UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS
International General Certificate of Secondary Education

CANDIDATE NAME									
CENTRE NUMBER						CANDIDATE NUMBER			

CO-ORDINATED SCIENCES **0654/23**

Paper 2 (Core) **May/June 2013**

2 hours

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 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 28.

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 **27** printed pages and **1** blank page.

BLANK PAGE

1 Fig. 1.1 shows an experimental car powered by solar panels.

For Examiner's Use

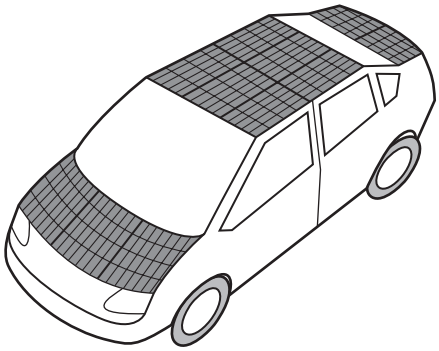


Fig. 1.1

(a) The speed / time graph in Fig. 1.2 shows the motion of the car over a short time.

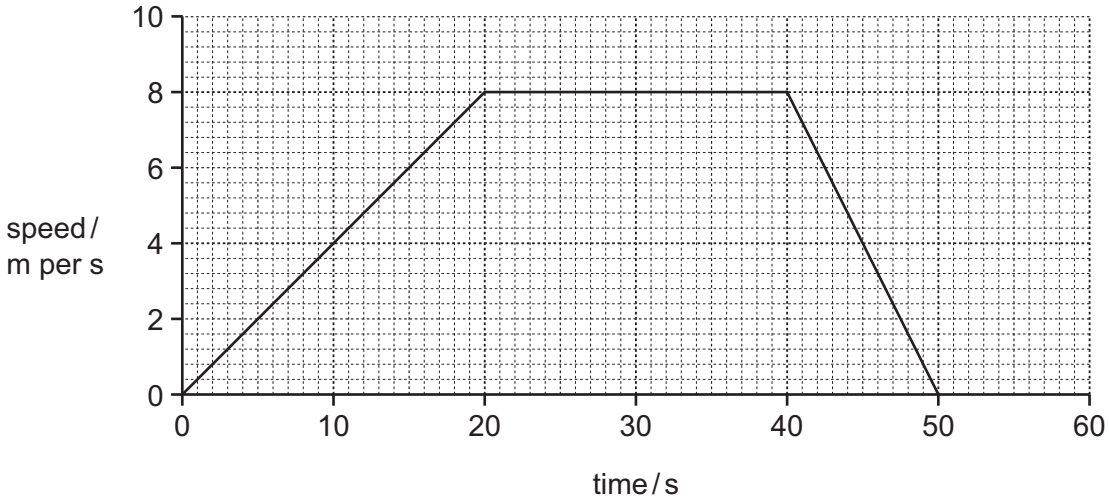


Fig. 1.2

On Fig. 1.2 label

N at a point at which the car was not moving,

A at a point when the car was accelerating,

C at a point at which the car was travelling at constant speed. [3]

For Examiner's Use

(b) The energy output from the solar panels was measured during one day. Fig. 1.3 is a graph of the results.

