



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

**COMBINED SCIENCE**

**0653/22**

Paper 2 Multiple Choice (Extended)

**May/June 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.

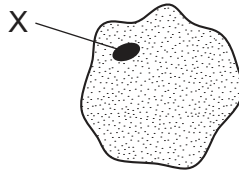
This document consists of **16** printed pages.

- 1 A person moves their hand away from a hot object.

Which characteristic of living organisms is this?

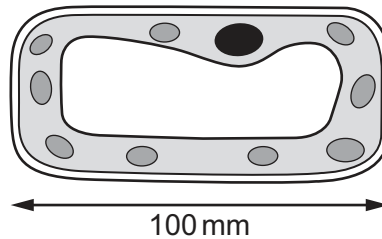
- A growth
- B nutrition
- C reproduction
- D sensitivity

- 2 The diagram shows an animal cell under a light microscope.



What is the function of part X?

- A to carry out photosynthesis
  - B to let molecules in and out of the cell
  - C to store and pass on cell information
  - D to support and protect the cell
- 3 The diagram shows an image of a plant cell that has been magnified.



The magnification is  $\times 200$ .

What is the length of the actual cell?

- A 0.2 mm
- B 0.5 mm
- C 2 mm
- D 20 000 mm

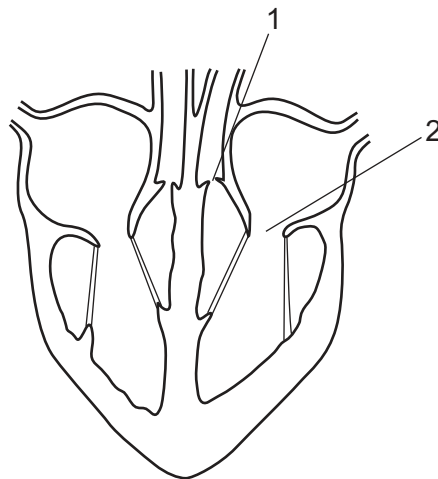
4 Which statement about enzymes is correct?

- A They are killed by high temperatures.
- B They are made from amino acids.
- C They are unaffected by pH.
- D They are used up in biological reactions.

5 Which row matches the adaptation of a root hair cell to its function?

	adaptation	function
<b>A</b>	large surface area	uptake of water and glucose
<b>B</b>	large surface area	uptake of water and ions
<b>C</b>	small surface area	uptake of water and glucose
<b>D</b>	small surface area	uptake of water and ions

6 The diagram shows a section through the heart.

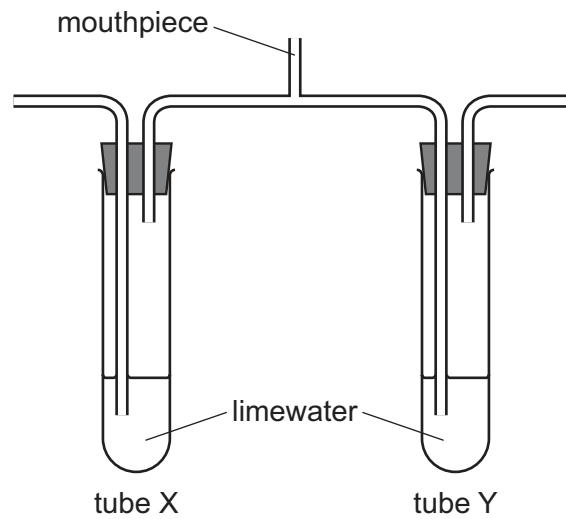


The ventricles contract and blood is forced into the arteries.

What is the state of valves 1 and 2 when this happens?

	valve 1	valve 2
<b>A</b>	closed	closed
<b>B</b>	closed	open
<b>C</b>	open	closed
<b>D</b>	open	open

7 The diagram shows apparatus at the start of a breathing experiment.



A person breathes in and out through the mouthpiece for a short time.

