Centre Number	Candidate Number	Name

UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS
International General Certificate of Secondary Education

COMBINED SCIENCE **0653/02**

Paper 2 Core

May/June 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.
Do not use staples, paper clips, highlighters, glue or correction fluid.

Answer **all** questions.
You may use a pencil for any diagrams, graphs, tables or rough working.
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 **17** printed pages and **3** blank pages.

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For
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Use

1 (a) Each box below contains a description of a solid, a liquid or a gas.

Join each box to the correct diagram. One has been done for you.

| It takes up the shape of its container and has a constant volume. |

gas

| The particles form a regular arrangement. |

liquid

| The particles are widely spaced out. |

| The particles are kept in place and only vibrate. |

solid
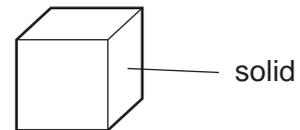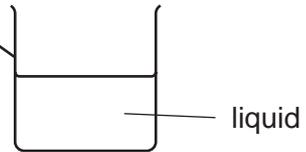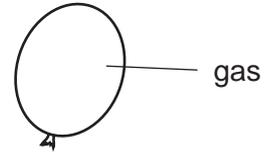
[2]

(b) A student sets up the apparatus shown in Fig. 1.1.
He wants to use this apparatus to detect thermal radiation.

glass tube

rubber bung

water

flask coated with
black paint
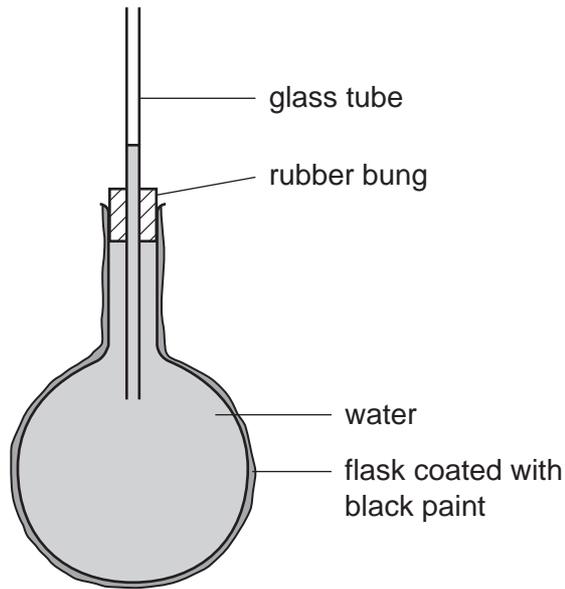
Fig. 1.1

(i) Describe what the student would observe when the flask coated with black paint is exposed to a source of thermal radiation.

....

.... [1]

(ii) Explain the observation in **(i)** in terms of water particles.

....

....

....

....

.... [3]

(iii) Suggest why the flask is coated with black paint.

.... [1]

2   Fig. 2.1 shows a fetus developing in the uterus.
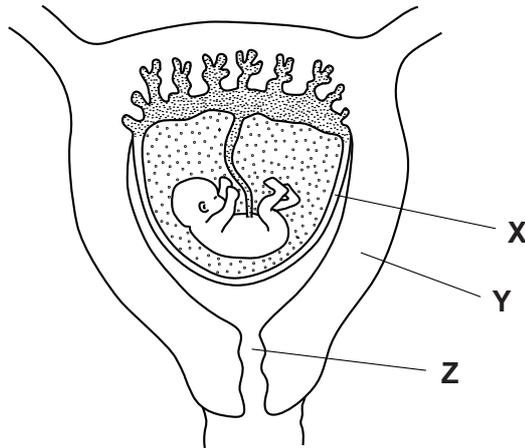
Fig. 2.1

(a) Name the parts labelled **X**, **Y** and **Z**.

X ....

Y ....

Z ....   [3]

(b) Describe how the fetus obtains oxygen.

....

....

....

.... [3]

(c) Anna is planning to start a family. She smokes 6 cigarettes a day.
Explain why Anna should give up smoking before she becomes pregnant.

....

....

.... [2]

3   **(a)** Table 3.1 shows some information about the elements in Group VII of the [ ]
      Table. Use the Periodic Table on page 20 to help you with this question.

   (i) Complete the table.

Table 3.1

Period in which the element is found	symbol	physical state at 25 °C
	Cl	
	Br	
	I	

[2]

   (ii) Fluorine is the Group VII element in Period 2.
         Suggest the physical state of fluorine at 25 °C.

   .... [1]

(b) Bromine exists as diatomic molecules, Br_2. Bromine molecules react with magnesium
      atoms to form magnesium bromide.

