UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS
International General Certificate of Secondary Education

CANDIDATE NAME

CENTRE NUMBER

CANDIDATE NUMBER

6951258103

CO-ORDINATED SCIENCES **0654/22**

Paper 2 (Core) **May/June 2010**

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 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.

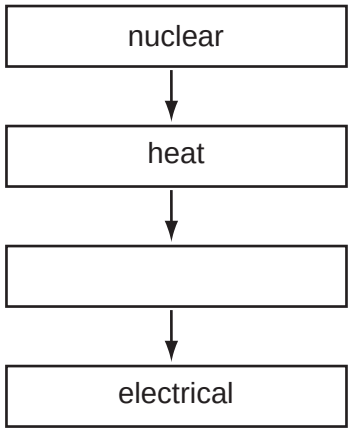
At the end of the examination, fasten all your work securely together.
The number of marks is given in brackets [ ] at the end of each question or part question.

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

This document consists of **23** printed pages and **1** blank page.

For Examiner's Use

1 **(a)** Complete the diagram in Fig. 1.1 to show the energy transfers in a power station fuelled by a nuclear reactor.



[1]

Fig. 1.1

(b) Name **one** nuclear fuel.

..... [1]

(c) **(i)** Coal is a non-renewable energy source.

Explain what is meant by the term *non-renewable*.

.....

..... [1]

(ii) State **one** example of a renewable energy source that can be used to generate electricity.

..... [1]

(iii) State **one** advantage of a nuclear power station over a coal-burning power station.

.....

..... [1]

(d) Explain why electricity is transmitted at high voltage.

Your answer should include ideas about current, voltage and energy loss.

.....

.....

..... [2]

For Examiner's Use

(e) One of the waste products formed in nuclear power stations is the isotope strontium-90.

Strontium-90, like other waste products from nuclear reactors, has been produced by nuclear fission.

(i) State what happens to the nuclei of atoms during nuclear fission.

..... [1]

(ii) Strontium-90 decays by beta particle emission. What is a beta particle?

..... [1]

2 **(a)** In Fig. 2.1 the substances in the left hand column are all proteins found in the human body.

Draw lines to link each protein to its function.

protein	function
haemoglobin	breaks down starch to maltose
insulin	transports oxygen
amylase	reduces blood glucose level

[2]

Fig. 2.1

(b) List the four elements found in all proteins.

.....

.....

[2]

(c) Two food samples were tested with iodine solution, Benedict's reagent and biuret reagent. The results are shown in Table 2.1.

Table 2.1

	food sample A	food sample B
colour after iodine test	brown	blue-black
colour after Benedict's test	orange-red	orange-red
colour after biuret test	purple	blue

State which food or foods contained protein.

Explain your answer.

.....

.....

.....

[2]

(d) When a person eats more protein than can be immediately used in the body, the excess protein is broken down to produce the waste product urea.

Name the organ in which urea is produced. ..... [1]

(e) Suggest how a nitrogen atom in a molecule of nitrogen gas in the atmosphere could become part of a protein in a plant.

.....

.....

.....

.....

..... [3]

[Turn over

For Examiner's Use

3 **(a)** Electrolysis is used in industry to convert the raw material, salt (sodium chloride), into three valuable products.

Two of these products are chlorine and sodium hydroxide solution.

A simplified diagram of the apparatus is shown in Fig. 3.1.

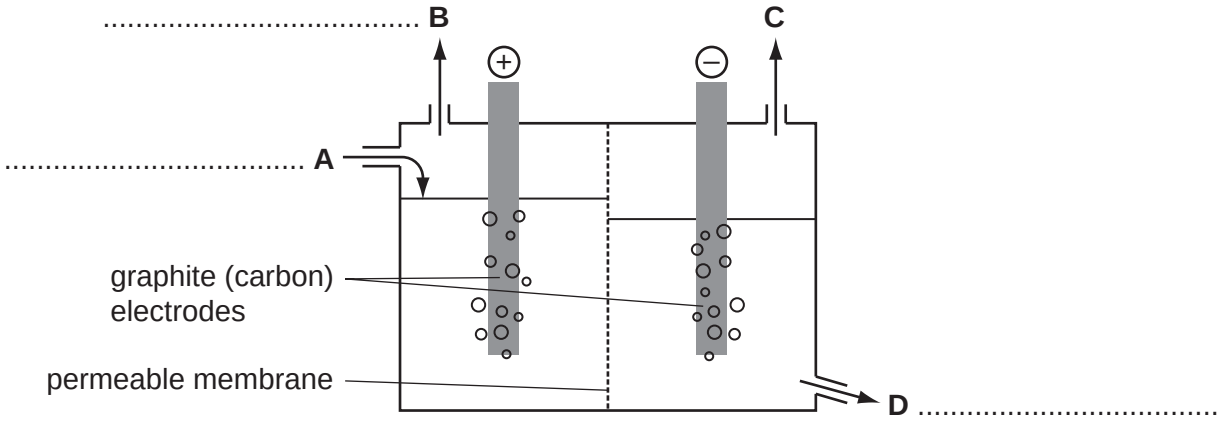


Fig. 3.1

(i) The product which leaves the apparatus at point **C** is a colourless gas which burns with a squeaky pop.