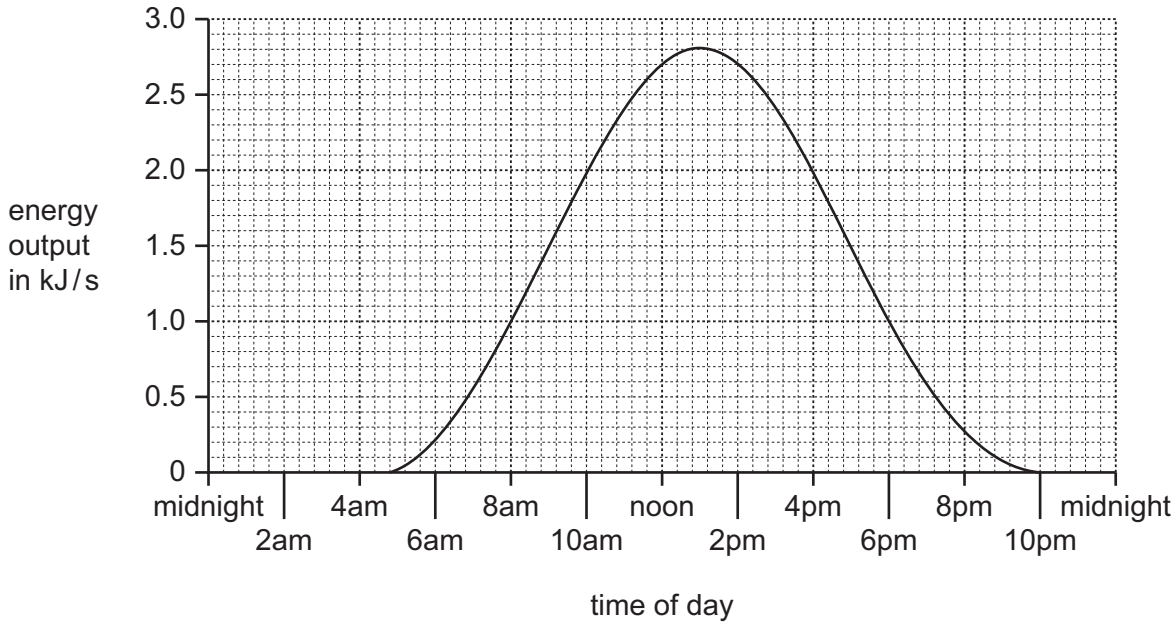


Fig. 1.3

(i) Describe how the energy output from the solar panels varies during one day.

.....

.....

..... [2]

(ii) Explain why the energy output from the solar panels varies during the day.

.....

..... [1]

(c) Generators are used to produce electricity in power stations.

Describe how energy from a **named** fossil fuel is transferred to the generator in a power station.

.....

.....

.....

..... [3]

(d) Fig. 1.4 shows a small photovoltaic cell (solar cell) being investigated.

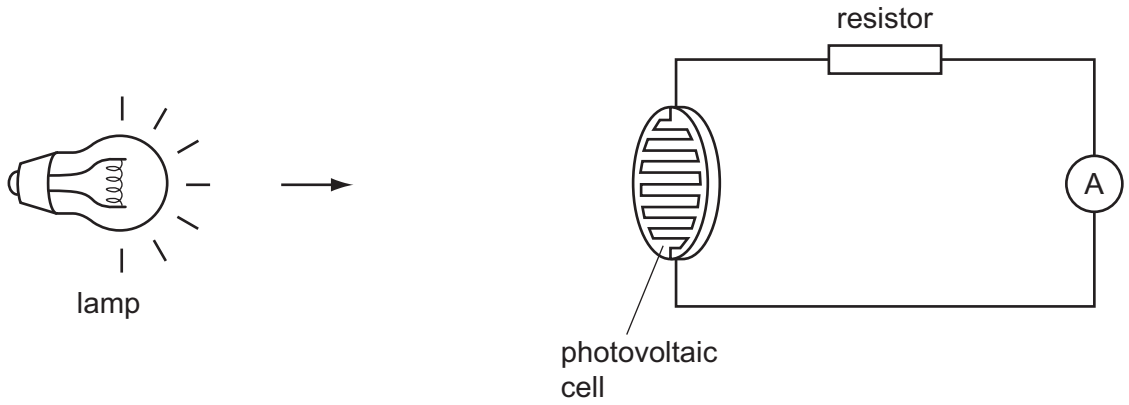


Fig. 1.4

A voltmeter is added to the circuit to measure the voltage across the photovoltaic cell.

Using the correct symbol, draw the voltmeter in the correct position on Fig. 1.4. [2]

(e) The car has mirrors to help the driver see behind the car. The driver sees a truck in his mirror as shown on Fig. 1.5.

Use Fig. 1.5 to describe **two** characteristics of an image seen in a plane mirror apart from size.

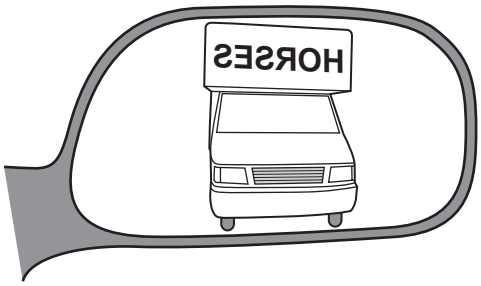


Fig. 1.5

.....

.....

.....

..... [2]

2 Petroleum (crude oil) is a mixture of hydrocarbons.

(a) Three useful products obtained from petroleum are refinery gas, gasoline (petrol) and diesel oil (gas oil).

(i) State **one** use for each of these products.

refinery gas .....

gasoline .....

diesel oil ..... [3]

(ii) Name **two** compounds that are produced when hydrocarbons undergo complete combustion.

1 .....

2 ..... [2]

(iii) Explain why combustion of hydrocarbons is an example of an oxidation reaction.

.....

..... [1]

(b) Fig. 2.1 shows a simplified diagram of a process which is used to convert large saturated hydrocarbon molecules into smaller, more useful molecules.

