UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS
International General Certificate of Secondary Education

CANDIDATE NAME

CENTRE NUMBER

CANDIDATE NUMBER

2674589816

COMBINED SCIENCE **0653/22**

Paper 2 (Core) **October/November 2011**

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 24.

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 **21** printed pages and **3** blank pages.

UNIVERSITY of CAMBRIDGE International Examinations

For Examiner's Use

1 Coral reefs are found in shallow seawater. Limestone is a common type of rock found in the Earth's crust. Both coral reefs and limestone are made mainly of the ionic compound, calcium carbonate.

(a) A student used the apparatus shown in Fig. 1.1 to test a rock sample to discover whether or not it is limestone.

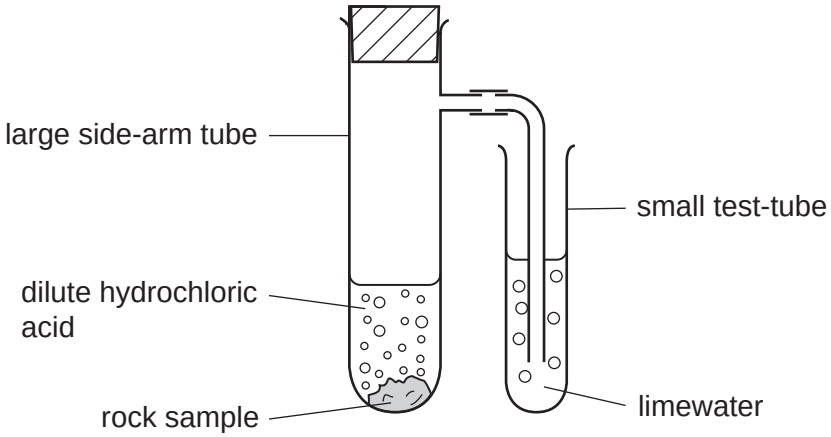

Fig. 1.1

The student observed that a gas was given off and that the limewater in the small test-tube became cloudy.

(i) Name the gas that was given off. ..... [1]

(ii) State the chemical formula of hydrochloric acid.

..... [1]

(iii) After some time, the student observed that the gas stopped forming, but a small piece of the rock sample remained in the large side-arm tube.

Explain why gas stopped forming.

.....

.....

..... [2]

(iv) The student carried out a flame test on the solution that remained in the large side-arm tube. This test produced an orange-red colour.

Name the element that this observation suggests is contained in the rock sample.

..... [1]

(b) In recent years, the amount of carbon dioxide dissolving in seawater has increased.

During this period, many coral reefs have become weakened and damaged.

For Examiner's Use

(i) State and explain briefly how an increase in carbon dioxide concentration will affect the pH of seawater.

.....

.....

..... [2]

(ii) Suggest a reason why an increase in carbon dioxide concentration might be responsible for damage to coral reefs.

.....

..... [1]

For Examiner's Use

2 **(a)** Fig. 2.1 shows the horizontal forces acting on an aircraft moving along the runway. These forces are balanced.

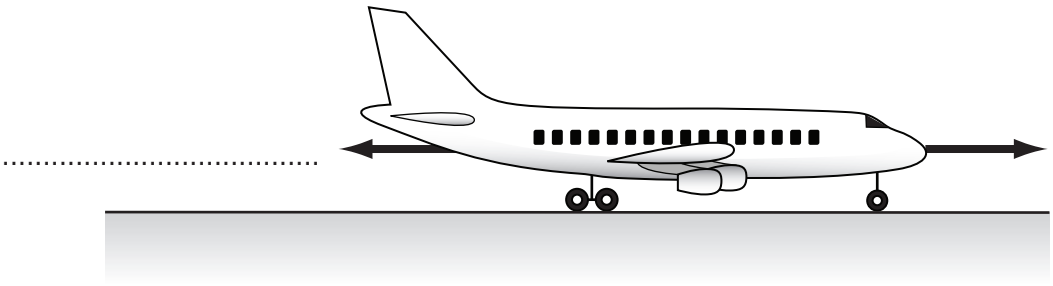

Fig. 2.1

(i) The arrow to the right represents the driving force produced by the engines.