   (i) State the type of chemical bonding in bromine molecules.

   .... [1]

   (ii) The formula of magnesium bromide is $MgBr_2$.
         Explain what is meant by this formula.

   ....

   ....

   .... [1]

(c) (i) State **one** element which is often added to water intended for drinking.

   .... [1]

   (ii) Suggest and explain what might happen if the element you have named in **(i)** was
         not added to water intended for drinking.

   ....

   ....

   .... [2]

For Examiner's Use

4 (a) A radioactive tracer can be used to detect leaks in water pipes.
The tracer is placed in the water flowing through the pipe and a radiation detector is used to check for radiation coming from water leaking out of the pipe.

(i) Suggest a suitable instrument for detecting the radiation.

.... [1]

(ii) State two precautions which should be taken when handling and storing the radioactive tracer.

1. ....

2. .... [2]

(b) Beta-radiation is one form of ionising radiation.

(i) Explain why beta-radiation is said to be *ionising*.

....

....

.... [2]

(ii) Explain why ionising radiation can be harmful to humans.

....

....

.... [2]

(c) The flow chart shows how electricity is produced in a nuclear power station.
Complete the flow chart by filling in the missing words.

> During nuclear fission .... energy is released.

> This energy is used to change water into ....

> This causes a .... to turn which then turns a generator.
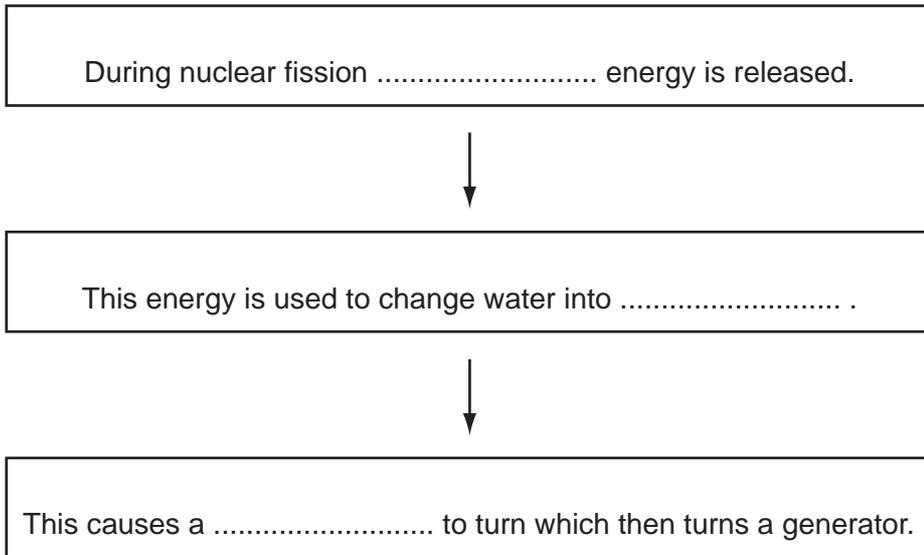
[3]

(d) (i) The voltage of the electricity generated is increased using transformers for transmission through power lines to the users.

Explain why this is done.

....

....

.... [2]

(ii) The electrical supply to a house is at a voltage of 220 V.
An electric kettle is plugged into the supply.
The current flowing through the heating element of the kettle is 10 A.

Calculate the resistance of the heating element.

Show your working and state the formula that you use.

formula used

working

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

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5 **(a)** The list below contains descriptions of some different parts of cells.

A contains genes made of DNA

B controls what enters and leaves the cell

C is fully permeable

Write the **letter** or **letters** of the descriptions that fit each of these parts of cells.
Each part may have one letter, two letters or no letters at all.

nucleus ....

cell wall ....

chloroplast ....

cell surface membrane .... [3]

(b) Fig. 5.1 shows a cell from a plant root.
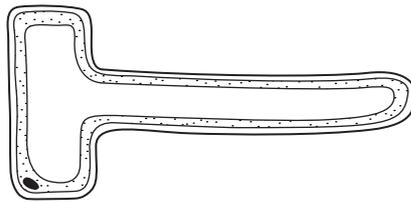
Fig. 5.1

This cell takes up water from the soil.
The water is than carried up to the leaves in the xylem vessels.

(i) Name the type of cell in Fig. 5.1.

.... [1]

(ii) Explain how this cell is adapted for its function.

.... [1]

(iii) In the leaves, a small amount of the water is used for photosynthesis.
Write the word equation for photosynthesis.

.... [2]

(iv) What happens to most of the water after it has travelled into the leaves?