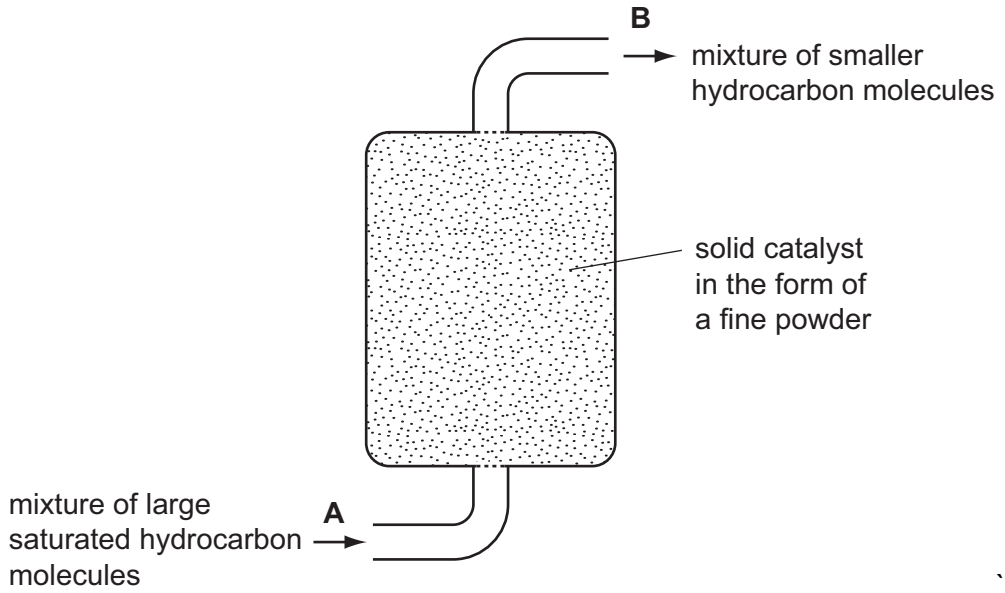


Fig. 2.1

(i) Name the process shown in Fig. 2.1. ..... [1]

For Examiner's Use

(ii) A chemist takes samples of the mixture of compounds from point **A** and point **B** in Fig. 2.1.

He adds bromine solution to each sample and shakes the mixture.

Predict and explain the appearance of each mixture after shaking with bromine solution.

sample from point **A** .....

sample from point **B** .....

explanation .....

.....

..... [4]

3 Fig. 3.1 shows part of a food web in a northern forest. The arrows show the direction of energy flow.

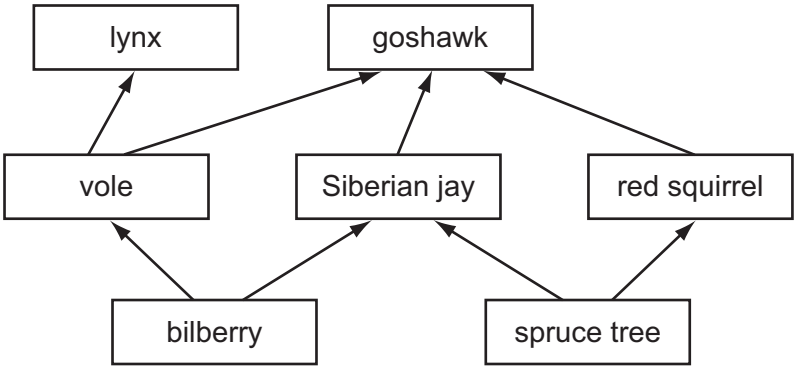


Fig. 3.1

(a) Complete Table 3.1 by selecting **two** organisms from the food web that belong in **each** column.

You can use each organism once, more than once or not at all.

Table 3.1

	producer	consumer	herbivore	carnivore
organism **1**				
organism **2**				

[4]

(b) If the forest is cut down, the species in the food web may not be able to survive.

List **two other** undesirable effects that may occur if the forest is cut down.

1 .....

2 ..... [2]

(c) State **three** ways in which energy is used in the body of an animal, such as a lynx.

1 .....

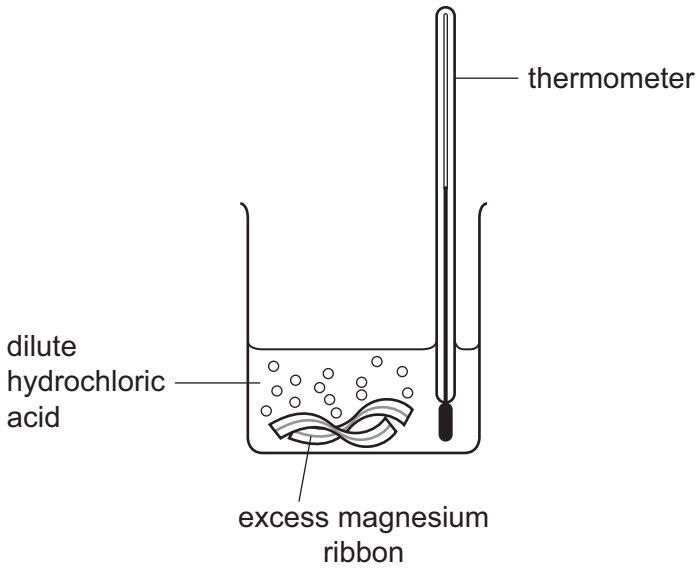
2 .....

