Cambridge IGCSE

Cambridge International Examinations
Cambridge International General Certificate of Secondary Education

CANDIDATE NAME									
CENTRE NUMBER						CANDIDATE NUMBER				

6226960290

COMBINED SCIENCE **0653/41**

Paper 4 (Extended) **May/June 2018**

1 hour 15 minutes

Candidates answer on the Question Paper.

No Additional Materials are required.

READ THESE INSTRUCTIONS FIRST

Write your Centre number, candidate number and name on all the work you hand in.
Write in dark blue or black pen.
You may use an HB pencil for any diagrams or graphs.
Do not use staples, paper clips, glue or correction fluid.
DO **NOT** WRITE IN ANY BARCODES.

Answer **all** questions.
Electronic calculators may be used.
You may lose marks if you do not show your working or if you do not use appropriate units.
A copy of the Periodic Table is printed on page 20.

At the end of the examination, fasten all your work securely together.
The number of marks is given in brackets [ ] at the end of each question or part question.

This document consists of **20** printed pages.

CAMBRIDGE International Examinations

1 **(a)** Table 1.1 shows four substances found in food, and elements they may contain.

Complete Table 1.1 by placing a tick (✓) in the box if the elements shown are contained in the substances.

Table 1.1

substance in food	element			
	carbon	hydrogen	nitrogen	oxygen
carbohydrate				
fat				
protein				
water				

[4]

(b) Health problems can occur if a person does not eat a healthy diet.

Describe how a person can improve their diet if they suffer from constipation.

Explain your answer.

.....

.....

.....[2]

(c) A poor diet over a long time can also contribute to coronary heart disease.

Complete the following sentences using the words from the list.

Each word may be used once, more than once or not at all.

cilia **fatty** **mucus** **protein**

smoking **stress** **unhealthy**

Coronary heart disease occurs when the coronary arteries become narrowed by ..... deposits. In addition to a poor diet possible causes of coronary heart disease are ..... and ..... .

[3]

(d) Coronary heart disease can be treated by inserting a stent into a narrowed coronary artery.

Fig. 1.1 shows a stent inside a coronary artery. Blood can flow freely through the stent.

narrowed coronary artery

coronary artery with stent inserted

Fig. 1.1

(i) Describe the effect of the stent on the rate of blood flow through the coronary artery.

Explain your answer.

.....

.....

.....[1]

(ii) Explain how the stent can benefit the heart muscle.

.....

.....

.....

.....[2]

2 **(a)** A student investigates the relative reactivity of different metals.

She places cleaned pieces of each metal in separate metal chloride solutions, as shown in Fig. 2.1.

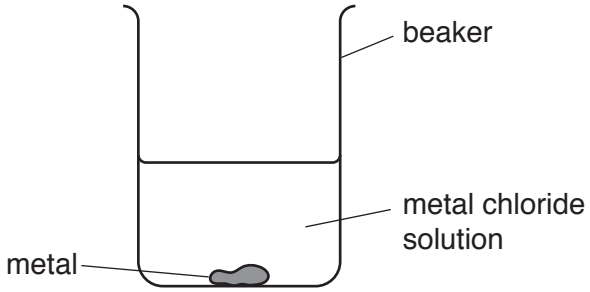


Fig. 2.1

She records her observations in Table 2.1.

Table 2.1

metal	metal chloride solution			
	aluminium chloride	lead chloride	tin chloride	zinc chloride
aluminium	–	✓	✓	✓
lead	✗	–	✗	✗
tin	✗	✓	–	✗
zinc	✗	✓	✓	–

key: ✓ reaction occurs
✗ no reaction
– metal not placed into solution

(i) Explain why the student does not use all combinations of metal and metal chloride solution.

.....

.....

.....[1]

(ii) Deduce the order of reactivity of the four metals, from most reactive to least reactive.

..... most reactive

.....

.....

..... least reactive

[2]

(b) Another metal, magnesium, reacts with dilute hydrochloric acid.

During this reaction, hydrogen gas and a salt are produced.

(i) Name the salt.

.....[1]

(ii) Construct the balanced symbol equation for this reaction.

Include state symbols.

.....[2]

(iii) Complete Fig. 2.2 to show apparatus used to collect the gas produced and measure its volume.

List the additional apparatus needed to measure the rate of this reaction.

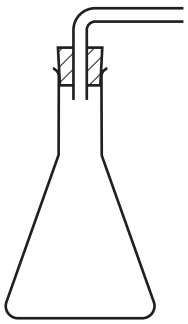


Fig. 2.2

apparatus .....
[2]

(c) An atom of aluminium is represented by:

$$^{27}_{13}Al$$

(i) Define *mass number*.