Which row shows the results?

	limewater in tube X	limewater in tube Y
<b>A</b>	stays clear	stays clear
<b>B</b>	stays clear	turns cloudy
<b>C</b>	turns cloudy	stays clear
<b>D</b>	turns cloudy	turns cloudy

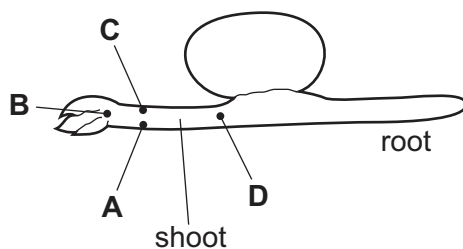
8 How does mucus benefit the gas exchange system?

- A** It absorbs carbon monoxide before it reaches the alveoli.
- B** It prevents friction between the air and the trachea.
- C** It removes the nicotine in cigarette smoke.
- D** It traps pathogens.

- 9 The diagram shows a seedling with its root and shoot horizontal.

The seedling is kept moist for three days.

Where will the greatest concentration of auxin be found?



- 10 Which substance is at a higher concentration in the blood on the fetal side of the placenta than in the blood on the mother's side of the placenta?

- A amino acids
- B carbon dioxide
- C glucose
- D oxygen

- 11 Which type of blood cell is affected by the human immuno-deficiency virus (HIV) and what effect does the virus have on those cells?

	type of blood cell	effect on the blood cell
A	red	prevents them carrying oxygen
B	red	stops them from making the blood clot
C	white	stops them from performing phagocytosis
D	white	reduces antibody production

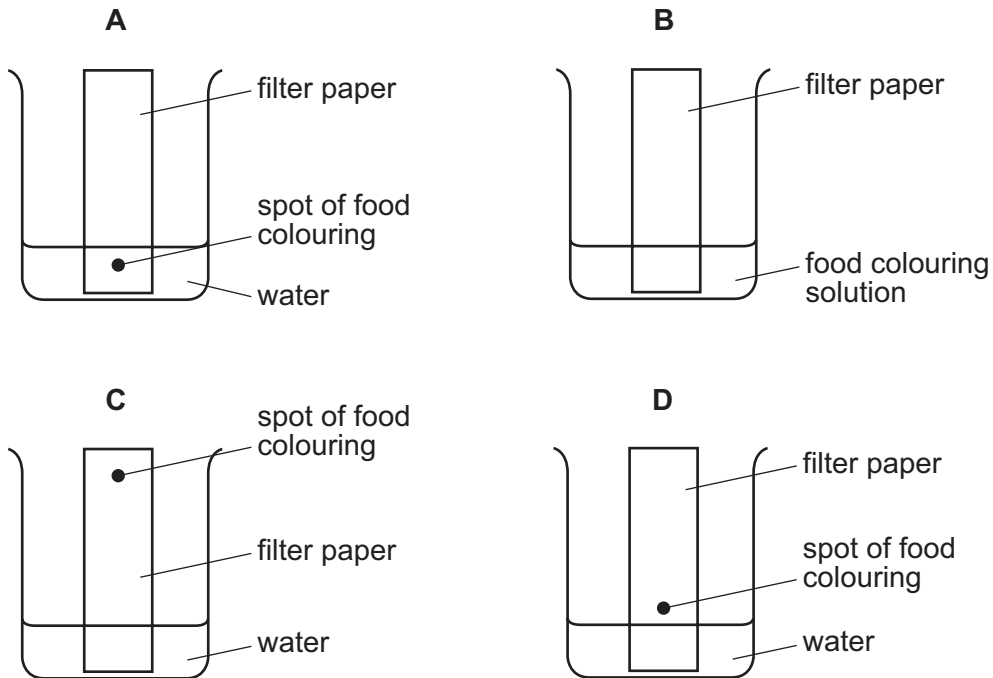
- 12 What is an ecosystem?