3 ..... [3]

For Examiner's Use

4 A student added excess magnesium to dilute hydrochloric acid.

During the reaction, the thermometer reading changed.



(a) (i) State **two** observations which show that a chemical change occurs when magnesium is added to dilute hydrochloric acid.

1 .....

2 ..... [2]

(ii) Name the gas that is given off in this reaction and describe a test for this gas.

name .....

test .....

..... [2]

(iii) Explain why the pH of the mixture increases during the reaction.

.....

.....

..... [2]

[Turn over

(b) The student set up the apparatus shown in Fig. 4.1.

She investigated the rate of reaction between magnesium and dilute hydrochloric acid.

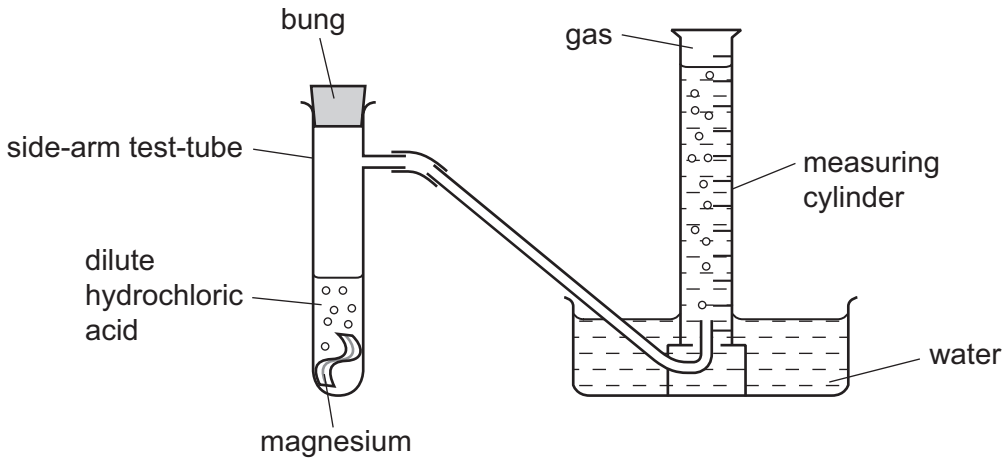


Fig. 4.1

At the start of the experiment, the measuring cylinder contained no gas and was full of water.

(i) The student knew that the speed at which the gas is produced is a good way of measuring the rate of reaction.

What should the student measure to find the rate at which gas is produced?

.....

.....

..... [2]

(ii) State **two** variables that affect the rate of reaction between magnesium and dilute hydrochloric acid.

1 .....

2 ..... [2]

For Examiner's Use

5 **(a)** Visible light and γ-(gamma) radiation are two regions of the electromagnetic spectrum.

(i) Name a region of the electromagnetic spectrum that is used in remote control devices for televisions.

.....[1]

(ii) State **one** way in which the waves in different regions of the electromagnetic spectrum differ from each other.

.....[1]

(b) Fig. 5.1 shows a light ray passing from the air through a glass fibre, and back out into the air.

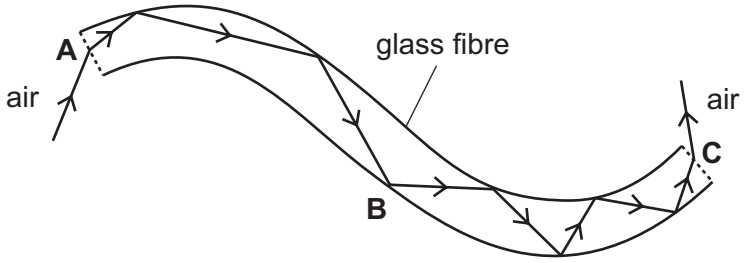


Fig. 5.1

Use **one** of the phrases to complete the sentences below.

Each phrase can be used once, more than once or not at all.

hits at an angle greater than the critical angle.
hits at an angle less than the critical angle.
is passing into a less dense medium.
is passing into a more dense medium.

The ray of light changes direction at

A because it .....

.....

B because it .....

.....

C because it .....

.....[3]

For Examiner's Use

(c) One source of background radiation is cosmic rays.

Cosmic rays are 90% protons, 9% α-(alpha) particles and 1% electrons.

(i) What is an α-particle?

.....

[1]

(ii) Name a source of background radiation apart from cosmic rays.

.....

[1]

(d) The following sentence about α-particles was written by a student. The statement is **not** correct.

α-particles can pass through a thin sheet of lead

Change the statement to make it correct.

Write your correct statement below.

.....

.....

[1]

(e) Underline the **two** pieces of equipment that detect ionising radiations.

ammeter	**Geiger-Müller tube**	**litmus paper**
newton-meter	**photographic film**	**thermometer**

[2]

(f) **Three** of the following statements are true. Tick the correct statements.

