

Centre Number	Candidate Number	Name
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UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS  
International General Certificate of Secondary Education

**COMBINED SCIENCE**

**0653/02**

Paper 2 (Core)

October/November 2006

**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.

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	
10	
<b>Total</b>	

This document consists of **18** printed pages and **2** blank pages.



- 1 (a) The pie chart in Fig. 1.1 shows the energy sources used to generate the electricity in a European country in one year.

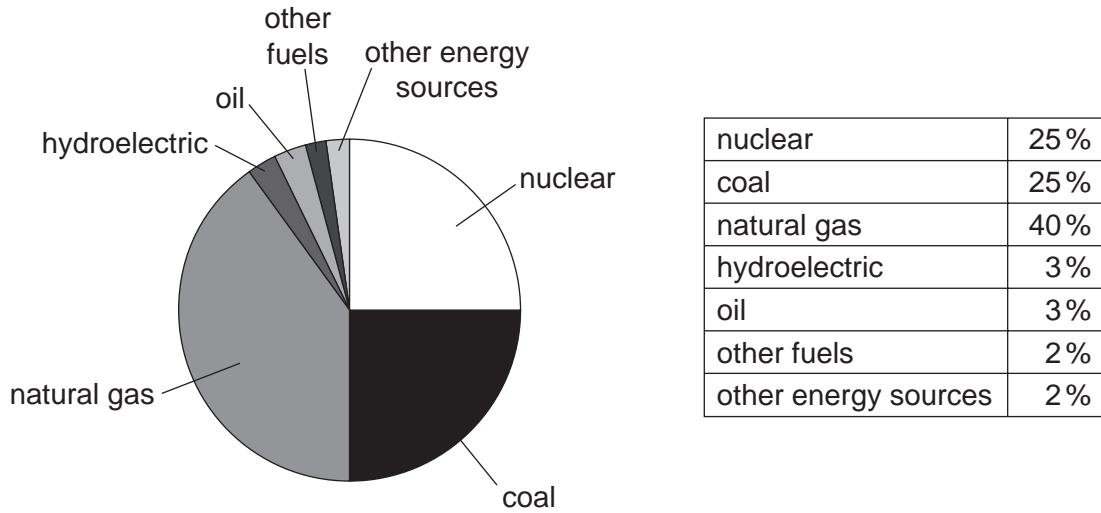


Fig. 1.1

- (i) Suggest **one** fuel which could have been included in the 'other fuels' section.

..... [1]

- (ii) Calculate the percentage of the country's electricity that comes from fossil fuels listed in Fig. 1.1.

..... [1]

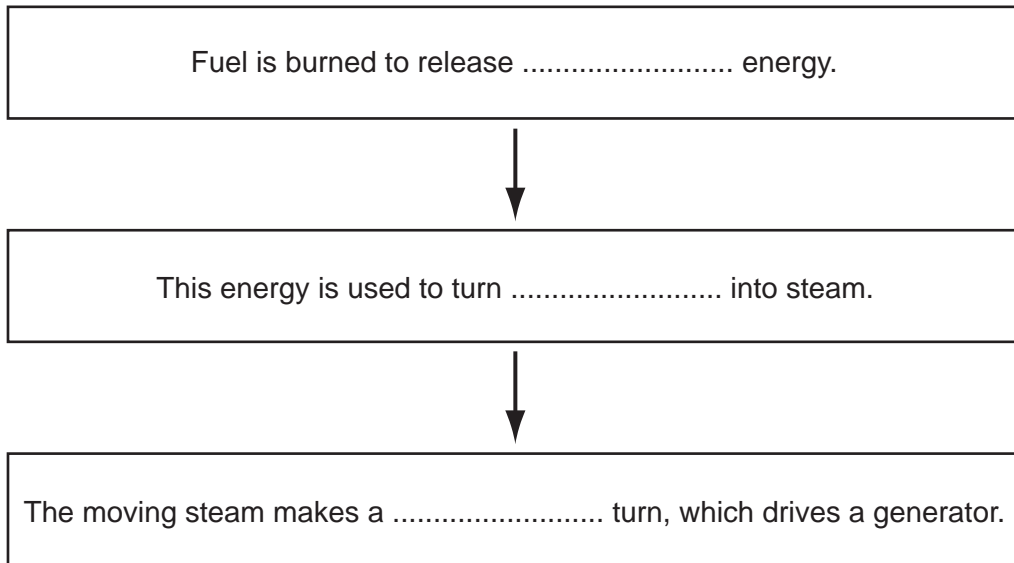
- (iii) Hydroelectricity is a renewable energy resource.  
Name two other renewable energy resources.

