UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS
International General Certificate of Secondary Education

CANDIDATE NAME									
CENTRE NUMBER						CANDIDATE NUMBER			

COMBINED SCIENCE **0653/03**

Paper 3 (Extended) **October/November 2009**

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 a soft pencil for any diagrams, graphs, tables or rough working.
Do not use staples, paper clips, highlighters, glue or correction fluid.
DO **NOT** WRITE IN ANY BARCODES.

Answer **all** questions.
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.

For Examiner's Use	
1	
2	
3	
4	
5	
6	
7	
8	
9	
Total	

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

1 Fig. 1.1 shows a transverse section of part of a leaf. The arrows show water movement.

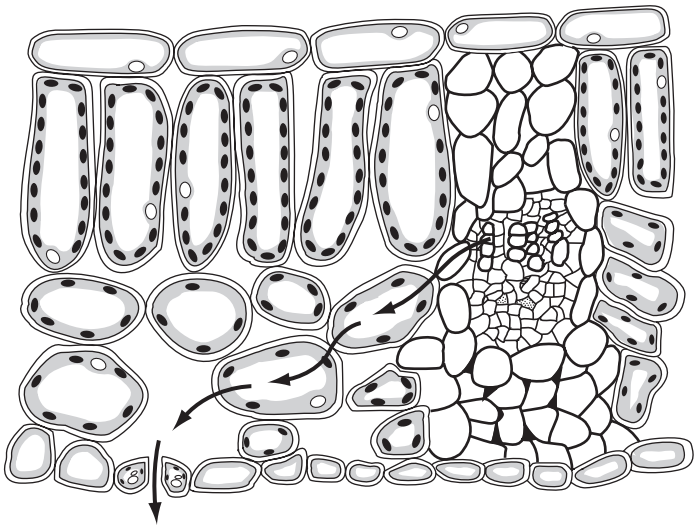


Fig. 1.1

1 (a) (i) On Fig. 1.1, label a palisade cell, using a label line. [1]

(ii) Explain why palisade cells need a good supply of water.

.....

.....

..... [2]

1 (b) (i) Name the type of cell that transports water from the roots to a leaf.

0653/03/O/N/09

..... [1]

(ii) Name the process by which water moves from one plant cell to another, as it moves across the leaf.

..... [1]

For Examiner's Use

1 (c) The loss of water vapour from the leaf to the air is called transpiration.

(i) Describe and explain how temperature affects the rate of transpiration.

.....

.....

.....

.....

..... [3]

(ii) Explain why temperature also affects the rate at which water is transported up to the leaves from the roots.

.....

.....

..... [2]

For Examiner's Use

2 Radiation can be used to monitor the thickness of paper in a paper mill.

Fig. 2.1 shows a radiation detector connected to a control unit. This sends messages to machines that adjust the gap between the rollers.

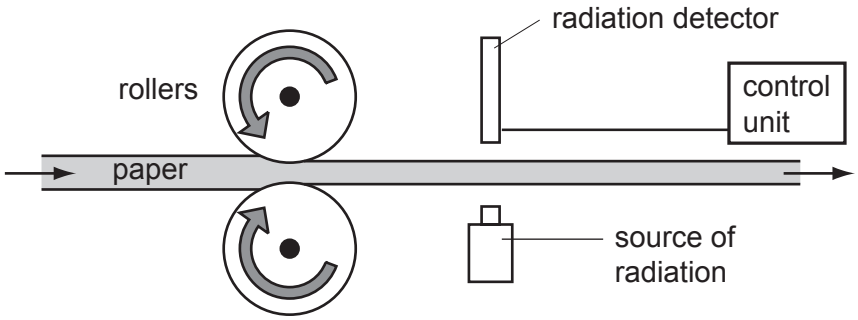


Fig. 2.1

2 (a) The following sentences describe what happens if the paper sheet produced is too thin.

0653/03/O/N/09

The sentences are in the wrong order.