Both α-(alpha) radiation and β-(beta) radiation pass easily through the body.	☐
α-radiation damages cells in a very localised area of the body.	☐
Ionisation does not always kill cells – sometimes it causes them to mutate.	☐
Cancer occurs when a large number of cells are killed.	☐
The dose of radiation received depends on the length of exposure.	☐

[2]

(g) Most atoms contain electrons, protons and neutrons.

State which of these particles

has the least mass, ...

has no charge, ...

has a negative charge, ...

are in the nucleus. ..... and ..... [4]

For Examiner's Use

For Examiner's Use

6 **(a)** The words in the list below are all related to human reproduction.

Choose words from the list to match each description. You may use each word once, more than once or not at all.

oviduct **prostate gland** **sperm**

testis **urethra** **uterus** **zygote**

a cell formed when the nuclei of the male and female gamete fuse	
a male gamete	
the organ in which sperms are made	
the place where fertilisation occurs	

[4]

(b) Fig. 6.1 shows changes in the thickness of a woman's uterus lining over a time interval of 45 days.

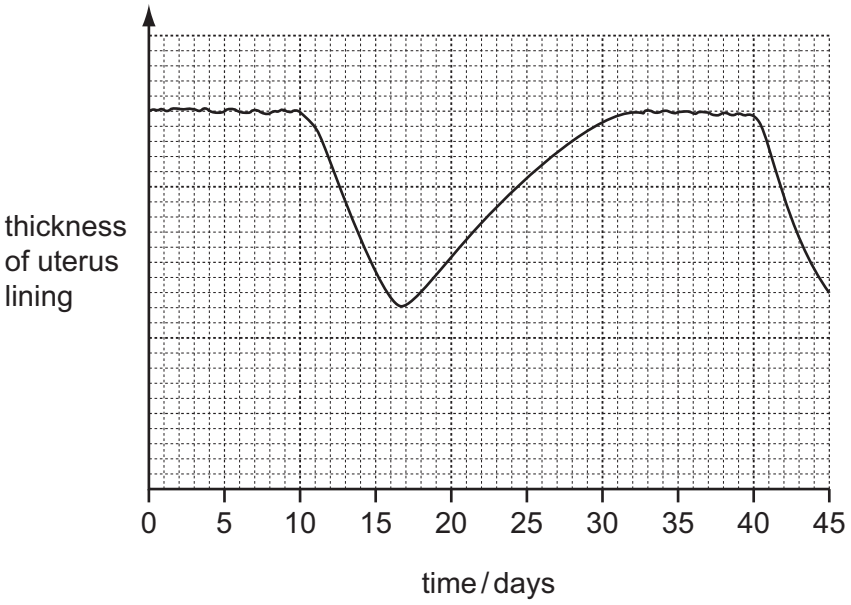


Fig. 6.1

(i) Use Fig. 6.1 to estimate the number of days for which one menstrual cycle lasted.

..... [1]

(ii) Suggest the day on which an egg was released from the woman's ovaries.

..... [1]

For Examiner's Use

(c) A woman with HIV / AIDS can pass the disease to her child.

(i) What does the abbreviation HIV stand for?

.....

[1]

(ii) Describe how a woman can pass the disease to her child.

.....

.....

.....

[2]

7 **(a)** **(i)** Copper is used to make water pipes, cooking pots and electrical wires.

State **three** different properties of copper that make it a suitable material for these uses.

1 .....

2 .....

3 ..... [3]

(ii) Name the family of metals in the Periodic Table which includes copper.

..... [1]

(b) Bronze is a mixture containing copper and tin.

(i) State the general name of materials such as bronze.

..... [1]

(ii) State **one** advantage of bronze compared with copper.

..... [1]

(c) Fig. 7.1 shows a process in which a copper compound is split into elements.

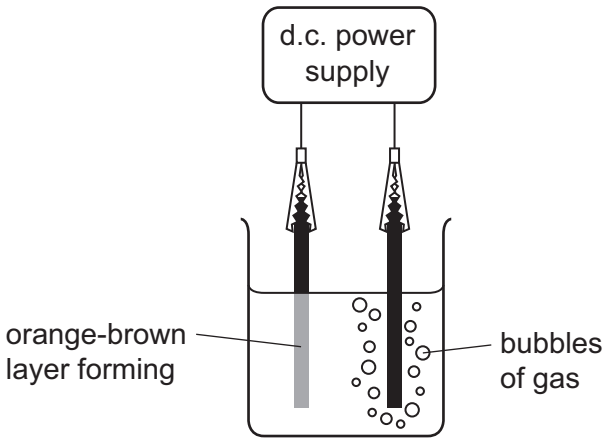


Fig. 7.1

(i) Name the process shown in Fig. 7.1. ..... [1]

(ii) On Fig. 7.1 label the cathode. [1]

For Examiner's Use

(iii) One of the products of the process shown in Fig. 7.1 is a gas. This gas bleaches damp litmus paper.

