



**Cambridge International Examinations**  
Cambridge International General Certificate of Secondary Education

**COMBINED SCIENCE**

**0653/21**

Paper 2 Multiple Choice (Extended)

**October/November 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.

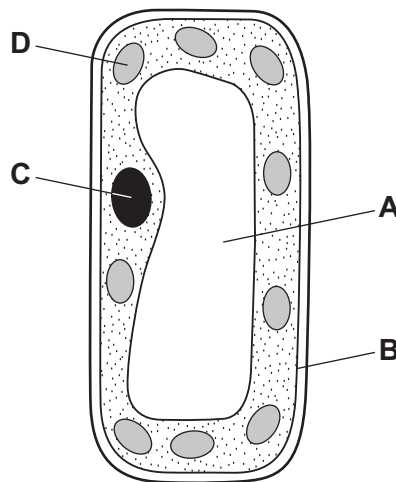
This document consists of **16** printed pages.

1 Which characteristics help to define a living organism?

- A diffusion, movement, respiration
- B excretion, nutrition, sensitivity
- C excretion, reproduction, transpiration
- D growth, inspiration, nutrition

2 The diagram shows a palisade cell.

Which structure converts energy from light into chemical energy?



3 Why does the rate of enzyme activity change when the temperature rises above the optimum temperature?

- A The enzyme has been denatured.
- B The enzyme has been used up.
- C The enzyme molecules are moving too slowly.
- D The enzyme speeds up the rate of the reaction.

4 Which chemical is used to test for a food substance that contains the elements carbon, hydrogen, nitrogen and oxygen?

- A Benedict's solution
- B biuret solution
- C ethanol
- D iodine solution

5 Which letters from the list represent the balanced equation for photosynthesis?

P	$C_6H_{12}O_6$	T	$H_2O$
Q	$6C_6H_{12}O_6$	U	$6H_2O$
R	$CO_2$	V	$O_2$
S	$6CO_2$	W	$6O_2$



6 In which order does food pass through parts of the alimentary canal?

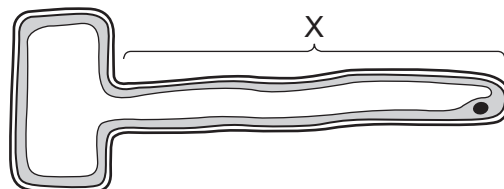
**A** oesophagus → colon → small intestine

**B** small intestine → oesophagus → rectum

**C** small intestine → rectum → anus

**D** stomach → colon → small intestine

7 The diagram shows a plant cell.



What does structure X do?

**A** decreases the surface area of the cell for water and ion absorption

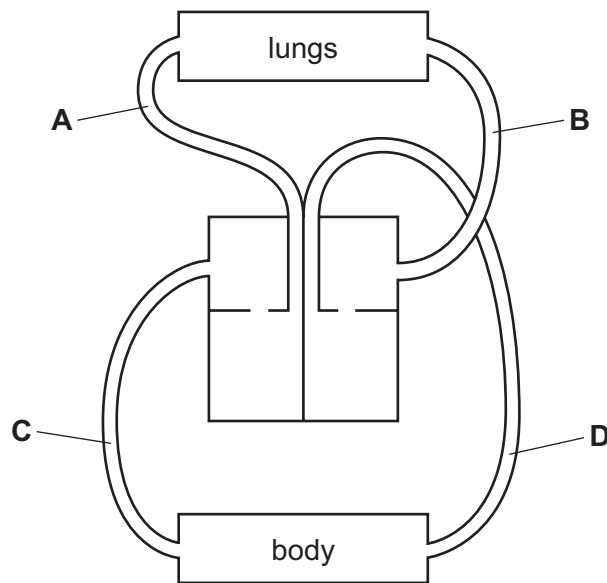
**B** decreases the surface area of the cell for water and sugar absorption