1. ....

2. ....

[2]

(b) Generators are required in order to produce electricity in a power station. Complete the diagram below to show the processes involved.



[3]

(c) Transformers are used to increase the voltage before electricity is transmitted.

Explain why this is done.

.....  
..... [1]

- 2 A student uses the apparatus shown in Fig. 2.1 to investigate several different chemical reactions. In each reaction, a solid reacts with hydrochloric acid and a gas is produced. The volume of gas produced in each case can be measured using the gas syringe.

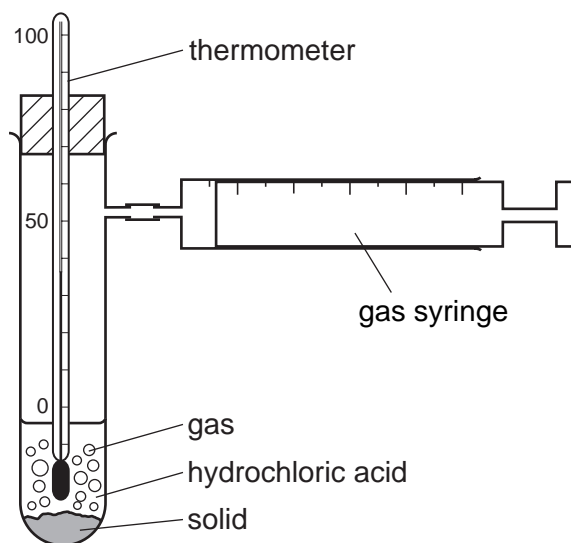


Fig. 2.1

- (a) (i) Table 2.1 lists three experiments in which three different solids react with hydrochloric acid.

Complete Table 2.1 by writing in the right hand column the name of the gas produced.

Table 2.1

experiment number	solid reacted	gas produced
1	calcium carbonate	
2	magnesium	
3	sodium hydrogencarbonate	

[3]

- (ii) Write the chemical formula of hydrochloric acid.

..... [1]

- (iii) Choose **one** of the gases you have named in Table 2.1 and describe the test for this gas.

.....  
 .....  
 ..... [2]

- (b) How would the student use the apparatus shown in Fig. 2.1 to find out whether a reaction was exothermic?

.....  
..... [1]

- (c) The student finds that the rate of reaction is greatest for experiment 3.

- (i) Suggest the measurements which the student took in order to find the rate of reaction in each experiment.

.....  
.....  
..... [2]

- (ii) Suggest **one** way in which the student could change the conditions of experiment 3 in order to **reduce** the rate of reaction.

.....  
..... [1]

3 Fig 3.1 shows a human fetus just before birth.

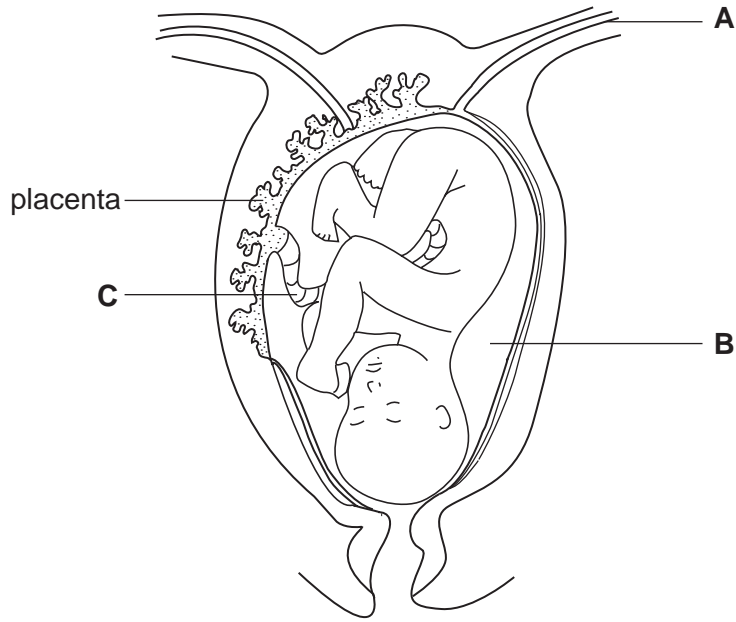


Fig. 3.1

(a) Name structures A to C, using some of these words.

amniotic fluid      artery      cervix      oviduct      umbilical cord      zygote

A .....