Name the copper compound that is being separated into its elements.

Explain your answer.

name of compound .....

explanation .....

..... [2]

8 Fig. 8.1 shows a washing machine. When the door is closed and the machine is switched on, an electric motor rotates the drum and clothes.

For Examiner's Use

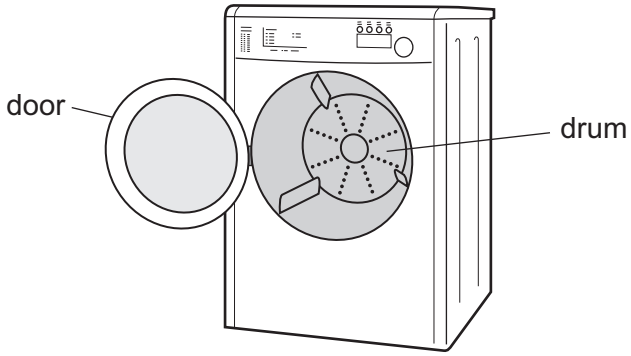


Fig. 8.1

(a) Choose words from the list below to complete the sentences.

chemical	**heat**	**kinetic**	**light**
nuclear	**gravitational potential**		**sound**

In an electric motor, the useful energy transfer is electrical energy into

..... energy.

Some of the electrical energy supplied to the motor is wasted as

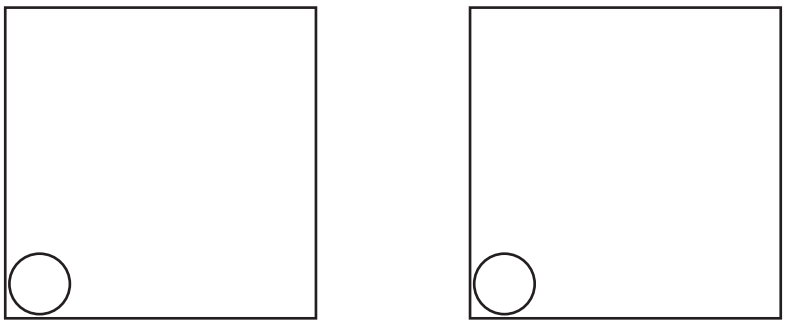
..... energy and

..... energy. [2]

(b) Inside the washing machine, some of the water evaporates when the washing machine is being used.

(i) During evaporation, water changes state from liquid to gas.

Complete the diagrams to show the arrangement of particles in a liquid and in a gas.



liquid gas

[3]

For Examiner's Use

(ii) Explain, in terms of particles, the process of evaporation.

.....

.....

.....

..... [3]

(c) A current of 3 A passes through the heating element when the voltage across it is 220 V.

Calculate the resistance of the heating element.

State the formula that you use and show your working.

formula

working

..... Ω [2]