**C** increases the surface area of the cell for water and ion absorption

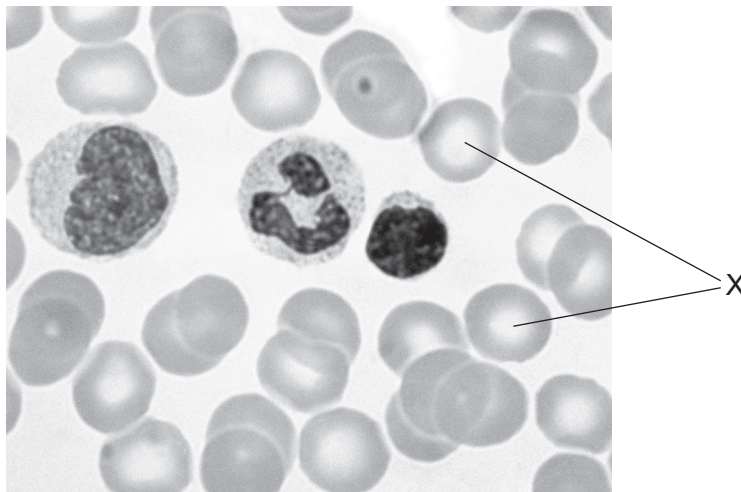
**D** increases the surface area of the cell for water and sugar absorption

- 8 The diagram shows the double circulation of blood around the human body.

Which blood vessel contains blood at the highest pressure?



- 9 The photomicrograph shows a sample of human blood.



What is the function of the cells marked X?

- A antibody formation
- B clotting of blood
- C phagocytosis
- D transport of oxygen

10 Which component of tobacco smoke reduces the ability of haemoglobin to carry oxygen?

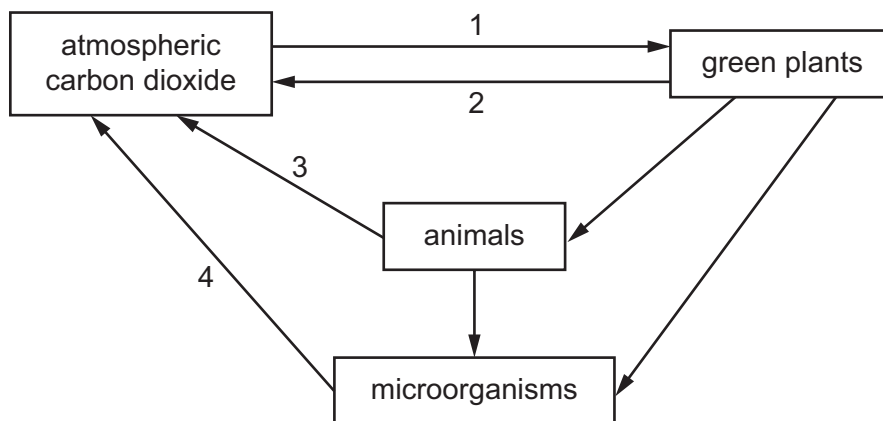
- A carbon monoxide
- B nicotine
- C smoke particles
- D tar

11 During pregnancy, the fetus is contained within the amniotic sac. The amniotic sac contains amniotic fluid.

What is the function of the amniotic fluid?

- A It protects the fetus against knocks and bumps.
- B It provides the fetus with oxygen and nutrients.
- C It removes the fetal waste products.
- D It supplies the fetus with blood.

12 The diagram represents part of the carbon cycle.



Which arrows show where respiration takes place?

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

13 Which gas dissolves in water vapour to produce acid rain?

- A methane
- B nitrogen
- C oxygen
- D sulfur dioxide

14 The formulae of three substances are shown.

substance	formula
methane	CH <sub>4</sub>
water	H <sub>2</sub> O
oxygen	O <sub>2</sub>

Which statement is correct?

- A Methane is made from five different types of atom.
- B Methane, water and oxygen are molecules.
- C Only methane and water are molecules.
- D Oxygen is made from two different types of atom.

15 Which process is used to separate petroleum?

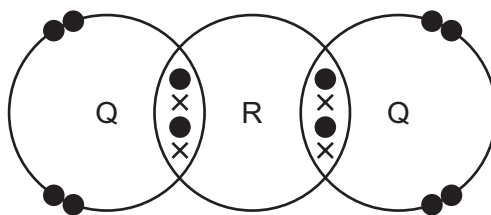
- A crystallisation
- B distillation
- C filtration
- D fractional distillation

16 What is the electronic structure of a chlorine atom, Cl, and of a chloride ion, Cl<sup>-</sup>?

	chlorine atom	chloride ion
A	2,8,6	2,8,8
B	2,8,7	2,8,6
C	2,8,7	2,8,8
D	2,8,8	2,8,7

- 17 Element Q and element R combine to form a covalent compound,  $Q_2R$ .

The arrangement of the outer-shell electrons in the compound is shown.



Which compound has the same arrangement of outer shell electrons as  $Q_2R$ ?