.... [1]

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6   Petroleum (crude oil) provides many important products including fuels and polymers.

gaseous fuels

liquid fuels

polymers

OIL

petroleum
(crude oil)

oil refinery
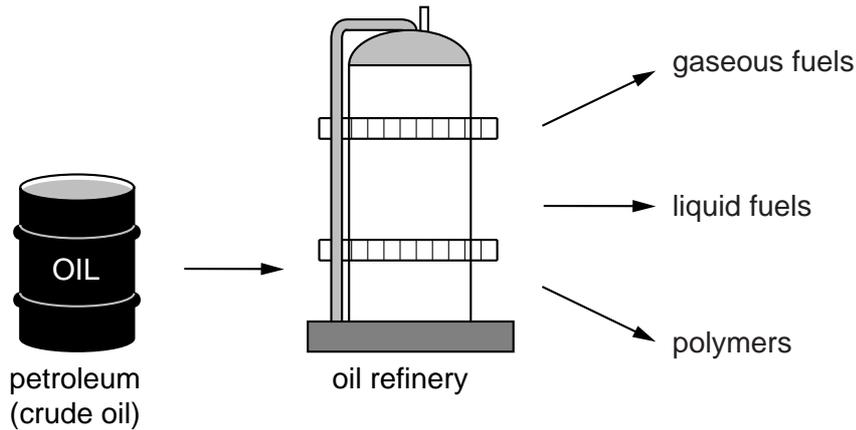
(a) Name the **two** main elements which are always found combined together in fuels
obtained from petroleum.

[2]

(b) Butane is a gaseous fuel obtained from petroleum.

(i) State **one** form of energy that is transferred to the surroundings when butane is
oxidised.

[1]

(ii) Name **one** product that is formed when butane is completely oxidised.

[1]

(c) Table 6.1 shows the total number of atoms which are combined in molecules of three
compounds **A**, **B** and **C**.

Table 6.1

compound	A	B	C
number of atoms in one molecule	60 000	11	26

Suggest and explain which one of these compounds is a polymer.

[2]
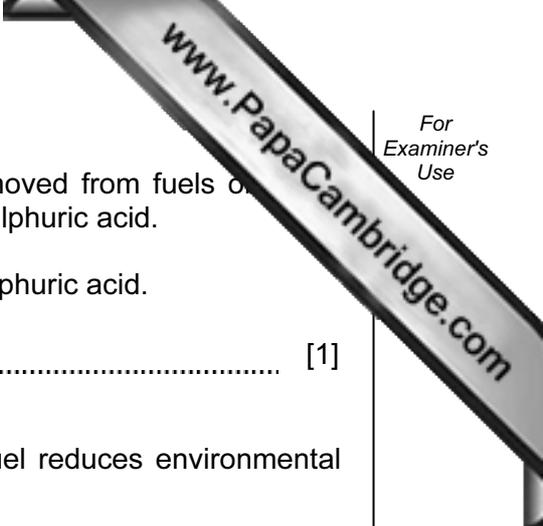
(d) Compounds containing the element sulphur are usually removed from fuels o from petroleum. The sulphur is collected and used to make sulphuric acid.

(i) State the number of sulphur atoms in one molecule of sulphuric acid.

.... [1]

(ii) Explain why the removal of sulphur compounds from fuel reduces environmental damage.

....

....

....

.... [3]

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7 Fig. 7.1 shows sugar cane growing in Fiji.

Fig. 7.1

(a) In Fiji, much of the land is hilly. It often rains very hard.

With reference to Fig. 7.1, explain how the fields of sugar cane can help to reduce soil erosion.

....

....

.... [2]

(b) Would a field of sugar cane have a low species diversity or a high species diversity? Explain your answer.

....

....

.... [2]

(c) Sugar cane is used to produce sugar, which can be used in cooking.
A man eats a cake containing sugar.

 (i) Describe how the sugar is absorbed into his blood.

 [2]

 (ii) Explain how his blood sugar level will be prevented from rising too high after he has eaten the cake.

 [3]

 (iii) Explain why he would feel tired and ill if his blood sugar level dropped very low.

 [2]

8 The element iron is extracted from iron ore, which is a rock found in the Earth's crust.

(a) The main iron compound in iron ore is iron oxide. When iron oxide reacts with carbon monoxide, iron is produced. The word equation for this reaction is shown below.

iron oxide + carbon monoxide ⟶ iron + carbon dioxide

(i) State **one** difference between an element such as iron and a compound such as iron oxide.

....

....

