nitric acid?

- A chromatography
- B crystallisation
- C distillation
- D filtration

16 Aqueous copper(II) sulfate is electrolysed using copper electrodes.

What is the half-equation for the reaction at the cathode?

- A  $\text{Cu} + 2\text{e}^- \rightarrow \text{Cu}^{2+}$
- B  $\text{Cu} \rightarrow \text{Cu}^{2+} + 2\text{e}^-$
- C  $\text{Cu}^{2+} + 2\text{e}^- \rightarrow \text{Cu}$
- D  $\text{Cu}^{2+} \rightarrow \text{Cu} + 2\text{e}^-$

17 Phosphoric acid contains phosphate ions,  $\text{PO}_4^{3-}$ .

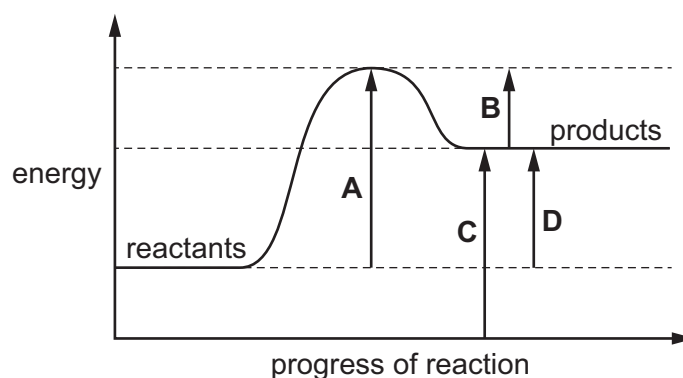
Phosphoric acid reacts with calcium hydroxide,  $\text{Ca}(\text{OH})_2$ , to form the salt calcium phosphate.

What is the formula of calcium phosphate?

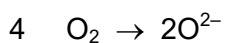
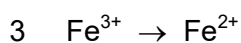
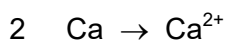
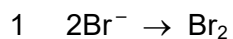
- A  $\text{CaPO}_4$
- B  $\text{Ca}(\text{PO}_4)_3$
- C  $\text{Ca}_2\text{PO}_4$
- D  $\text{Ca}_3(\text{PO}_4)_2$

18 An energy level diagram for a reaction is shown.

Which arrow shows the overall energy change for the reaction?



19 Which changes show oxidation?



**A** 1 and 2

**B** 1 and 4

**C** 2 and 3

**D** 3 and 4

20 What reacts with ammonia gas?

	hydrochloric acid	sodium hydroxide
<b>A</b>	✓	✓
<b>B</b>	✓	x
<b>C</b>	x	✓
<b>D</b>	x	x

key

✓ = reacts

x = does not react

21 Which row describes trends in the properties of Group I elements as the group is descended?

	melting point	reactivity with water
<b>A</b>	decreasing	decreasing
<b>B</b>	decreasing	increasing
<b>C</b>	increasing	decreasing
<b>D</b>	increasing	increasing

22 Some observations from an investigation are shown.

- 1 Metal W does not react with dilute hydrochloric acid.
- 2 Metal X does not react with cold water but does react with dilute hydrochloric acid.
- 3 Metal Y reacts with cold water.
- 4 Metal Z does not react with dilute hydrochloric acid but does react with aqueous ions of metal W.

What is the order of reactivity of the metals?

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

23 Which statement explains how oxides of nitrogen are formed in a car engine?

- A** Nitrogen from the air reacts with the fuel.
- B** Oxygen and nitrogen from the air react together.
- C** Oxygen from the air reacts with sulfur impurities in the fuel.
- D** Oxygen from the air reacts with the fuel.

24 Other than hydrogen and oxygen, which substance provides only **one** of the essential elements for plant growth?

- A**  $K_3PO_4$       **B**  $KNO_3$       **C**  $(NH_4)_3PO_4$       **D**  $NH_4NO_3$

25 Concentrated sulfuric acid is made by the Contact process.

During this process, sulfur trioxide is added to concentrated sulfuric acid rather than to water.

Which statement about the reaction of sulfur trioxide with water is correct?