- A** carbon dioxide  
**B** hydrogen chloride  
**C** methane  
**D** water
- 18 Aluminium sulfate contains aluminium ions,  $Al^{3+}$ , and sulfate ions,  $SO_4^{2-}$ .

Iron(II) nitride contains iron(II) ions,  $Fe^{2+}$ , and nitride ions,  $N^{3-}$ .

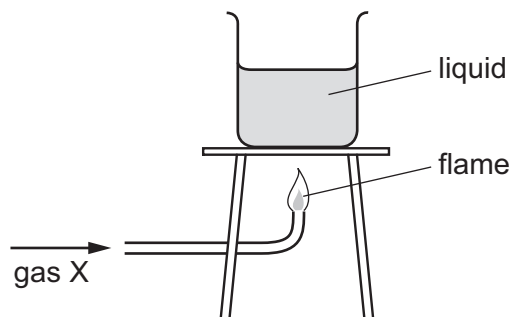
What are the formulae of aluminium sulfate and of iron(II) nitride?

	aluminium sulfate	iron(II) nitride
<b>A</b>	$Al_2(SO_4)_3$	$Fe_2N_3$
<b>B</b>	$Al_2(SO_4)_3$	$Fe_3N_2$
<b>C</b>	$Al_3(SO_4)_2$	$Fe_2N_3$
<b>D</b>	$Al_3(SO_4)_2$	$Fe_3N_2$

- 19 What is produced at the anode during the electrolysis of molten lead(II) bromide?

- A** bromide ions  
**B** bromine  
**C** lead  
**D** lead(II) ions

- 20 The diagram shows gas X burning and heating a liquid.

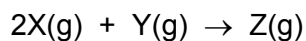


Which row is correct?

	gas X	the burning of gas X is exothermic
<b>A</b>	hydrogen	✓
<b>B</b>	hydrogen	x
<b>C</b>	oxygen	✓
<b>D</b>	oxygen	x

- 21 Gases X and Y react together to form gas Z.

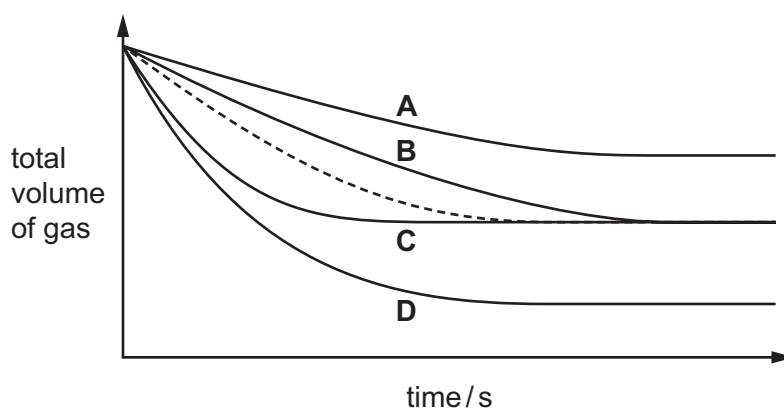
The equation for the reaction is shown.



The total volume of gas is measured as the reaction occurs. The dotted line in the graph shows the results.

The reaction is repeated using the same volumes of X and Y under the same conditions but with the addition of a catalyst.

Which line shows the results for the second experiment?





- 22** Carbon reacts with carbon dioxide at high temperatures.



Which statement about the reaction is correct?

- A** Both carbon and carbon dioxide are oxidised.
  - B** Both carbon and carbon dioxide are reduced.
  - C** The carbon is oxidised and the carbon dioxide is reduced.
  - D** The carbon is reduced and the carbon dioxide is oxidised.
- 23** Excess aqueous barium nitrate is added to dilute sulfuric acid to produce barium sulfate.
- How is barium sulfate obtained from the reaction mixture?
- A** electrolysis
  - B** evaporation
  - C** filtration
  - D** fractional distillation
- 24** Which statement about elements in the Periodic Table is correct?
- A** Barium is a non-metal in Group II and its atoms have two electrons in their outer shells.
  - B** Chlorine is a non-metal in Group VII and its atoms have seven electrons in their outer shells.
  - C** Fluorine is a non-metal in Group VII and its atoms have one electron in their outer shells.
  - D** Sodium is a metal in Group II and its atoms have one electron in their outer shells.
- 25** Which substance is added to the blast furnace to remove acidic impurities during the extraction of iron?
- A** calcium silicate
  - B** carbon monoxide
  - C** coke
  - D** limestone

**26** P, Q, R and S are four gases found in clean air.

P is very unreactive.