A The gap between the rollers is increased.

B The paper sheet is now rolled a little thicker.

C A signal goes from the detector to the control unit.

D The paper sheet absorbs less beta radiation so more reaches the detector.

Arrange the sentences in the correct order.

[2]

2 (b) Explain why an alpha radiation source **cannot** be used to monitor the thickness of the paper sheet.

0653/03/O/N/09

.....

..... [1]

For Examiner's Use

2 (c) Table 2.1 shows the half-life and type of radiation given out by four different radioactive isotopes. 0653/03/O/N/09

Table 2.1

radioactive isotope	half-life / days	radiation given out
bismuth-210	5.0	beta
polonium-210	138.0	alpha and gamma
radon-222	3.8	alpha
iodine-131	8.0	beta and gamma

2 c (i) A sample of each isotope has the same count rate today. Which sample will have the highest count rate one month from today? 0653/03/O/N/09

Explain your answer.

.....

.....

..... [2]

2 c (ii) Which isotopes in the table give out radiation that is the most ionising? 0653/03/O/N/09

Explain your answer.

.....

.....

..... [2]

For Examiner's Use

3 **(a)** Erupting volcanoes release a plume into the air, containing many gases.

0653/03/O/N/09

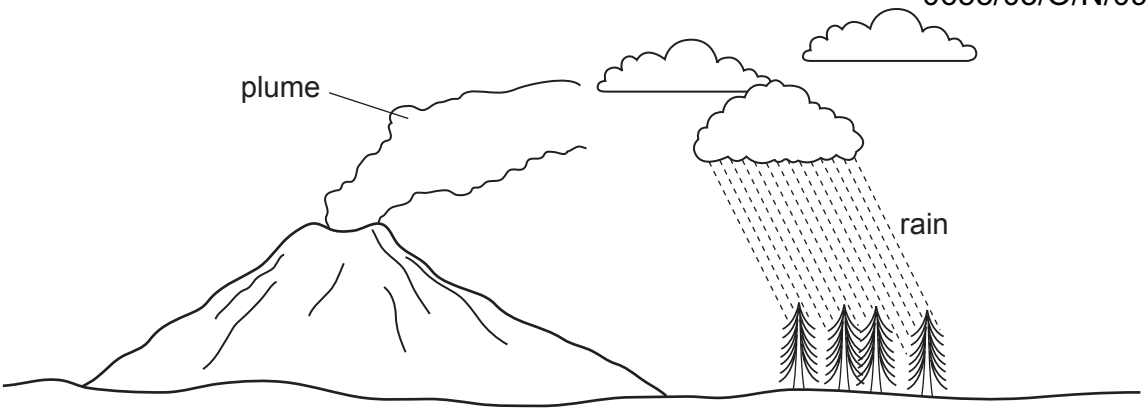


Table 3.1 shows some of the gases released by three volcanoes **A**, **B** and **C**.

Table 3.1

	% of each gas in the plume		
gas in plume	volcano **A**	volcano **B**	volcano **C**
H_2O	37.1	77.2	97.1
CO_2	48.9	11.3	1.44
SO_2	11.8	8.34	0.50
H_2	0.49	1.39	0.70
CO	1.51	0.44	0.01

3 a (i) Explain why hydrogen is an element and the other gases are compounds.

0653/03/O/N/09

.....

.....

..... [2]

3 a (ii) The plume from volcano **A** could be much more damaging to plant life than the plumes from the other volcanoes.

0653/03/O/N/09

Use the information in Table 3.1 to explain why.

.....

.....

.....

.....

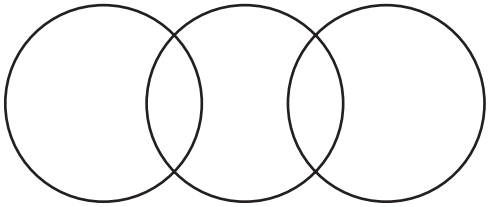
..... [3]

For Examiner's Use

3 (b) (i) Complete the bonding diagram below to show

0653/03/O/N/09

- the chemical symbols of the elements in a molecule of carbon dioxide,
- the arrangement of the outer electrons in each atom.