.... [1]

(ii) The reaction shown in **(a)** is an example of oxidation and reduction.

State and explain briefly which substance has been reduced in this reaction.

....

....

.... [2]

(b) Fig. 8.1 shows a diagram of a car.

car body made from mild steel

galvanised underside of car
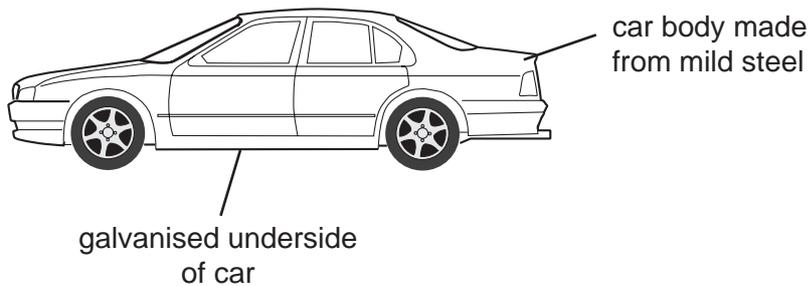
Fig. 8.1

Mild steel is an alloy containing a large amount of iron.

(i) Name an element, other than iron, which is present in mild steel.

.... [1]

(ii) The steel on the underside of the car is galvanised by coating it with a layer
This protects the steel from rusting.

Suggest how this prevents the steel from rusting.

....

....

....

.... [3]

(c) Fig. 8.2 shows a test-tube containing a small piece of galvanised steel reacting in
sulphuric acid.

sulphuric acid
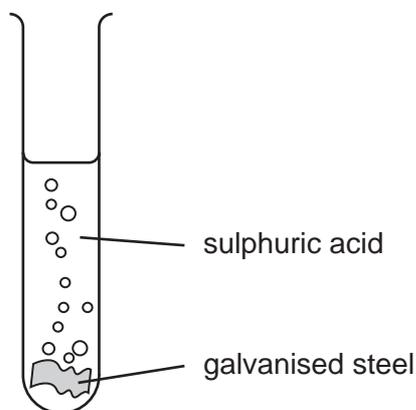
galvanised steel

Fig. 8.2

Suggest the names of two salts which will remain in the solution in the test-tube when
all of the galvanised steel has reacted.

1. ....

2. .... [2]

9 **(a)** An athlete takes part in a race. His performance is shown on the speed–time g
Fig. 9.1.
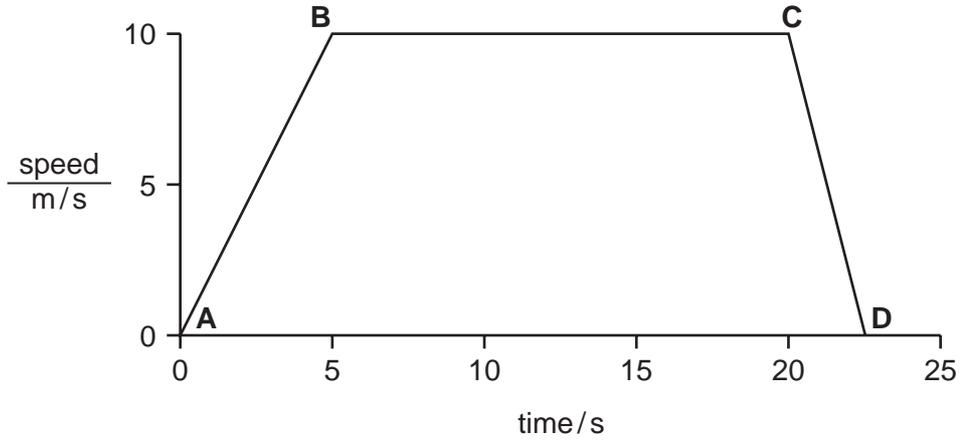
Fig. 9.1

Use the graph to describe the motion of the athlete between

 (i) **A** and **B**, ...

 (ii) **B** and **C**, ...

 (iii) **C** and **D**. .... [3]

(b) Calculate the distance travelled between 5 seconds and 20 seconds.

Show your working and state the formula that you use.

formula used

working

.... m [2]

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DATA SHEET
The Periodic Table of the Elements

Group

I	II											III	IV	V	VI	VII	0
																	4 **He** Helium 2
7 **Li** Lithium 3	9 **Be** Beryllium 4				1 **H** Hydrogen 1							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 **A*l*** Aluminium 13	28 **Si** Silicon 14	31 **P** Phosphorus 15	32 **S** Sulphur 16	35.5 **C*l*** 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 **T*l*** 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
X
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.).