- A** It produces an acid mist.
- B** It is endothermic.
- C** It produces oleum,  $H_2S_2O_7$ .
- D** The rate of reaction is low.



26 What are the products of the thermal decomposition of calcium carbonate,  $\text{CaCO}_3$ ?

- A calcium and carbon dioxide
- B calcium, carbon and oxygen
- C calcium oxide and carbon dioxide
- D calcium oxide and carbon monoxide

27 Reactants for three chemical processes are listed.

- 1 ethene + steam
- 2 ethene + hydrogen
- 3 ethene in addition polymerisation

Which processes form saturated hydrocarbons?

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

28 A student measures the diameter and the length of a long, thin wire.

Which apparatus is used to give accurate measurements?

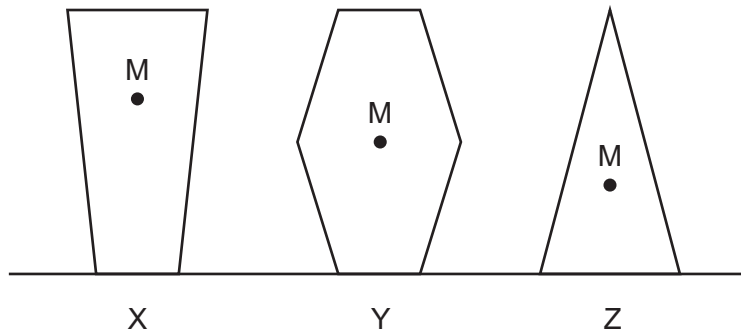
	diameter	length
<b>A</b>	metre rule	metre rule
<b>B</b>	metre rule	micrometer screw gauge
<b>C</b>	micrometer screw gauge	metre rule
<b>D</b>	micrometer screw gauge	micrometer screw gauge

29 A girl runs 5000 m in 1200 seconds and then walks a further 3000 m in 1800 seconds.

What is her average speed for this journey?

- A 1.7 m/s    B 2.7 m/s    C 2.9 m/s    D 5.8 m/s

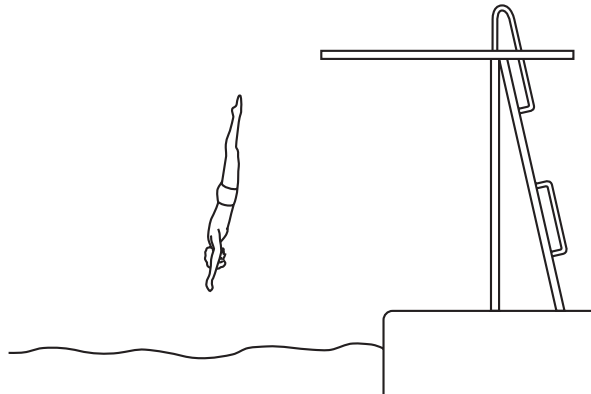
30 Three objects X, Y and Z are at rest on a table. The centre of mass of each object is labelled M.



What is the order of stability of these three objects, from most stable to least stable?

- A**  $X \rightarrow Y \rightarrow Z$     **B**  $Y \rightarrow Z \rightarrow X$     **C**  $X \rightarrow Z \rightarrow Y$     **D**  $Z \rightarrow Y \rightarrow X$

31 The diagram shows a man diving into water.



Which form of energy is increasing as he accelerates downwards through the air?

- A** chemical  
**B** elastic potential (strain)  
**C** gravitational potential  
**D** kinetic

32 The Sun is an important energy resource.

Which energy source powers the Sun?