[2]

3 b (ii) Use information in the Periodic Table on page 20 to calculate the relative molecular mass of sulfur dioxide.

0653/03/O/N/09

Show your working.

..... [1]

3 (c) The air also contains noble gases, such as argon, which are very unreactive.

Draw a diagram of an argon atom showing how all of the electrons are arranged.

0653/03/O/N/09

[2]

For Examiner's Use

4 The enzyme amylase is present in saliva. It helps to digest starch in the mouth.

(a) (i) Name the substance that is produced when amylase digests starch.

0653/03/O/N/09

..... [1]

(ii) State **one** part of the alimentary canal, other than the mouth, where amylase digests starch.

0653/03/O/N/09

..... [1]

4 (b) There is a rare allele of the gene that is responsible for the production of amylase. A person with only one copy of this allele still produces amylase. However, a person with two copies of the allele does not produce amylase.

4 b (i) State how this information shows that this allele is recessive.

0653/03/O/N/09

.....

..... [1]

4 b (ii) Explain why a person with two copies of this allele would not be able to obtain energy from any starch in their diet.

0653/03/O/N/09

.....

.....

.....

..... [3]

For Examiner's Use

4 b (iii) Complete the genetic diagram to show how two people who both produce amylase can have a child who does not produce amylase.

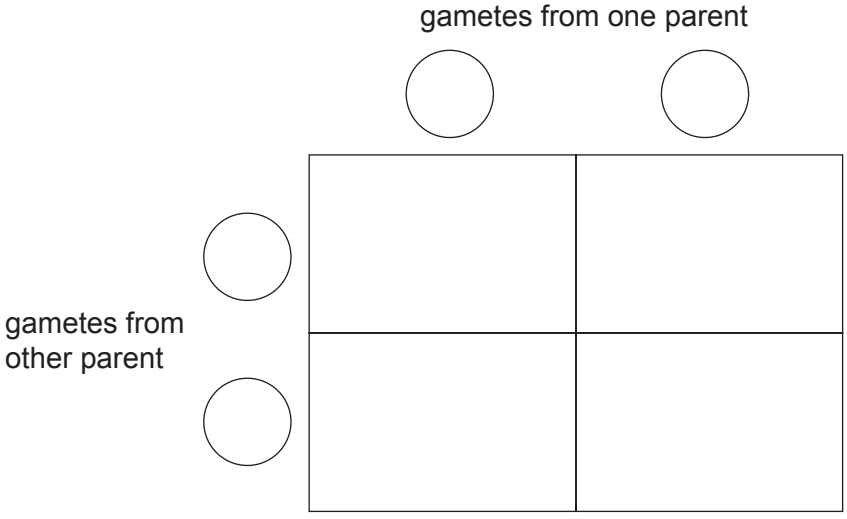
Use the symbol **A** for the dominant allele and **a** for the recessive allele.

0653/03/O/N/09

phenotypes of parents produces amylase produces amylase

genotypes of parents **Aa** .....

gametes ◯ and ◯ ◯ and ◯



[4]

5 A student uses dilute hydrochloric acid to test four pieces of rock, **W**, **X**, **Y** and **Z**.
She allows some of the acid to fall onto the samples and observes what happens.