On the diagram, name the other force. [1]

(ii) Explain what is meant by the phrase *forces are balanced*.

.....

..... [1]

(iii) Describe the movement of the aircraft when these forces are balanced.

.....

..... [1]

(b) In the air, the aircraft travels at 80 m / s for one hour.

Calculate the distance travelled.

State the formula that you use and show your working.

formula used

working

..... m [2]

For Examiner's Use

(c) People who fly frequently have greater exposure to ionising radiation than those who do not fly.

(i) Explain why exposure to ionising radiation may be harmful.

.....

.....

..... [2]

(ii) This ionising radiation is cosmic radiation from outer space. This is one source of background radiation.

State **one** other natural source of background radiation.

..... [1]

(d) The aircraft is able to navigate using radar. This involves using microwaves. These are part of the electromagnetic spectrum.

Name **one** other wave which is part of the electromagnetic spectrum and give a use for this radiation.

name .....

use ..... [2]

For Examiner's Use

3 **(a)** Complete the word equation for aerobic respiration.

oxygen + ... ⟶ ..... + ... [2]

(b) Describe how oxygen is transported from the lungs to a cell in a human muscle.

.....

.....

..... [2]

(c) An athlete ran on a treadmill at a slow speed for 5 minutes. She then ran on the same treadmill at a faster speed for 5 minutes.

Fig. 3.1 shows the volume of oxygen she used per minute during both runs.

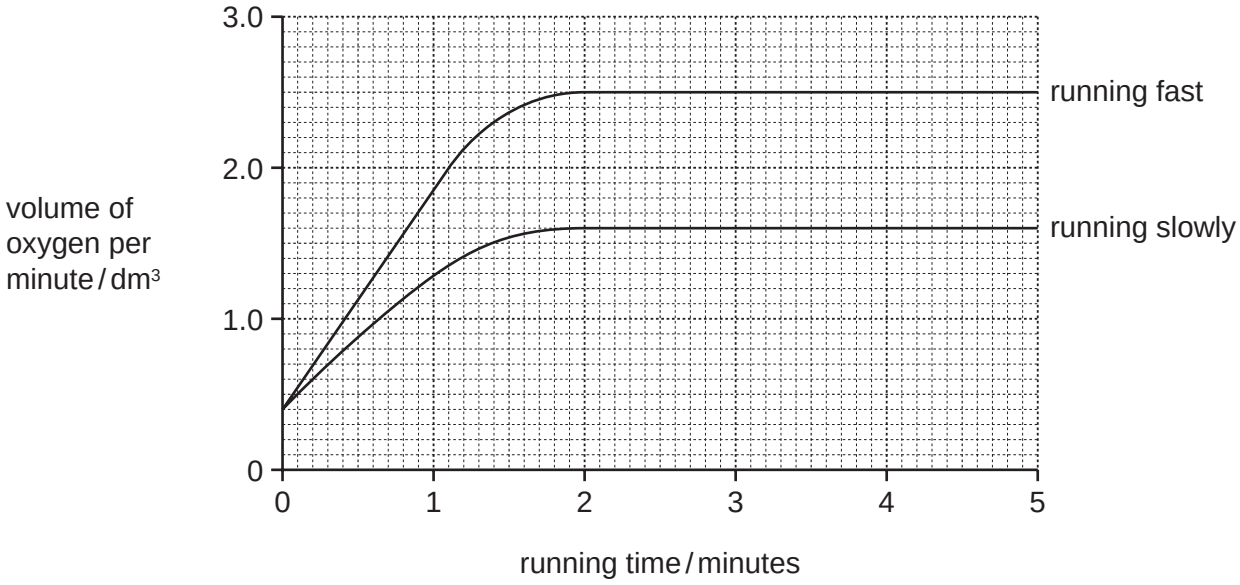

Fig. 3.1

(i) State the volume of oxygen used per minute by the athlete before she began to run.

..... dm^3 [1]

(ii) Describe how the volume of oxygen used per minute during the fast run differs from the slow run.

.....

.....