B .....

C .....

[3]

(b) Explain how the developing fetus obtains nutrients while it is in the uterus.

.....

.....

.....

..... [3]

(c) Outline what happens during the birth of the baby.

.....  
.....  
.....  
..... [2]

(d) If a mother has AIDS, there is a risk that her baby may be born with HIV and develop AIDS.

Explain how this could happen.

.....  
.....  
..... [2]

- 4 (a) Fig. 4.1 shows a ray of light passing from air into a glass block.

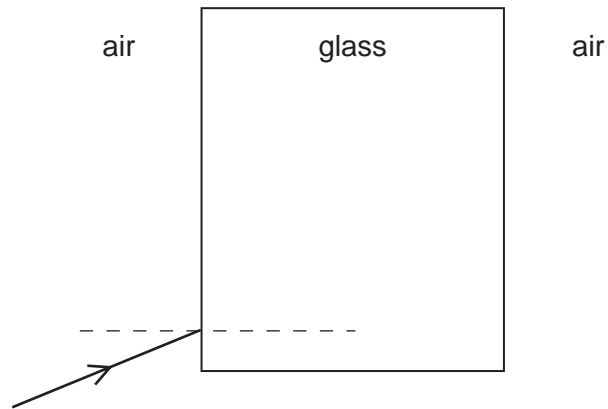
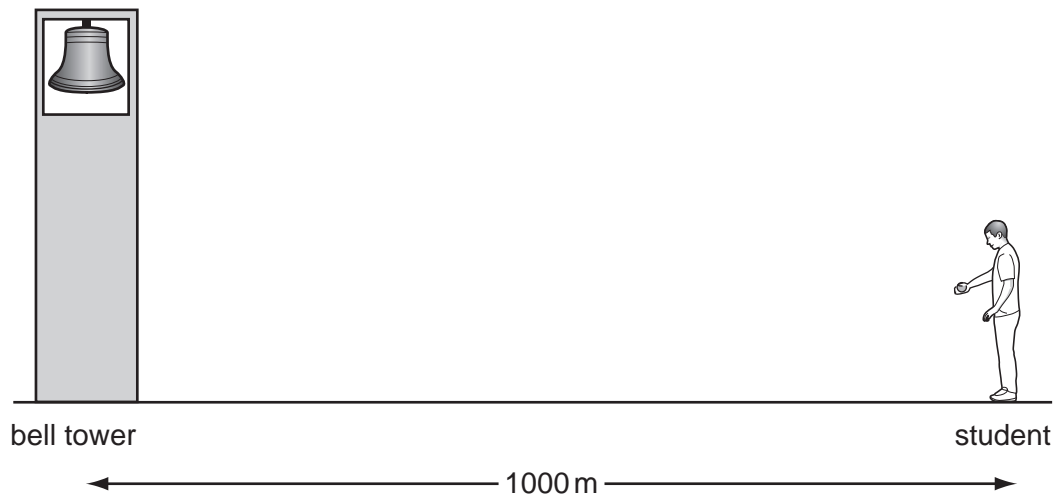


Fig. 4.1

- (i) On Fig. 4.1, draw two straight lines to show what happens to the ray of light as it passes through the block and out into the air. [2]
- (ii) On Fig. 4.1, indicate the angle of refraction as the ray enters the block. [1]



- (b) A student carried out an experiment to find the speed of sound in air by watching and listening to a bell being rung. He stood with a timer 1000 m from the bell.



The sound took 3 seconds to travel from the bell to the student.

Calculate the speed of sound.

Show your working and state the formula that you use.

formula used

working

..... m/s [2]

- 5 Fig. 5.1 shows industrial apparatus used to obtain useful products, **A** to **F**, from petroleum (crude oil).