0653/03/O/N/09

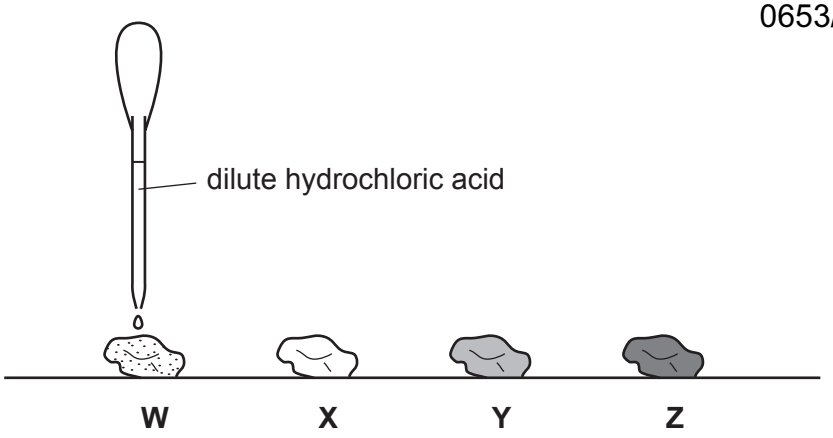


Fig. 5.1

The appearance of the rock samples before hydrochloric acid was added is shown in Table 5.1.

Table 5.1

rock	appearance
W	light grey
X	white
Y	green
Z	dark grey

5 **(a)** **(i)** Describe what the student will observe if the rock she is testing with acid contains a carbonate.

0653/03/O/N/09

.....

[1]

(ii) Suggest and explain which of the rock samples, **W**, **X**, **Y** or **Z**, contains a compound of a transition metal.

0653/03/O/N/09

.....

.....

[1]

For Examiner's Use

5 (b) Copper metal can be extracted from copper carbonate in two stages, as shown in Fig. 5.2.

0653/03/O/N/09

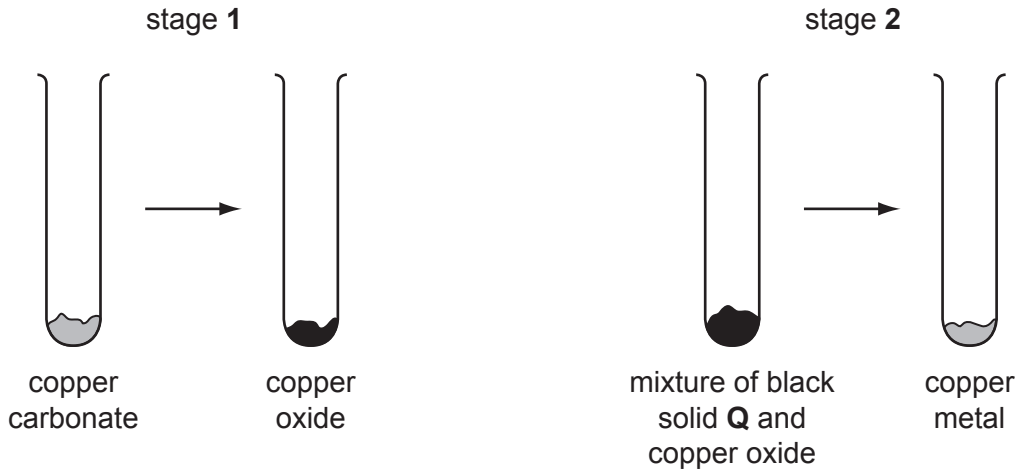


Fig. 5.2

5 b (i) The reaction in stage **1** occurs when copper carbonate is heated strongly.

0653/03/O/N/09

Suggest the word equation for the reaction.

..... [1]

5 b (ii) Solid **Q** is a non-metallic element.

0653/03/O/N/09

Suggest the identity of this element. ..... [1]

5 b (iii) Using your answer to **(ii)** complete and balance the symbolic equation for the reaction in stage **2**.

0653/03/O/N/09

$$CuO + \text{.....} \rightarrow Cu + \text{.....}$$

[2]

5 b (iv) The compound copper oxide contains copper ions.

0653/03/O/N/09

State whether copper ions must gain or lose electrons in order to be converted into copper atoms.

Explain your answer.

.....

.....

..... [2]

For Examiner's Use

5 (c) Copper metal can also be made from copper oxide by a different method.