- A a network of inter-connected food chains
- B a specific area in which a plant or an animal lives
- C all the plants and animals living within a specific area
- D the interactions between all living organisms, in a specific area, and their environment

13 What is an undesirable effect of overuse of fertilisers in agriculture?

- A acid rain
- B deforestation
- C eutrophication
- D global warming

14 Which diagram shows how a mixture of dyes in a food colouring are separated?



15 A mixture contains hydrogen, helium, neon and oxygen.

What describes this mixture?

- A elements and compounds
- B elements only
- C molecules and compounds
- D molecules only

16 Which row describes the electronic structures of a chlorine atom and of a sodium ion?

	chlorine atom	sodium ion
<b>A</b>	2,8,7	2,8
<b>B</b>	2,8,7	2,8,8
<b>C</b>	2,8,8	2,8
<b>D</b>	2,8,8	2,8,8

17 Aluminium ions have the formula  $Al^{3+}$ .

Oxide ions have the formula  $O^{2-}$ .

What is the formula of aluminium oxide?

- A**  $AlO$                       **B**  $AlO_2$                       **C**  $Al_2O_3$                       **D**  $Al_3O_2$

18 Aqueous copper chloride is electrolysed using inert electrodes.

Which row describes what happens at each electrode?

	cathode	anode
<b>A</b>	chloride ions gain electrons to form chlorine	copper ions lose electrons to form copper
<b>B</b>	chloride ions lose electrons to form chlorine	copper ions gain electrons to form copper
<b>C</b>	copper ions gain electrons to form copper	chloride ions lose electrons to form chlorine
<b>D</b>	copper ions lose electrons to form copper	chloride ions gain electrons to form chlorine

19 Methane reacts with oxygen, releasing heat.

Which statement explains the energy changes in this reaction?

- A** Chemical energy is changed into thermal energy.  
**B** Energy is made in the reaction.  
**C** The heat released increases the temperature of the surroundings.  
**D** The reaction is endothermic.

20 Magnesium ribbon reacts with dilute hydrochloric acid to form hydrogen gas.

Which change increases the rate of the reaction?

- A adding water to the mixture
- B trapping the hydrogen gas
- C using a lower temperature
- D using powdered magnesium

21 In which reactions is the underlined substance oxidised?

- 1 iron when it rusts
- 2 methane when it burns in air
- 3 copper oxide when it reacts with carbon

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

22 Substance X is warmed with aqueous sodium hydroxide and aluminium.

A gas is produced which turns damp red litmus paper blue.

Which anion is present in X?

- A carbonate
- B hydroxide
- C nitrate
- D sulfate



23 The elements in Group VII of the Periodic Table are shown.

fluorine

chlorine

bromine

iodine

astatine

Which statement is **not** correct?

- A Astatine has a lower melting point than iodine.
- B Chlorine can displace iodine from an iodide solution.
- C Fluorine is more reactive than astatine.
- D Iodine vapour has a darker colour than fluorine gas.

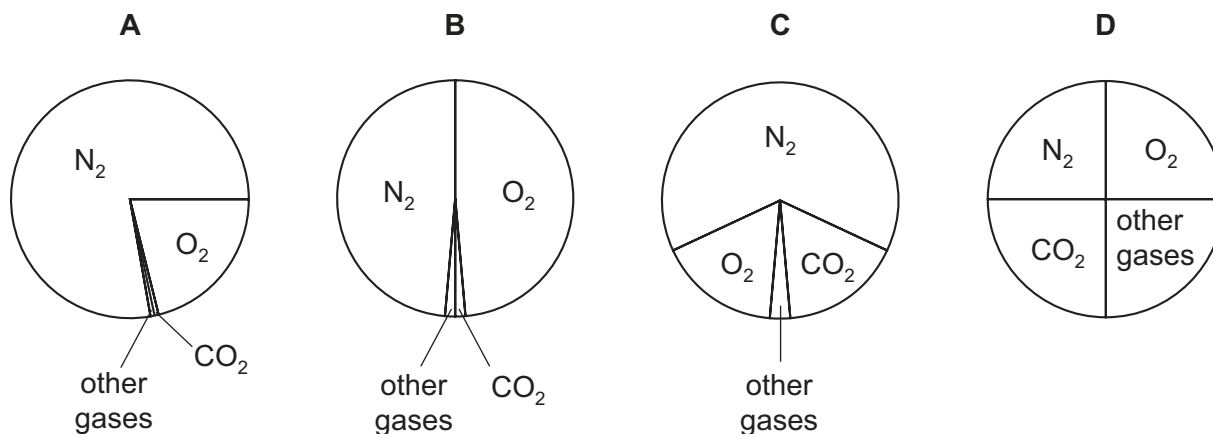
24 What is an alloy?