.....

.....[1]

(ii) Complete Fig. 2.3 to show the electronic structure of an atom of aluminium.

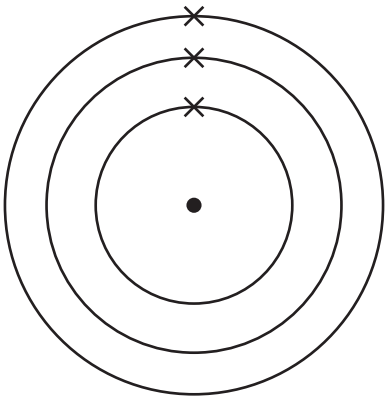


Fig. 2.3

[2]

3 Fig. 3.1 shows an airship carrying a load of weight **W**.

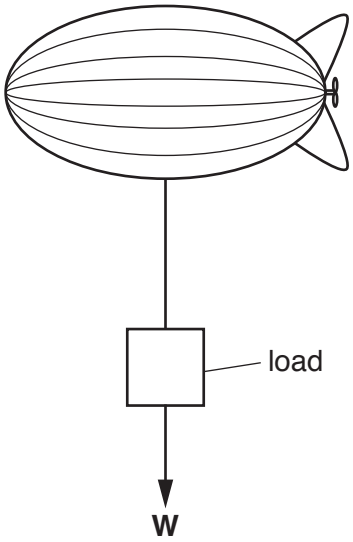


Fig. 3.1

(a) The airship and load are moving along horizontally on a calm day with no wind.

(i) On Fig. 3.1 draw another force arrow to show how the vertical forces acting on the load are balanced. [1]

(ii) At one time in its journey, the airship is moving and all of the forces acting on the airship are balanced.

Describe the motion of the airship at this time.

.....

.....[1]

(b) The airship moves at a constant height.

Fig. 3.2 shows a speed-time graph for part of the journey.

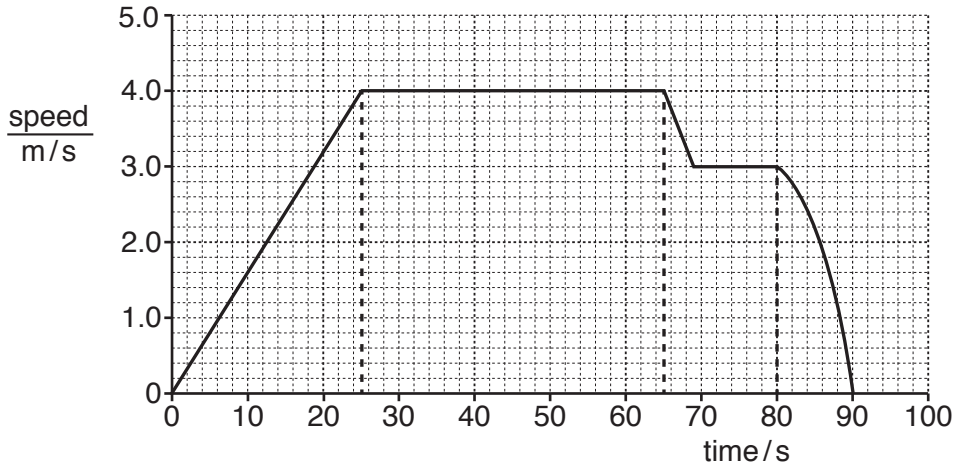


Fig. 3.2

(i) Use terms from the list to complete the statements below.

Each term may be used once, more than once or not at all.

changing acceleration **constant acceleration** **constant speed**

Between 0 s and 25 s the airship travels with

..... .

Between 25 s and 65 s the airship travels with

..... .

Between 80 s and 90 s the airship travels with

..... .

[1]

(ii) Calculate how far the airship travelled in the first 65 s of its journey.

Show your working.

distance = ... m [2]

(c) The load is a solid metal cube of density 7000 kg / m^3. Each side of the cube measures 2.0 m.

Calculate the mass of the metal cube.

State any formula you use and show your working.

mass = ... kg [3]

4 **(a)** Fig. 4.1 shows three leaves **P**, **Q** and **R**. The leaves are of similar size. They are all taken from the same type of plant on a sunny day.