0653/03/O/N/09

Fig. 5.3 shows some of the reactants and products involved.

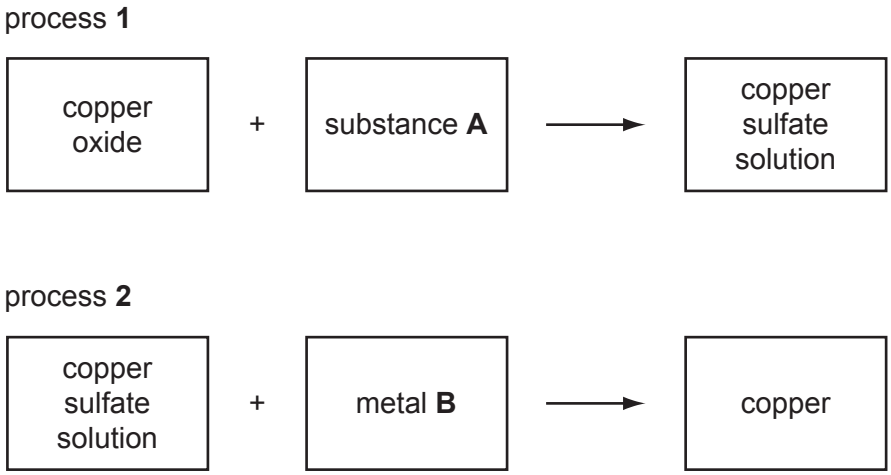


Fig. 5.3

0653/03/O/N/09

5 c (i) Suggest the name of substance **A**. ..... [1]

0653/03/O/N/09

5 c (ii) Suggest the name of metal **B**. ..... [1]

0653/03/O/N/09

5 c (iii) Name the type of chemical change which occurs in process **2**.

..... [1]

5 c (iv) Explain why copper is formed in process **2**. 0653/03/O/N/09

.....

..... [1]

For Examiner's Use

6 A motorcyclist begins a journey on his motorcycle. The motorcycle starts from rest and stops at a road junction after 80 seconds. The motorcycle then moves off again and completes the journey.

6 (a) Fig 6.1 shows the motion of the motorcycle. 0653/03/O/N/09

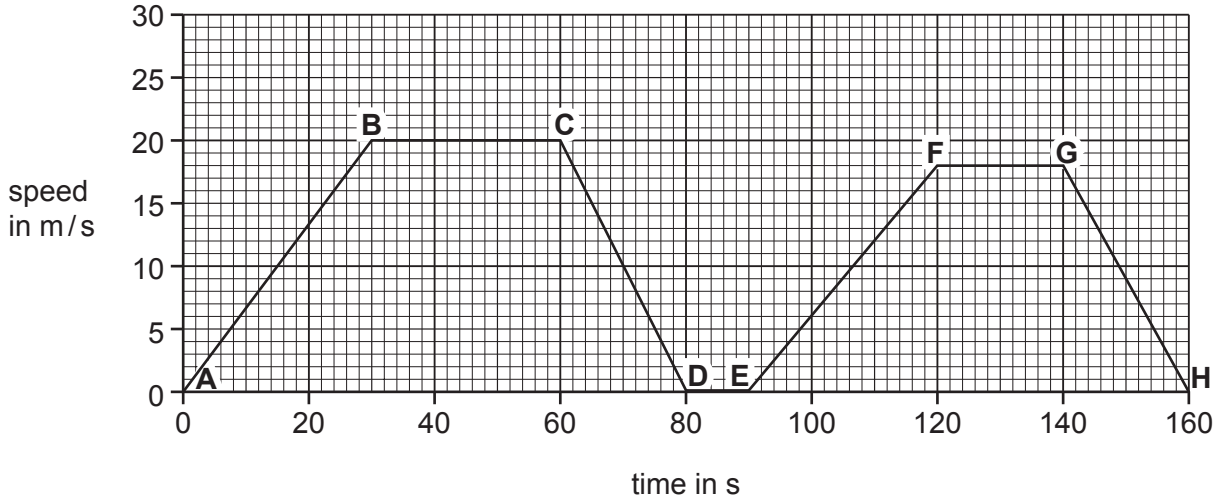


Fig. 6.1

6 a (i) From the start of the journey, how long did it take the motorcyclist to reach a speed of 10 m/s? 0653/03/O/N/09