For Examiner's Use

9 Fig. 9.1 shows a pitcher plant, which grows in Malaysia and Indonesia.

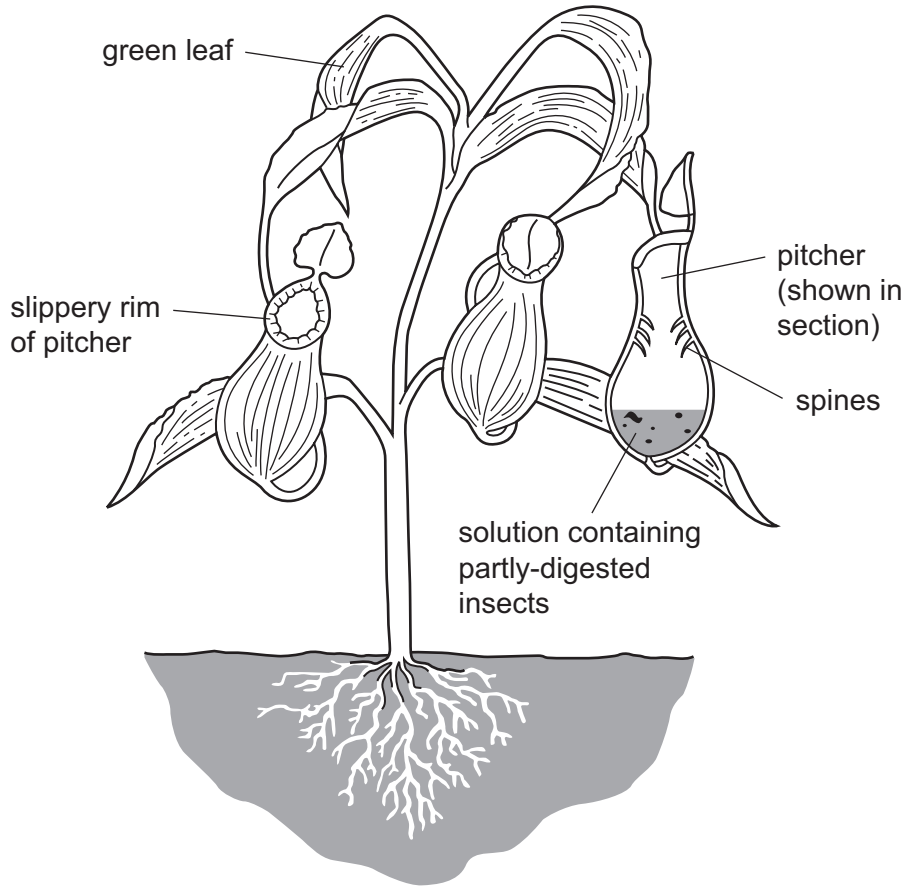


Fig. 9.1

(a) The leaves of pitcher plants carry out photosynthesis, using carbon dioxide and water to make carbohydrates. They obtain carbon dioxide and water in the same way as other plants.

(i) Complete Table 9.1 to show how the leaves obtain carbon dioxide and water. You do not need to write anything in the shaded box.

Table 9.1

substance	source	part of plant that absorbs it	process by which it is absorbed
carbon dioxide	air		
water			

[4]

(ii) Write the **word** equation for photosynthesis.

.....

[2]

For Examiner's Use

(b) Pitcher plants grow where the concentration of nitrate ions in the soil is very low. Most plants need nitrate ions to make amino acids and proteins.

Pitcher plants use a different way of obtaining amino acids. They trap insects in their pitchers, and produce a solution that digests the proteins in the insects' bodies.

(i) Describe **two** features of the pitchers, shown in Fig. 9.1, that help to trap insects inside them.

1 .....

2 ..... [2]

(ii) Define the term *digestion*.

.....

.....

..... [2]

(iii) Suggest what is present in the solution that the pitcher plant produces inside its pitchers, to enable digestion to take place.

.....

..... [1]

[Turn over

(c) A scientist investigated the hypothesis that a scent produced by the rim of the pitchers acts as a stimulus that attracts insects.

She took several identical Petri dishes.

- She placed a piece of the rim of a pitcher, *or* a small amount of solution from inside the pitcher *or* water, on one side of the dish (side **A**).
- She put a small amount of water on the other side (side **B**) as shown in Fig. 9.2.
- She then placed an insect in the centre of the dish. She recorded which side of the dish the insect moved to.

She repeated this 19 more times, using a different insect each time.

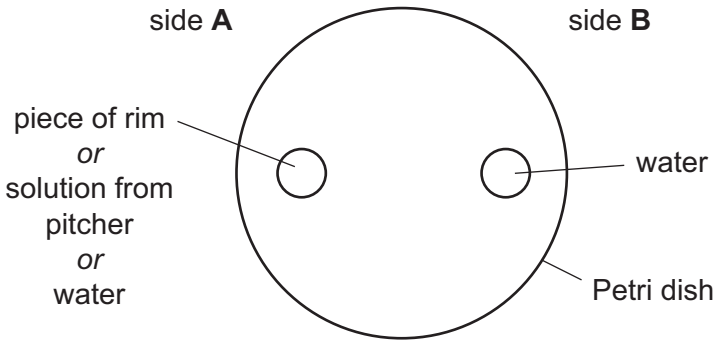


Fig. 9.2

Table 9.2 shows her results.

Table 9.2

substance on side **A** of dish	substance on side **B** of dish	number of insects that moved to each side	
		A	**B**
piece of rim	water	16	4
solution from pitcher	water	4	16
water	water	10	10

(i) Suggest why the scientist placed water on both sides of some dishes.

.....

..... [1]

(ii) Do the results support the scientist's hypothesis? Explain your answer.

.....

.....

..... [2]

For Examiner's Use

10 (a) When wood is burnt, a solid material known as wood ash remains.

Wood ash contains calcium carbonate and potassium compounds, which can be used to improve the quality of soil.

(i) Explain briefly how calcium carbonate and potassium compounds could improve the quality of soil.

calcium carbonate

.....

.....

.....

potassium compounds

.....

.....

.....

[3]

(ii) Suggest how a sample of wood ash could be tested to show that it contained carbonate ions.

.....

.....

..... [2]

(b) Soil quality is also improved by the addition of nitrogen compounds such as ammonium sulfate, $(NH_4)_2SO_4$.

(i) State the total number of atoms shown combined in the chemical formula $(NH_4)_2SO_4$.

..... [1]

(ii) Ammonium sulfate is the product of a reaction between an alkaline solution of ammonia and an acid.

Name the acid that reacts with ammonia to form ammonium sulfate and state the type of chemical reaction that occurs.

name of acid .....

type of reaction ..... [2]

[Turn over

(iii) Outline how crystals of ammonium sulfate could be obtained from a solution of ammonium sulfate.