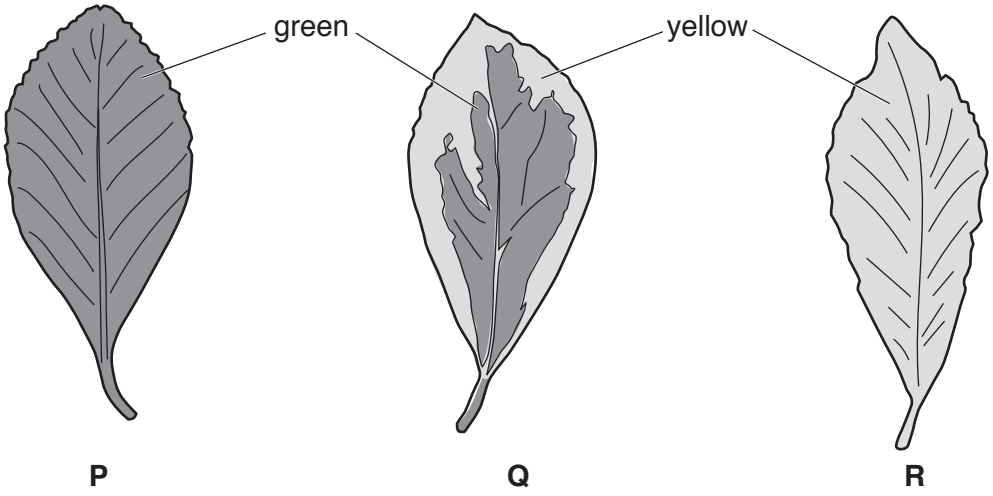


Fig. 4.1

(i) Suggest which leaf traps the most light energy.

Explain your answer.

leaf .....

explanation .....

.....

[1]

(ii) Describe in detail what happens to the light energy that is trapped in the leaves.

.....

.....

.....[2]

(b) All cells of plants need a source of glucose for aerobic respiration.

(i) State the balanced symbol equation for aerobic respiration.

.....[2]

(ii) Suggest how root cells are supplied with glucose.

.....

.....

.....[2]

5 **(a)** Ethene is manufactured by cracking larger hydrocarbon molecules.

(i) State what is meant by a *hydrocarbon*.

.....

.....[2]

(ii) Complete the dot-and-cross diagram in Fig. 5.1 to show the bonding electrons in a molecule of ethene, C_2H_4.

C C

Fig. 5.1

[2]

(iii) Describe a test to distinguish between ethane and ethene.

State the result for each.

test .....

ethane .....

ethene .....

[2]

(b) During the complete combustion of hydrocarbons, carbon dioxide is formed.

(i) The proportion of carbon dioxide in air is increasing.

Explain why this gives cause for concern.

.....

.....[1]

(ii) The combustion of hydrocarbons is an exothermic change.

Explain what is meant by *exothermic*.

Use ideas about energy transformations in your answer.

.....

.....

.....[2]

6 Fig. 6.1 shows a man watching television. He changes the channel with a remote control. The channel he now watches is showing a hot-air balloon high in the sky.

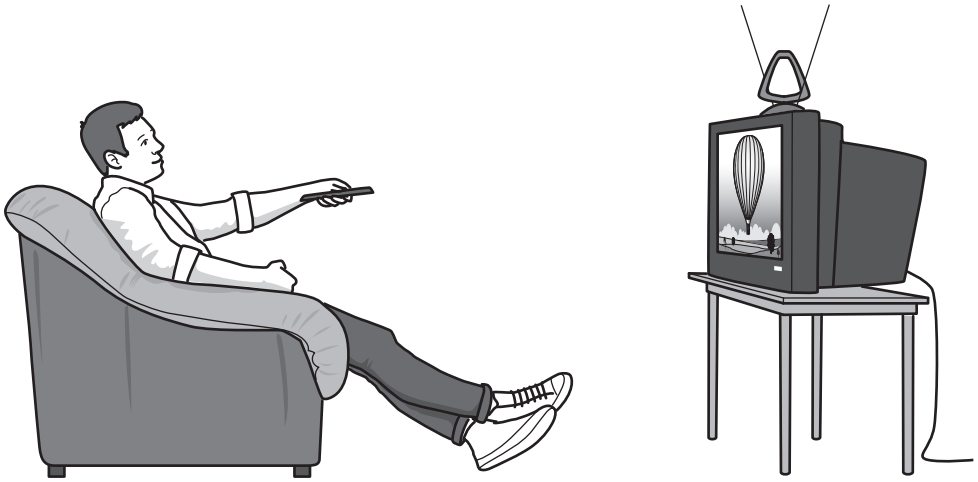


Fig. 6.1

(a) Fig. 6.2 shows an incomplete electromagnetic spectrum.