..... [1]

6 a (ii) For how long was the motorcyclist travelling at a steady speed of 20 m/s? 0653/03/O/N/09

..... [1]

6 a (iii) During which two parts of the journey was the motorcyclist slowing down? 0653/03/O/N/09

from ..... to .....

and from ..... to ..... [1]

6 a (iv) Use Fig. 6.1 to show how far the motorcyclist travelled between 0 seconds and 80 seconds. 0653/03/O/N/09

Show your working.

..... [2]

For Examiner's Use

6 (b) Describe the motion of the moving motorcycle if the total frictional force it experiences is the same as the force produced by the engine. 0653/03/O/N/09

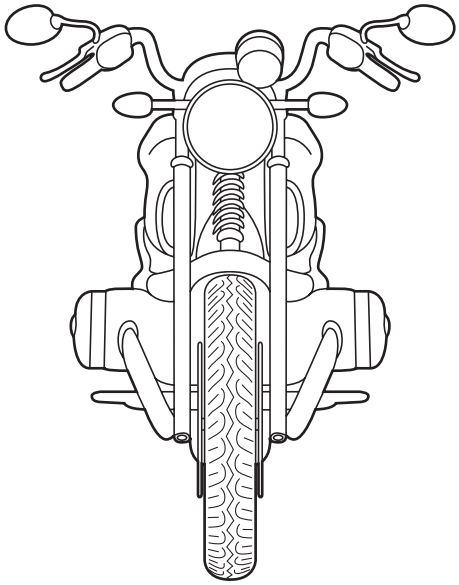
Explain your answer.

.....

..... [2]

6 (c) Explain in terms of centre of mass why a stationary motorcycle is very unstable.

0653/03/O/N/09



.....

.....

.....

.....

.....

..... [3]

For Examiner's Use

6 (d) The motorcycle has two lamps connected in a parallel circuit shown in Fig. 6.2.

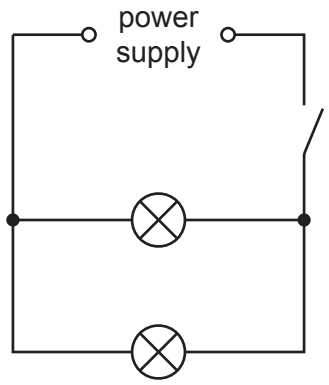


Fig. 6.2

One lamp when lit has a resistance of 1 Ω. The other lamp when lit has a resistance of 2 Ω.

Calculate the combined resistance of the two lamps.

State the formula that you use and show your working.