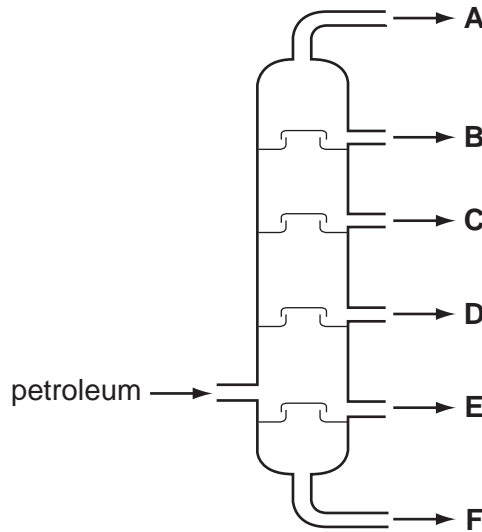


Fig. 5.1

- (a) (i) Name the process shown in Fig. 5.1.

..... [1]

- (ii) State which of the products, **A** to **F**, is at the highest temperature when it first comes out of the apparatus in Fig. 5.1.

..... [1]

- (b) Product **B** in Fig. 5.1 is used as fuel for cars.

- (i) Name the **element** which reacts with molecules of product **B** in car engines.

..... [1]

- (ii) Describe and explain **one** way in which the use of product **B** as car fuel could be affecting our environment.

.....  
 .....  
 .....  
 ..... [3]

(c) Plastics contain molecules called polymers.

Describe how a typical polymer molecule such as poly(ethene) is different from a simple molecule such as ethene.

.....

.....

..... [2]

- 6 An athlete ran on a treadmill on three different days. He ran a different distance on each day.

The volume of oxygen that he used was measured during each run. The results are shown in Table 6.1.

**Table 6.1**

length of run / m	total oxygen used / dm <sup>3</sup>
100	10
1500	36
10 000	150

- (a) (i) Calculate the oxygen used per metre in the 100 metre run.

..... dm<sup>3</sup> [1]

- (ii) Describe the relationship shown in Table 6.1 between the oxygen used and the length of the run.

.....  
..... [1]

- (b) (i) Describe how the oxygen breathed in by the athlete was transported to his muscles.

.....  
.....  
..... [2]

- (ii) Explain how the oxygen taken in by the athlete was used to provide the energy that he used in the runs.

.....  
.....  
.....  
..... [3]

(c) Professional athletes never drink alcohol before a race. Suggest how drinking even a small amount of alcohol could increase an athlete's time in a 100 m race.

.....

.....

..... [2]

7 (a) A torch contains 3 cells, a switch and a lamp connected in series.

(i) Draw a circuit diagram for this circuit using the correct symbols.

[3]

(ii) The potential difference across each of the cells in the circuit is 1.5 V.

State the total potential difference across the three cells.

..... [1]

(b) Visible light is one of the main regions of the electromagnetic spectrum.  
Infra-red radiation is also a region of the electromagnetic spectrum.

(i) State a source, a detector and a use of infra-red radiation.

source

.....

detector

.....

use

..... [3]

(ii) Name **one** other region of the electromagnetic spectrum.

..... [1]

8 (a) Table 8.1 shows some properties of elements.

Write the letter **M** in the right hand column next to properties which are typical of **metallic** elements.

**Table 8.1**

can be hammered into different shapes	
poor conductor of heat	
is a gas at room temperature (20°C)	
good conductor of electricity	
poor conductor of electricity	

[2]

(b) Aluminium is an important metal in Group III of the Periodic Table.

(i) State the chemical symbol for aluminium.

..... [1]

(ii) State the number of protons in one atom of aluminium.

..... [1]

(iii) Why is aluminium a suitable material for making containers used to store food?

.....  
..... [1]

(c) Aluminium is obtained from the compound aluminium oxide.

Explain why aluminium oxide is called a compound and not an element.

.....  
.....  
..... [2]

(d) Electrolysis is used to extract aluminium from aluminium oxide, an ionic compound which is insoluble in water.

(i) How can aluminium oxide be made into an electrolyte?

..... [1]

(ii) Complete the word equation below to show the chemical change that occurs when aluminium oxide undergoes electrolysis.