..... [2]

(iii) Suggest an explanation for the differences you have described in **(ii)**.

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.....

.....

..... [2]

(d) Professional athletes do not smoke cigarettes because smoking can cause emphysema. This reduces the ability of oxygen to diffuse into the blood from the lungs.

Explain what is meant by *emphysema*.

.....

..... [1]

4 Fig. 4.1 shows an electric hairdryer.

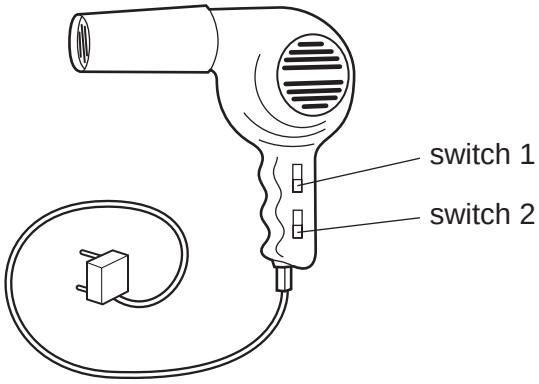

Fig. 4.1

(a) Fig. 4.2 shows the circuit diagram for the hairdryer.

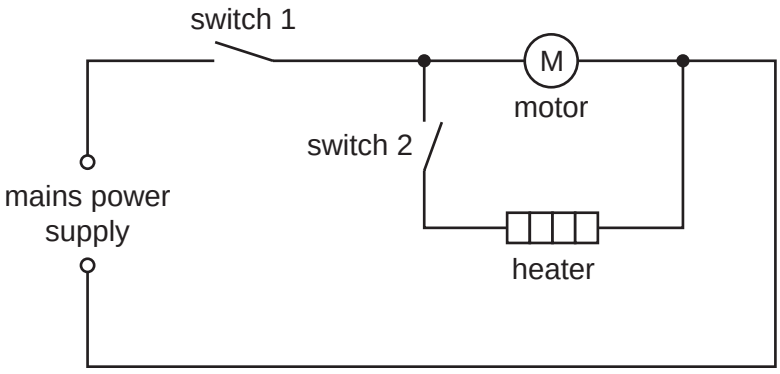

Fig. 4.2

(i) State which of the switches must be closed (on) for the heater in the hairdryer to work.

..... [1]

(ii) A student wanted to determine the resistance of the heater.

Fig. 4.3 shows the circuit he built to measure the current passing through the heater and the potential difference across the heater.

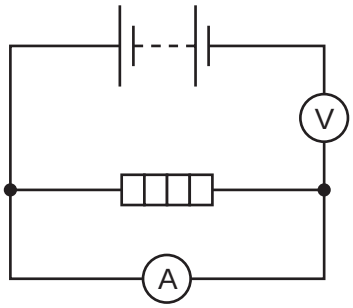

Fig. 4.3

His experiment did not work because his circuit was incorrect.

Draw the correct circuit in the space below.

[2]

(b) The electricity used in the hairdryer was generated at a power station.

(i) Name a fossil fuel that can be used in power stations.

..... [1]

(ii) Power is transmitted from the power station over large distances.

A high voltage is always used. Explain why.

.....

..... [1]

The high voltage is produced by a transformer.

Fig. 4.4 shows a simple transformer.

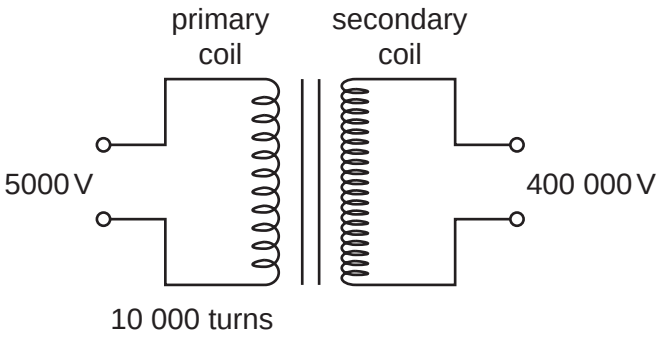

Fig. 4.4

(iii) Use the equation

$$V_p/V_s = N_p/N_s$$

to calculate the number of turns in the secondary coil.