Q makes up 21% of the air.

R makes up 78% of the air.

S is formed when fossil fuels are burned.

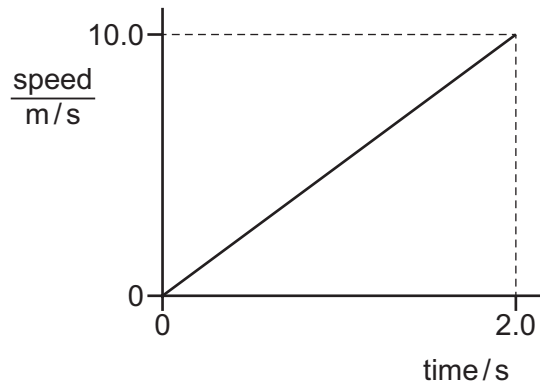
Which row is correct?

	P	Q	R	S
<b>A</b>	argon	nitrogen	oxygen	carbon dioxide
<b>B</b>	argon	oxygen	nitrogen	carbon dioxide
<b>C</b>	carbon dioxide	oxygen	nitrogen	argon
<b>D</b>	carbon dioxide	nitrogen	oxygen	argon

**27** Which process is an example of thermal decomposition?

- A** cracking an alkane
- B** electrolysis of molten lead(II) bromide
- C** extraction of iron in a blast furnace
- D** fractional distillation of petroleum

- 28 The diagram is a speed-time graph for a moving object.



What is the acceleration of the object and what distance does it travel in 2.0 s?

	<u>acceleration</u> $\text{m/s}^2$	distance travelled / m
<b>A</b>	5.0	10
<b>B</b>	5.0	20
<b>C</b>	20	10
<b>D</b>	20	20

- 29 A piece of scientific equipment is taken on a space ship from Earth to a distant planet.

Which property or properties of the equipment **must** remain the same on the distant planet?

	mass	weight
<b>A</b>	✓	✓
<b>B</b>	✓	✗
<b>C</b>	✗	✓
<b>D</b>	✗	✗

key

✓ = must be the same

✗ = does not have to be the same

- 30 A student stretches a steel spring by hanging a load on it. The measurements for the extension of the spring are shown in the table.

load / N	1.0	2.0	3.0	4.0	5.0	6.0
extension / cm	0.5	1.0	1.5	2.0	2.5	3.0

What is the value for the spring constant  $k$  of the spring?

- A** 0.50 N/cm      **B** 1.0 N/cm      **C** 2.0 N/cm      **D** 18 N/cm

- 31** A panel of solar cells is 15% efficient. The power supplied by the Sun to the panel is 40 kW.

What is the output power of the panel?

- A** 2.7 kW      **B** 6.0 kW      **C** 25 kW      **D** 34 kW

- 32** When a liquid evaporates, which molecules escape and what happens, if anything, to the temperature of the remaining liquid?

	molecules escaping	temperature of remaining liquid
<b>A</b>	less energetic molecules	decreases
<b>B</b>	less energetic molecules	stays the same
<b>C</b>	more energetic molecules	decreases
<b>D</b>	more energetic molecules	stays the same

- 33** A teacher explains about transfer of thermal energy.

When air is .....X....., it becomes less dense and rises.

This helps to explain transfer of thermal energy by .....Y..... .

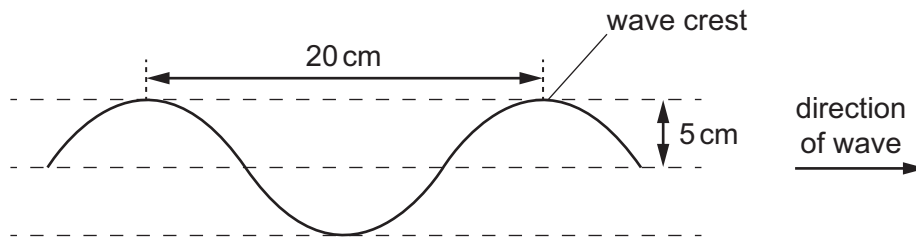
Which words complete gaps X and Y?

	X	Y
<b>A</b>	cooled	conduction
<b>B</b>	cooled	convection
<b>C</b>	heated	conduction
<b>D</b>	heated	convection

- 34 The diagram shows a section of a rope.

Four wave crests pass a point on the rope every second.