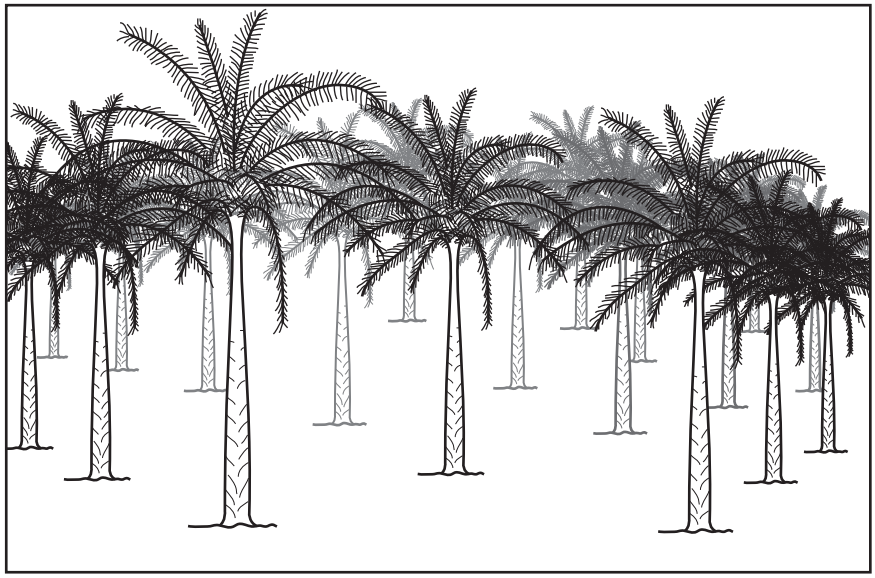
formula

working

..... [3]

For Examiner's Use

7 In some countries in south-east Asia, large areas of tropical rainforest have been cut down to clear the land. The land has then been planted with oil-palm trees. 0653/03/O/N/09



(a) Explain how cutting down tropical rainforest may affect each of the following.

7 a (i) soil erosion 0653/03/O/N/09

.....

.....

..... [2]

7 a (ii) species diversity 0653/03/O/N/09

.....

.....

..... [2]

For Examiner's Use

7 **(b)** Rats can become serious pests in oil-palm plantations. The rats damage the crops obtained from the oil-palms.

0653/03/O/N/09

7 b (i) The rats can be controlled by putting down poison for them to eat.

Suggest two disadvantages, other than the cost of the poison, of this method of control.

1 .....

.....

2 .....

..... [2]

7 b (ii) An alternative method of controlling the rats is to encourage owls to nest in the oil-palms by providing them with nest boxes. Owls are predators of rats.

0653/03/O/N/09

Suggest **one** disadvantage of this method of control.

.....

..... [1]

8 **(a)** Fig. 8.1 shows an aluminium saucepan on a cooker. Vegetables are being cooked in boiling water in the pan. 0653/03/O/N/09

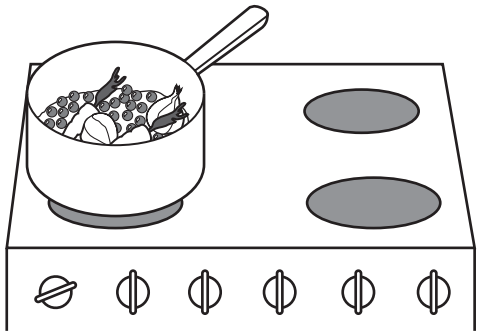


Fig. 8.1

State how the energy passes from the hot cooker through the base of the saucepan in to the water inside.

.....

[1]

8 **(b)** Fig. 8.2 shows a block of aluminium which has a mass of 540 g. 0653/03/O/N/09

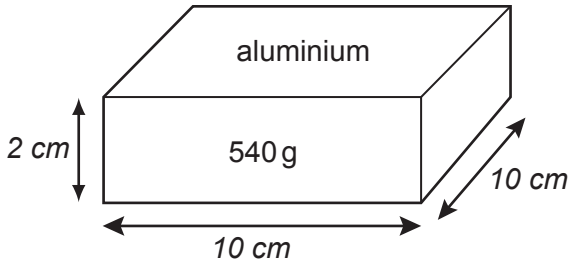


Fig. 8.2

Calculate the density of the block.

Show your working.

.....

[3]

8 (c) Describe how you would find the volume of an irregularly shaped object such as a carrot. You may draw a diagram if it helps your answer.

0653/03/O/N/09

For Examiner's Use

.....

..... [2]

9 Poly(ethene) is a compound used in making plastics. Poly(ethene) is a polymer made from the monomer, ethene (C_2H_4).

0653/03/O/N/09

9 (a) Describe how ethene molecules react to form poly(ethene). In your answer include a diagram showing the displayed (graphical) formulae of **two** ethene molecules and how these are changed during the reaction.

.....

.....