Show your working.

number of turns = ... [1]

(iv) Transformers are also used between power lines and people's houses.

Explain why.

.....

.....

..... [2]

5 Fig. 5.1 shows a section through a flower.

For Examiner's Use

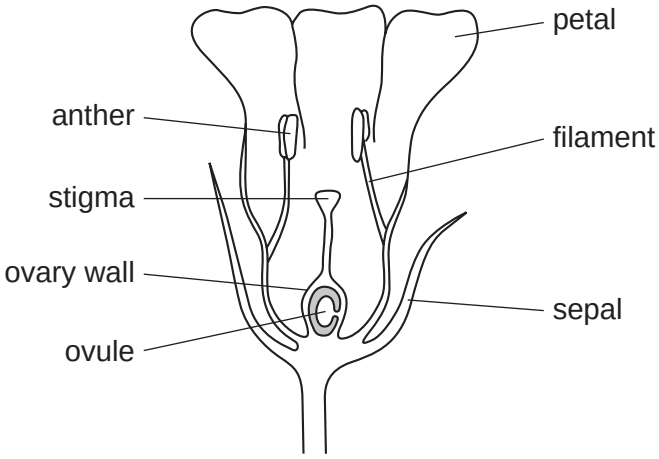

Fig. 5.1

(a) (i) State the function of each of the following parts of the flower.

petal .....

anther ..... [2]

(ii) Name the part of the flower that

develops into a seed, ...

develops into a fruit. ..... [2]

(b) Flowers are involved in sexual reproduction.

Complete the table to show whether each statement is true for asexual reproduction, sexual reproduction, both or neither.

Use a tick (✓) for a correct statement and a cross (✗) for an incorrect statement. You must write either a tick or cross in each space in the table.

The first statement has been completed for you.

statement	asexual reproduction	sexual reproduction
gametes are involved	✗	✓
new individuals are produced		
a zygote is produced		
offspring are always genetically identical		

[3]

6 Nordic gold is an alloy of four metals used to make coins.

Table 6.1 shows information about the metals contained in Nordic gold.

Table 6.1

metal	% by mass in Nordic gold	compound from which the metal is extracted
aluminium	5	Al_2O_3
copper		$CuFeS_2$
tin	1	SnO_2
zinc	5	ZnS

(a) (i) Complete Table 6.1 by stating the percentage of copper in Nordic gold. [1]

(ii) Suggest how Nordic gold could be made.

.....

..... [1]

(iii) In the right hand column, the elements present in compounds can be identified by their symbols.

Name a metallic element present in one of the compounds in Table 6.1 which is **not** present in Nordic gold.

..... [1]

(iv) Suggest **two** properties of Nordic gold, other than its appearance, that make it a suitable material from which to make coins.

1 .....

2 ..... [2]

(b) (i) Tin may be extracted from tin oxide by heating a mixture of tin oxide and carbon. The other product of this reaction is carbon monoxide.

Write a **word** chemical equation for this reaction.

..... [1]

(ii) State and explain which substance is **oxidised** when tin is extracted from tin oxide.

substance which is oxidised .....

explanation .....

..... [2]

(c) (i) Aluminium is extracted from the ionic compound aluminium oxide by electrolysis.

Explain the meanings of the following terms that are important in electrolysis.

cathode .....

electrolyte .....

..... [3]

(ii) State how the position of aluminium in the Periodic Table shows that aluminium atoms have three electrons in their outer shell.

.....

..... [1]

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For Examiner's Use

7 **(a)** Fig. 7.1 shows a mother pushing her child in a baby buggy. She uses a force of 100 N.