On Fig. 6.2 write in their correct boxes the names of the parts of the electromagnetic spectrum used for

- television transmission,
- changing the channel,
- watching the television.

Draw a line to link each use to the correct part of the spectrum you have named. One line has been completed for you.

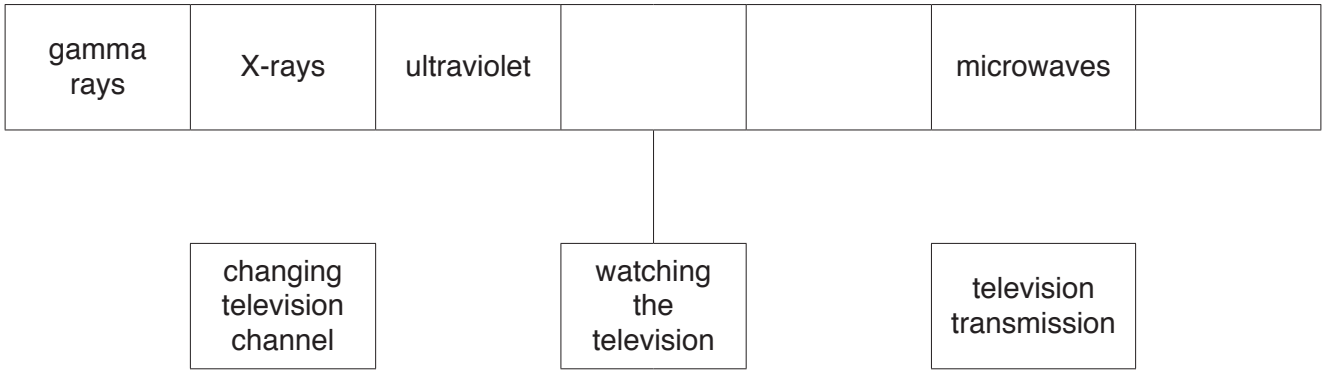


Fig. 6.2

[3]

(b) Fig. 6.3 shows a hot-air balloon being prepared for flight. A fuel burner produces hot gases. The balloon fills with the hot gases and the balloon rises up into the air.

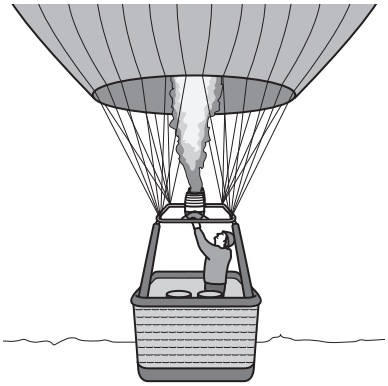


Fig. 6.3

(i) State the name of the method of thermal energy transfer from the fuel burner upwards into the balloon.

.....[1]

(ii) Explain in terms of density changes why this method of thermal energy transfer fills the balloon with the hot gases.

.....

.....

.....

.....[2]

(iii) Explain in terms of the motion of molecules, and the forces and distances between them, why the density of a gas changes on heating.

.....

.....

.....

.....

.....[3]

7 **(a)** Fig. 7.1 shows a food web in a garden.

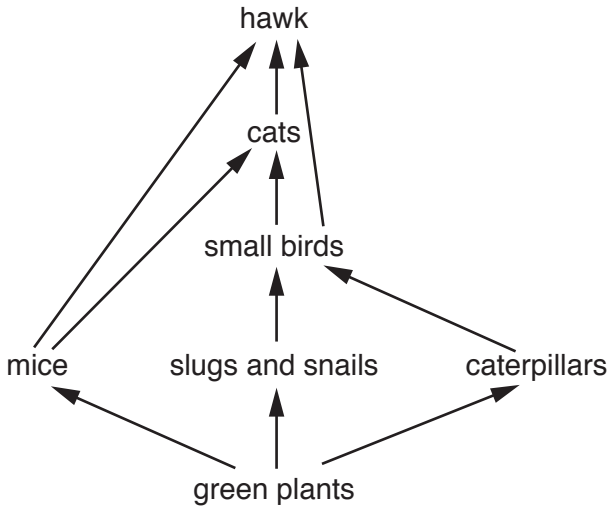


Fig. 7.1

(i) Using information in Fig. 7.1, draw a complete food chain consisting of only **four** organisms.

[2]

(ii) Name **all** organisms that feed at the same trophic level as the small birds.

.....[2]

(b) **(i)** The arrows show the transfer of chemical energy from one organism to another.

State **two** reasons why not all of the energy is transferred from the cat to the hawk.

1. .....