..... [3]

9 (b) Describe and explain what is observed when gaseous ethene is bubbled through a solution of bromine.

0653/03/O/N/09

.....

.....

..... [2]

DATA SHEET
The Periodic Table of the Elements

Group																	
I	II											III	IV	V	VI	VII	0
							1 **H** Hydrogen 1										4 **He** Helium 2
7 **Li** Lithium 3	9 **Be** Beryllium 4											11 **B** Boron 5	12 **C** Carbon 6	14 **N** Nitrogen 7	16 **O** Oxygen 8	19 **F** Fluorine 9	20 **Ne** Neon 10
23 **Na** Sodium 11	24 **Mg** Magnesium 12											27 **Al** Aluminium 13	28 **Si** Silicon 14	31 **P** Phosphorus 15	32 **S** Sulfur 16	35.5 **Cl** Chlorine 17	40 **Ar** Argon 18
39 **K** Potassium 19	40 **Ca** Calcium 20	45 **Sc** Scandium 21	48 **Ti** Titanium 22	51 **V** Vanadium 23	52 **Cr** Chromium 24	55 **Mn** Manganese 25	56 **Fe** Iron 26	59 **Co** Cobalt 27	59 **Ni** Nickel 28	64 **Cu** Copper 29	65 **Zn** Zinc 30	70 **Ga** Gallium 31	73 **Ge** Germanium 32	75 **As** Arsenic 33	79 **Se** Selenium 34	80 **Br** Bromine 35	84 **Kr** Krypton 36
85 **Rb** Rubidium 37	88 **Sr** Strontium 38	89 **Y** Yttrium 39	91 **Zr** Zirconium 40	93 **Nb** Niobium 41	96 **Mo** Molybdenum 42	**Tc** Technetium 43	101 **Ru** Ruthenium 44	103 **Rh** Rhodium 45	106 **Pd** Palladium 46	108 **Ag** Silver 47	112 **Cd** Cadmium 48	115 **In** Indium 49	119 **Sn** Tin 50	122 **Sb** Antimony 51	128 **Te** Tellurium 52	127 **I** Iodine 53	131 **Xe** Xenon 54
133 **Cs** Caesium 55	137 **Ba** Barium 56	139 **La** Lanthanum 57 *	178 **Hf** Hafnium 72	181 **Ta** Tantalum 73	184 **W** Tungsten 74	186 **Re** Rhenium 75	190 **Os** Osmium 76	192 **Ir** Iridium 77	195 **Pt** Platinum 78	197 **Au** Gold 79	201 **Hg** Mercury 80	204 **Tl** Thallium 81	207 **Pb** Lead 82	209 **Bi** Bismuth 83	**Po** Polonium 84	**At** Astatine 85	**Rn** Radon 86
Fr Francium 87	226 **Ra** Radium 88	227 **Ac** Actinium 89 †															

*58-71 Lanthanoid series
†90-103 Actinoid series

140 **Ce** Cerium 58	141 **Pr** Praseodymium 59	144 **Nd** Neodymium 60	**Pm** Promethium 61	150 **Sm** Samarium 62	152 **Eu** Europium 63	157 **Gd** Gadolinium 64	159 **Tb** Terbium 65	162 **Dy** Dysprosium 66	165 **Ho** Holmium 67	167 **Er** Erbium 68	169 **Tm** Thulium 69	173 **Yb** Ytterbium 70	175 **Lu** Lutetium 71
232 **Th** Thorium 90	**Pa** Protactinium 91	238 **U** Uranium 92	**Np** Neptunium 93	**Pu** Plutonium 94	**Am** Americium 95	**Cm** Curium 96	**Bk** Berkelium 97	**Cf** Californium 98	**Es** Einsteinium 99	**Fm** Fermium 100	**Md** Mendelevium 101	**No** Nobelium 102	**Lr** Lawrencium 103

Key: a over **X** over b
a = relative atomic mass
X = atomic symbol
b = proton (atomic) number

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