..... → aluminium + ..... [1]

9 Fig. 9.1 shows a root hair cell.

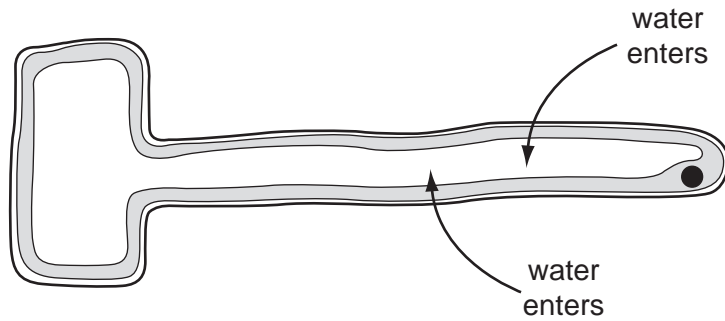


Fig. 9.1

(a) State two ways in which the structure of this cell differs from a palisade cell in a leaf.

1. ....  
.....
  2. ....  
.....
- [2]

(b) The function of a root hair is to take up water from the soil. The arrows in Fig. 9.1 show water entering the root hair cell.

(i) How many membranes does the water pass through between the soil and the vacuole of the root hair cell?

..... [1]

(ii) Describe the pathway taken by the water as it travels from the root hair and into the leaves of the plant.

.....  
.....  
..... [2]

(iii) Some of the water is used in photosynthesis in the leaves of the plant. Write the word equation for photosynthesis.

..... [2]

(iv) On a hot, sunny day much more water goes into the root hair cell than on a cold, dull day. Suggest an explanation for this.

.....  
.....  
..... [1]



10 (a) Explain why it could be dangerous to switch on a mains electrical appliance using wet hands.

.....  
.....  
..... [2]

(b) Explain why a source of alpha radiation is more dangerous if it gets inside the human body than outside the body.

.....  
.....  
..... [2]

(c) Explain why small expansion gaps are left between sections of road bridges.

.....  
.....  
..... [1]



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**DATA SHEET**  
**The Periodic Table of the Elements**

		Group												
		I	II	III	IV	V	VI	VII	VIII	IX	X	0		
		1 <b>H</b> Hydrogen 1												
7 <b>Li</b> Lithium 3	9 <b>Be</b> Beryllium 4											4 <b>He</b> Helium 2		
23 <b>Na</b> Sodium 11	24 <b>Mg</b> Magnesium 12											20 <b>Ne</b> Neon 10		
39 <b>K</b> Potassium 19	40 <b>Ca</b> Calcium 20	51 <b>V</b> Vanadium 23	48 <b>Ti</b> Titanium 22	45 <b>Sc</b> Scandium 21	55 <b>Mn</b> Manganese 25	56 <b>Fe</b> Iron 26	59 <b>Co</b> Cobalt 27	58 <b>Ni</b> Nickel 28	64 <b>Cu</b> Copper 29	65 <b>Zn</b> Zinc 30	75 <b>As</b> Arsenic 33	84 <b>Kr</b> Krypton 36		
85 <b>Rb</b> Rubidium 37	88 <b>Sr</b> Strontium 38	93 <b>Nb</b> Niobium 41	91 <b>Zr</b> Zirconium 40	89 <b>Y</b> Yttrium 39	101 <b>Ru</b> Ruthenium 44	106 <b>Pd</b> Palladium 46	108 <b>Ag</b> Silver 47	115 <b>In</b> Indium 49	112 <b>Cd</b> Cadmium 48	122 <b>Sb</b> Antimony 51	131 <b>Xe</b> Xenon 54			
133 <b>Cs</b> Caesium 55	137 <b>Ba</b> Barium 56	181 <b>Ta</b> Tantalum 73	178 <b>Hf</b> Hafnium 72	139 <b>La</b> Lanthanum 57	186 <b>Re</b> Rhenium 75	190 <b>Os</b> Osmium 76	197 <b>Au</b> Gold 79	204 <b>Tl</b> Thallium 81	201 <b>Hg</b> Mercury 80	209 <b>Pb</b> Lead 82	210 <b>Bi</b> Bismuth 83	210 <b>Po</b> Polonium 84	210 <b>At</b> Astatine 85	210 <b>Rn</b> Radon 86
226 <b>Ra</b> Radium 88	227 <b>Ac</b> Actinium 89											227 <b>Fr</b> Francium 87		
*58-71 Lanthanoid series													175 <b>Lu</b> Lutetium 71	
†90-103 Actinoid series													103 <b>Lr</b> Lawrencium 103	

a = relative atomic mass

X = atomic symbol

b = proton (atomic) number

Key

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