- A a compound containing two metallic elements
- B a compound containing two non-metallic elements
- C a mixture containing two metallic elements
- D a mixture containing two non-metallic elements

25 Which pair of substances produces a metal when they are mixed together?

- A copper and aqueous iron(II) ions
- B iron and aqueous zinc ions
- C magnesium and aqueous copper(II) ions
- D zinc and aqueous magnesium ions

26 Which pie chart shows the proportions of gases in clean air?

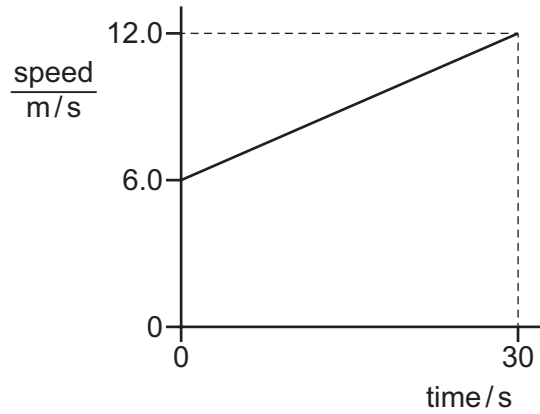


27 Petroleum is separated into different fractions by fractional distillation.

Which statement about fractional distillation is **not** correct?

- A** Larger molecules have stronger covalent bonds between their atoms.
- B** The boiling point of hydrocarbons increases with the size of the molecules.
- C** The different fractions have different boiling points.
- D** The smaller molecules have weaker intermolecular attractive forces between them.

28 The diagram shows the speed-time graph for a vehicle.



What is the acceleration of the vehicle, and how far does it travel in 30 s?

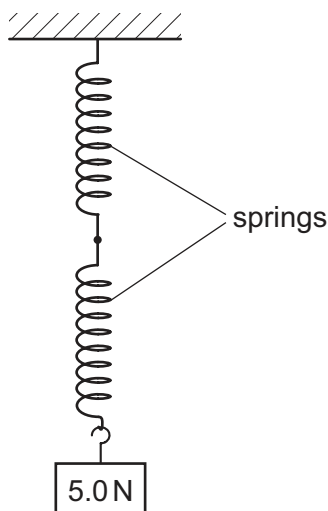
	<u>acceleration</u> m/s <sup>2</sup>	distance travelled/m
<b>A</b>	0.20	180
<b>B</b>	0.20	270
<b>C</b>	0.40	180
<b>D</b>	0.40	270

29 Which row shows the unit for force, the unit for mass and the unit for weight?

	force	mass	weight
<b>A</b>	kg	kg	N
<b>B</b>	kg	N	kg
<b>C</b>	N	kg	N
<b>D</b>	N	N	kg

- 30 A spring obeys Hooke's law. A load of 10N hangs from the spring and causes the spring to extend by 12 mm.

Two springs, identical to the first one, are now joined as shown. A load of 5.0N is hung from the springs.



What is the total extension of the combination of the two springs?

- A 3.0 mm      B 6.0 mm      C 12 mm      D 24 mm
- 31 A brick of mass of 3.0 kg rests on a shelf. The brick drops off the shelf. The brick hits the ground at a speed of 8.0 m/s. Air resistance can be ignored.