For Examiner's Use

.....

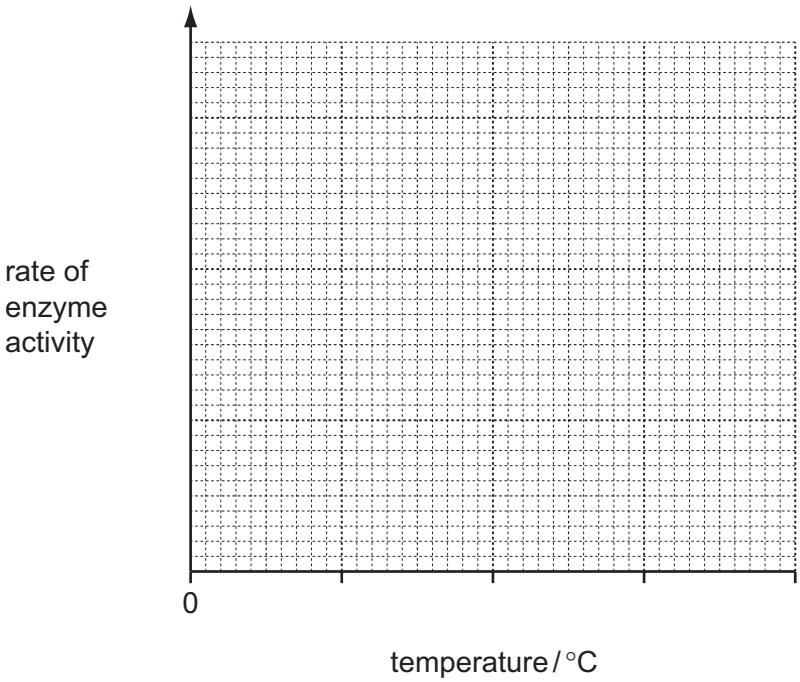
.....

..... [2]

Please turn over for Question 11.

11 (a) Complete the graph in Fig. 11.1 to show how enzyme activity is affected by temperature. You should write in at least two values for temperature on the 'temperature' axis.

For Examiner's Use



[3]

Fig. 11.1

(b) The internal body temperature of a human is kept constant, allowing enzymes to work efficiently. The skin helps to do this.

Fig. 11.2 shows a section through the skin in two different environmental conditions.

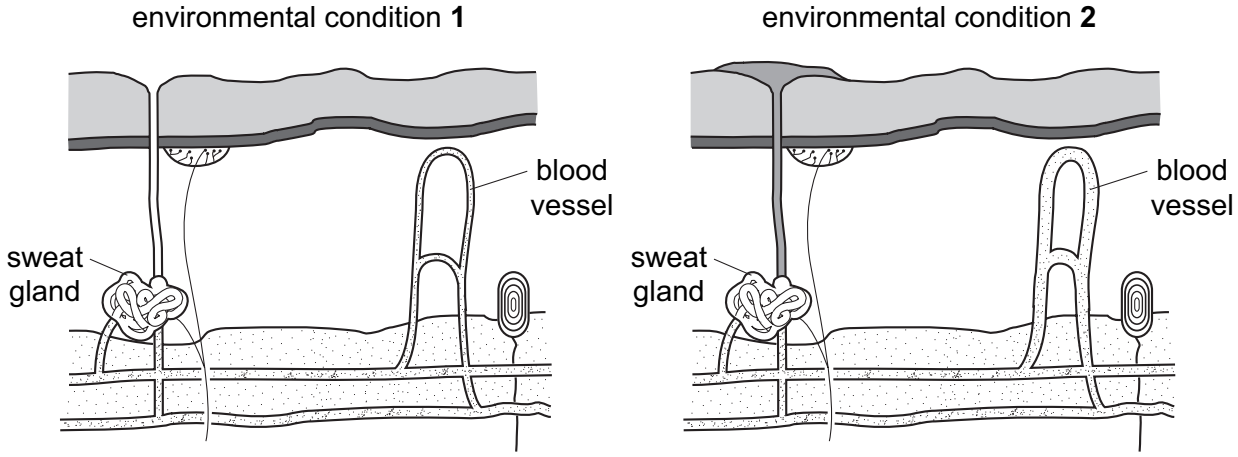


Fig. 11.2

For Examiner's Use

(i) Describe **two** ways in which the skin in environmental condition **2** differs from environmental condition **1**.

1 .....

.....

2 .....

..... [2]

(ii) Suggest how environmental condition **2** differs from environmental condition **1**.

..... [1]

(iii) The muscles also help to maintain a constant body temperature.

Explain how the muscles can help to return a low body temperature to normal.

.....

.....

..... [2]

DATA SHEET
The Periodic Table of the Elements

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.).