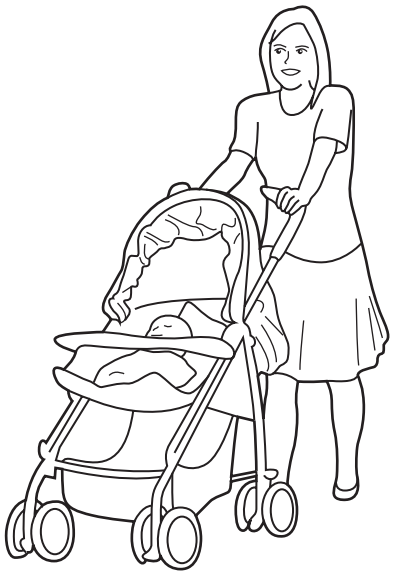

Fig. 7.1

The baby buggy is pushed 2000 m.

Calculate how much work has been done.

State the formula that you use and show your working.

formula used

working

..... J [2]

For Examiner's Use

(b) A child is playing on a swing. This is shown in Fig. 7.2.

At the top of the oscillation, the child and swing are momentarily at rest.

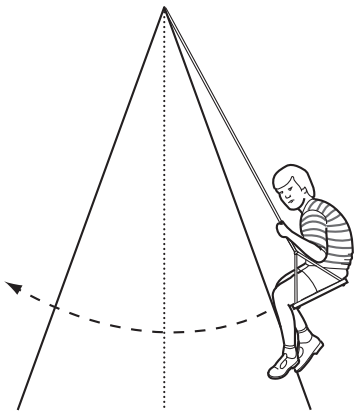

Fig. 7.2

(i) Write the correct energy type in the space to complete the box.

gravitational potential energy at the top of the oscillation	=	gravitational potential energy at the bottom of the oscillation	+	..... energy at the bottom of the oscillation	+	energy losses

[1]

(ii) Suggest a form of energy which is lost from the system.

..... [1]

(iii) Suggest where the lost energy goes.

..... [1]

(c) The child weighs 400 N.

The Earth's gravitational field strength is 10 N / kg.

(i) State the mass of the child.

..... kg [2]

(ii) The average density of the human body is 1020 kg / m^3.

Calculate the volume of the child.

State the formula that you use and show your working.

formula used

working

..... m^3 [1]

For Examiner's Use

8 Fig. 8.1 shows a tree frog that lives in a tropical rain forest.

Fig. 8.1

(a) Tree frogs feed on insects. Enzymes in their alimentary canal break down large molecules in the insects into small ones.

(i) State the correct biological term for this process. ..... [1]

(ii) Explain why this process is necessary for the frog's survival.

.....

..... [1]

(iii) Use words from the list to complete the sentences about enzymes.

carbohydrates	**cells**	**denatured**	**dissolved**
hydrogen	**killed**	**oxygen**	**proteins**

Enzymes are ..... that catalyse chemical reactions in living organisms. One example of an enzyme is catalase, which breaks down hydrogen peroxide to water and ..... . Enzymes are ..... by high temperatures. [3]

(b) Tropical rain forests have a high species diversity.

(i) Explain what is meant by *species diversity*.

.....

..... [1]

(ii) Many species of tree frog have become extinct in the last ten years.

Suggest how the loss of tree frogs from the rain forest could damage the ecosystem.

.....

.....

.....

..... [2]

For Examiner's Use

For Examiner's Use

9 Hydrocarbons are compounds which contain only the elements hydrogen and carbon.

(a) The simplest hydrocarbon is methane, which is an important fuel.

(i) State **one** natural source of methane.

.....

[1]

(ii) Complete the displayed (graphical) formula of a methane molecule.

[2]

(iii) Carbon dioxide and carbon monoxide are compounds released into the atmosphere when methane burns.

Describe **one** environmental disadvantage of each compound.

carbon dioxide .....

.....

.....

carbon monoxide .....

.....

.....

[3]

(b) Table 9.1 shows the molecular formulae and boiling points of four hydrocarbons.

Table 9.1

molecular formula	boiling point / °C
C_6H_{14}	69
$C_{10}H_{22}$	174
$C_{12}H_{26}$	216
C_5H_{12}	36

(i) Name a process which could be used to separate a mixture of the compounds in Table 9.1.

.....

[1]

(ii) Use the information in Table 9.1 to describe how the boiling point of a hydrocarbon is affected by the mass of its molecules.

.....

.....

.....

[2]

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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 **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.).