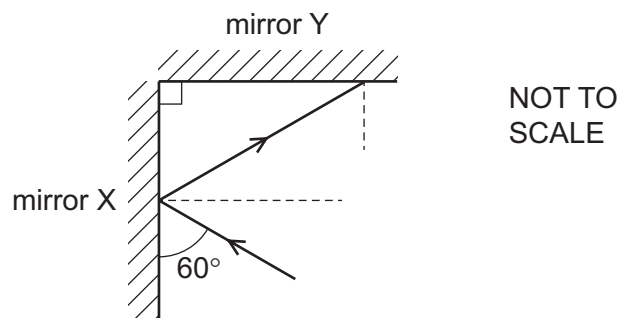
Each wave crest travels 80 cm in one second.



What is the speed of the wave?

- A 4.0 cm/s      B 5.0 cm/s      C 20 cm/s      D 80 cm/s
- 35 The diagram shows a ray of light striking a plane mirror X.

Plane mirror Y is at  $90^\circ$  to mirror X.



What is the angle of reflection at mirror Y?

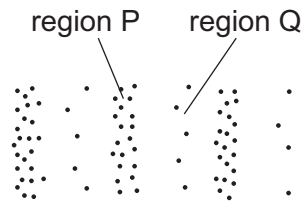
- A  $30^\circ$       B  $60^\circ$       C  $90^\circ$       D  $120^\circ$
- 36 Electromagnetic waves are used to scan passengers' luggage before they board an aeroplane.

Electromagnetic waves are also used in a television remote controller.

Which type of electromagnetic wave is used for each of these purposes?

	scanning luggage	television remote controller
A	radio waves	infra-red waves
B	radio waves	ultraviolet waves
C	X-rays	infra-red waves
D	X-rays	ultraviolet waves

- 37 The diagram represents a wave in air. Molecules are closer together in region P than they are in region Q.



What are the names of regions P and Q, and which type of wave is represented?

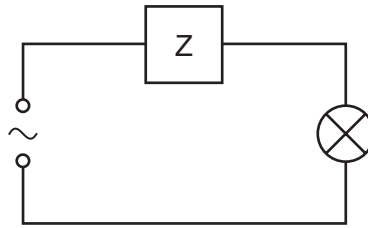
	region P	region Q	type of wave
<b>A</b>	compression	rarefaction	longitudinal
<b>B</b>	compression	rarefaction	transverse
<b>C</b>	rarefaction	compression	longitudinal
<b>D</b>	rarefaction	compression	transverse

- 38 The resistance of a wire depends on its length and on its diameter.

Which row shows two changes that **both** increase the resistance of the wire?

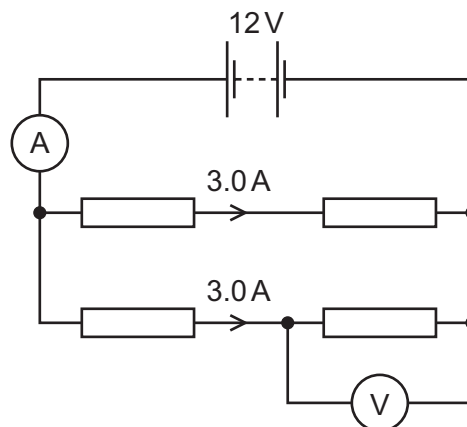
	change 1	change 2
<b>A</b>	decrease the length	decrease the diameter
<b>B</b>	decrease the length	increase the diameter
<b>C</b>	increase the length	decrease the diameter
<b>D</b>	increase the length	increase the diameter

- 39 The device Z in this circuit is designed to cut off the electricity supply **automatically** if too much current flows.



What is device Z?

- A** a fuse  
**B** a resistor  
**C** a switch  
**D** an ammeter
- 40 The diagram shows a circuit containing a 12 V battery, four identical resistors, an ammeter and a voltmeter. Two values of current are shown.



What is the reading on the ammeter and what is the reading on the voltmeter?

	reading on ammeter / A	reading on voltmeter / V
<b>A</b>	3.0	6.0
<b>B</b>	3.0	12
<b>C</b>	6.0	6.0
<b>D</b>	6.0	12

The Periodic Table of Elements

Group																			
I	II	Key										III	IV	V	VI	VII	VIII		
		atomic number atomic symbol name relative atomic mass										1 H hydrogen 1							
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		
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 <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
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 —

actinoids

The volume of one mole of any gas is 24 dm<sup>3</sup> at room temperature and pressure (r.t.p.).