The acceleration of free fall  $g$  is  $10 \text{ m/s}^2$ .

How much kinetic energy did the brick have just before it hit the ground, and how much potential energy did the brick have when it was on the shelf?

	kinetic energy before hitting ground / J	potential energy on shelf / J
<b>A</b>	24	24
<b>B</b>	24	96
<b>C</b>	96	0
<b>D</b>	96	96

32 Two cylinders contain the same type of gas.

In which case **must** the gas in one cylinder be at a higher temperature than the gas in the other cylinder?

- A In one cylinder the gas molecules are moving faster.
- B In one cylinder the gas occupies a smaller volume.
- C In one cylinder there is a greater number of gas molecules.
- D In one cylinder there is a greater spacing between the gas molecules.

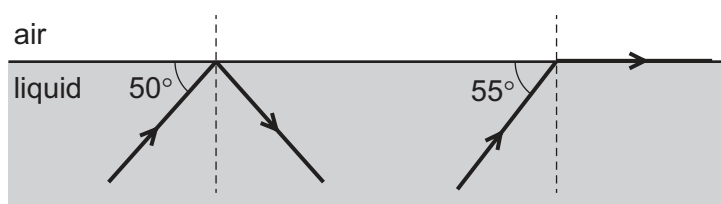
33 Which surface is a better absorber of infra-red radiation, and which surface is a better emitter of infra-red radiation?

	better absorber	better emitter
<b>A</b>	black surface	black surface
<b>B</b>	black surface	white surface
<b>C</b>	white surface	black surface
<b>D</b>	white surface	white surface

34 What can cause the speed of a wave to change?

- A either reflection or refraction
- B reflection only
- C refraction only
- D neither reflection nor refraction

35 The diagram represents the surface of a transparent liquid. Two rays of light are travelling within 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 Which type of electromagnetic wave is used in airport security scanners?

- A gamma-rays
- B microwaves
- C radio waves
- D X-rays

37 An electronic circuit in a fire alarm makes a loudspeaker vibrate alternately at two different frequencies.

Which pair of frequencies is suitable to use in the alarm to alert people to the danger of fire?

- A 1.5 Hz and 15 Hz
- B 15 Hz and 150 000 Hz
- C 150 Hz and 15 000 Hz
- D 150 000 Hz and 15 000 000 Hz

38 Four wires are made from the same material but have different lengths and diameters.

Which wire has the least resistance?

	length / cm	diameter / mm
A	50	0.10
B	50	0.20
C	100	0.10
D	100	0.20

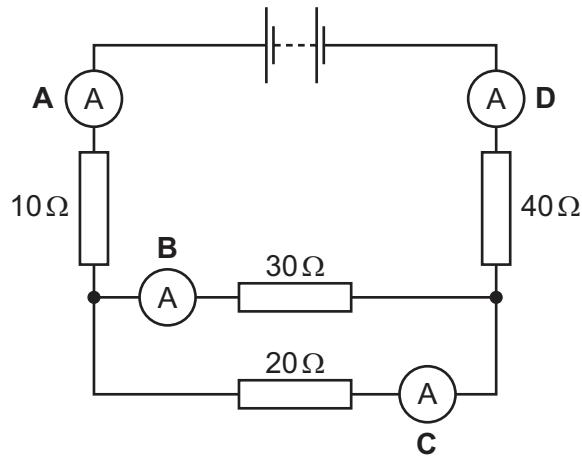
39 A 12 V power supply is connected to a  $6.0\ \Omega$  resistor. This causes a current in the resistor.

How much thermal energy is produced in the resistor in 5.0 minutes?

- A 120 J
- B 600 J
- C 7200 J
- D 21 600 J

40 The diagram shows a circuit containing four resistors and four ammeters.

Which ammeter has the smallest reading?



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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>										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
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.).