2. .....
[2]

(ii) Explain why there are not usually more than five trophic levels in a food chain.

.....

.....

.....[1]

8 **(a)** A student tries to make lead from a sample of solid lead(II) bromide using the electrolysis apparatus shown in Fig. 8.1.

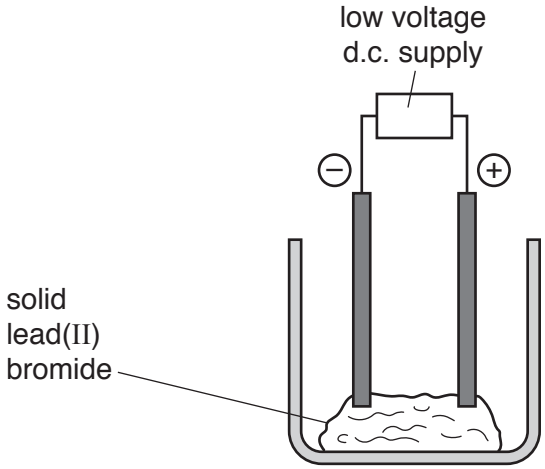


Fig. 8.1

This electrolysis does not work.

(i) Suggest a change that the student can make to the lead(II) bromide so that the electrolysis does work.

.....[1]

(ii) Explain why the electrolysis of solid lead(II) bromide does not work.

Use ideas about ions in your answer.

.....

.....[1]

(b) **(i)** Iron is extracted from its ore using carbon in an industrial process.

Name the industrial reaction vessel used.

.....[1]

(ii) Iron can be extracted from its ore using carbon.

Calcium, a Group II metal, cannot be extracted from its ore using carbon.

Explain this difference.

Use ideas about the reactivity of carbon and metals in your answer.

.....

.....

.....[2]

(c) (i) Metal **X** forms a coloured compound which acts as a catalyst.

Name the collection of metals in the Periodic Table which includes **X**.

.....[1]

(ii) Gas **Y** is an element that is used as an inert atmosphere in lamps.

Name the group of elements in the Periodic Table which includes **Y**.

.....[1]

9 Fig. 9.1 shows a small electric cooker with two hot plates.

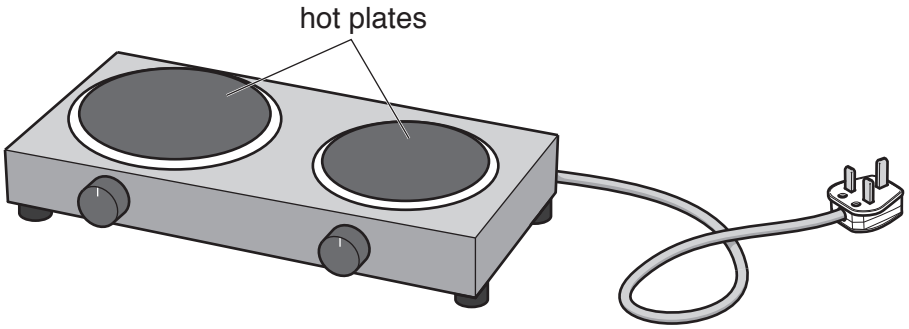


Fig. 9.1

The cooker is connected to a 240 V supply.

The plug contains a fuse with a rating of 13 A.

Each hot plate is controlled by a switch and a variable resistor.

Each hot plate can be turned on and off and controlled without affecting the other hot plate.

(a) (i) In Table 9.1 draw the circuit symbols for each component used in the cooker circuit.

Table 9.1

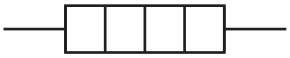
component	fuse	switch	variable resistor
symbol			

[2]

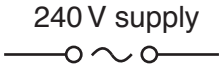
(ii) Name the type of circuit connection that will allow each hot plate to be controlled separately by its own switch.

.....[1]

(iii) Use the information about the cooker to draw a circuit diagram for the cooker.

Use the circuit symbol for a heater to represent a hot plate: 

The circuit diagram has been started for you.



[4]

(b) The larger hot plate is rated at a maximum of 1.5 kW, and the smaller hot plate is rated at a maximum of 1.0 kW.

Show by calculation that the 13 A fuse in the plug will not blow when the cooker is used with both hot plates at maximum rating.

State the formula you use and show your working.

formula

working

[3]

The Periodic Table of Elements

Group I	Group II						Group III	Group IV	Group V	Group VI	Group VII	Group VIII
					1 H hydrogen 1							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
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 –		

Key

atomic number
atomic symbol
name
relative atomic mass

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.).