- A** chemical  
**B** geothermal  
**C** nuclear fission  
**D** nuclear fusion

33 Which change increases the sensitivity of a liquid-in-glass thermometer?

- A decreasing the diameter of the capillary bore
- B decreasing the length of the capillary bore
- C increasing the diameter of the capillary bore
- D increasing the length of the capillary bore

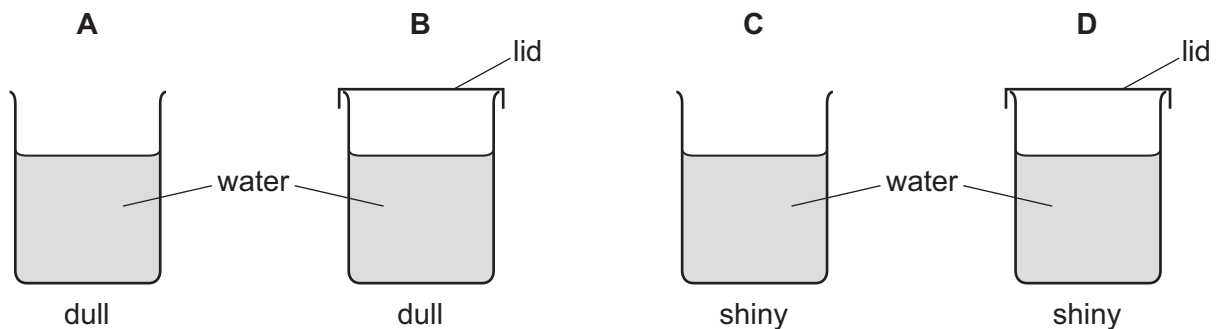
34 Four identical metal cans contain equal quantities of water at  $80^{\circ}\text{C}$ .

The outer surfaces of two of the cans are dull and the outer surfaces of the other two cans are shiny.

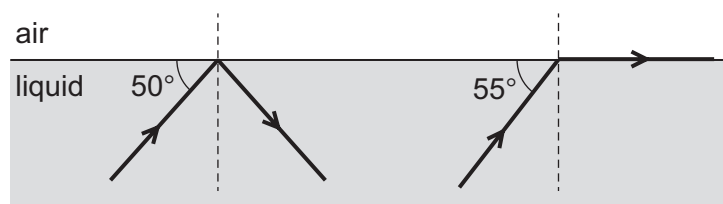
Lids are put on two of the cans, as shown.

All the cans are allowed to cool.

Which can cools the fastest?



35 The diagram represents the surface of a transparent liquid. Two rays of light are travelling in the liquid. They both reach the surface. The path of each ray is shown.



What is the critical angle for this liquid?

- A  $35^{\circ}$
- B  $40^{\circ}$
- C  $50^{\circ}$
- D  $55^{\circ}$

36 A wire is 50 cm long and has a resistance of  $16\ \Omega$ .

A second wire is made of the same material. It is 75 cm long and has twice the cross-sectional area of the first wire.

What is the resistance of the second wire?

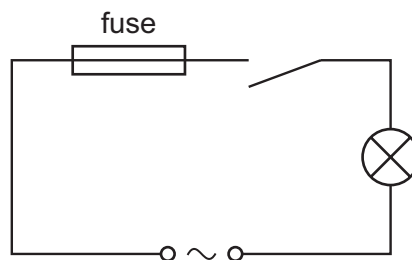
- A  $6.0\ \Omega$
- B  $12\ \Omega$
- C  $32\ \Omega$
- D  $48\ \Omega$

37 Which statements about the current–voltage characteristic of a filament lamp are correct?

- 1 It is a curve.
- 2 It passes through the origin.
- 3 It shows current increasing as voltage increases.

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

38 A student connects the circuit shown.



When the switch is closed the fuse blows and stops the current.

What is a possible reason for this?

- A** The current rating of the fuse is too high.
- B** The current is too large.
- C** The lamp is too dim.
- D** The voltage is too small.

39 A magnet is moved in and out of a coil and an electromotive force (e.m.f.) is induced.

How can the size of the induced e.m.f. be decreased?

- A** Add more turns to the coil.
- B** Move the magnet more quickly.
- C** Move the magnet more slowly.
- D** Turn the magnet around before moving it in and out.

40 A radioactive nucleus emits a  $\beta$ -particle.

What happens to the proton number (atomic number) of the nucleus?

- A It stays the same.
- B It increases by 1.
- C It decreases by 2.
- D It decreases by 4.

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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	<b>Key</b> atomic number atomic symbol name relative atomic mass						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				
11 <b>Na</b> sodium 23	12 <b>Mg</b> magnesium 24							1 <b>H</b> hydrogen 1	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	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.).