State the name or chemical formula of this gas.

..... [1]

(ii) Suggest the names or formulae of the chemicals found at points **A**, **B** and **D** in Fig. 3.1.

Write your answers on the diagram in Fig. 3.1. [2]

(iii) State **two** properties of graphite (carbon) which make it a suitable material from which to make the electrodes.

.....

..... [2]

(iv) Describe a safe chemical test for chlorine.

.....

..... [2]

For Examiner's Use

(b) Sucralose is a compound which is used instead of sucrose (sugar) to sweeten food and drink. Table 3.1 contains information about sucrose and sucralose.

Table 3.1

	chemical formula	kilojoules in 1 gram
sucrose	$C_{12}H_{22}O_{11}$	17
sucralose	$C_{12}H_{19}O_8Cl_3$	0

(i) Explain which compound, sucrose or sucralose, is a carbohydrate.

.....

..... [1]

(ii) State the total number of atoms which are combined in one molecule of sucralose.

..... [1]

(iii) Sweeteners containing sucralose are more expensive than sucrose, but one gram tastes much sweeter than one gram of sucrose.

Suggest why people might prefer to use sweeteners containing sucralose rather than sucrose.

.....

.....

..... [2]

For Examiner's Use

4 **(a)** Fig. 4.1 shows forces acting on three blocks. The size of an arrow indicates the size of the force it represents.

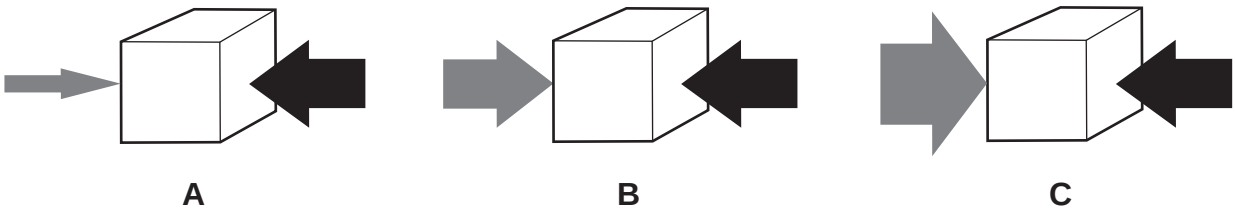


Fig. 4.1

(i) Which of the blocks would start to move?

Explain your answer.

blocks .....

explanation .....

..... [2]

(ii) On the blocks in Fig. 4.1 that move, draw another arrow to show the direction of motion. [1]

(iii) Name **one** force which acts downwards on all the blocks.

..... [1]

(iv) State the source of this force.

..... [1]

(b) One of the blocks has a mass of 720 g and a volume of 80 cm^3.

Calculate the density of the block.

State the formula that you use and show your working.

formula

working

..... g/cm^3 [2]

(c) A student tested a block to see if it conducted electricity.

Draw a simple circuit which the student could build for this purpose. Use the correct circuit symbols.

[3]

For Examiner's Use

5 **(a)** Fig. 5.1 shows how light intensity affects the rate of photosynthesis of a plant.

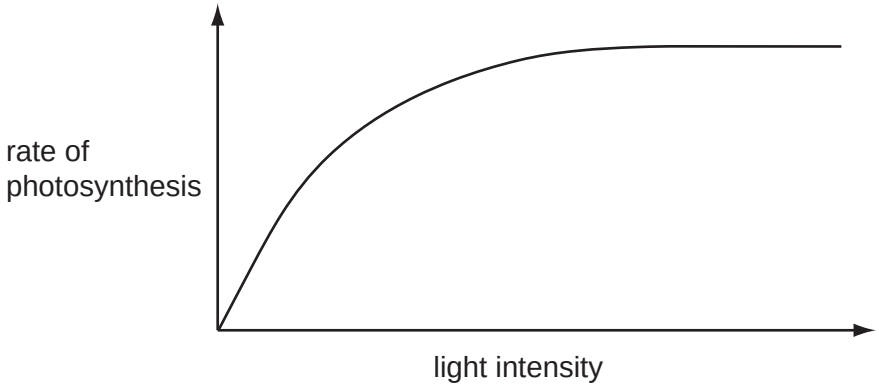


Fig. 5.1

(i) Describe the relationship between light intensity and the rate of photosynthesis.

.....

.....

..... [2]

(ii) Explain why light is needed for photosynthesis.

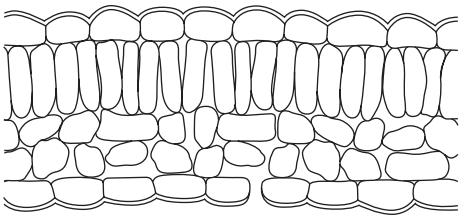
.....

.....

..... [2]

(b) The diagrams in Fig. 5.2 show sections through two leaves on the same tree. The two diagrams are drawn to the same scale.

leaf **A**



leaf **B**

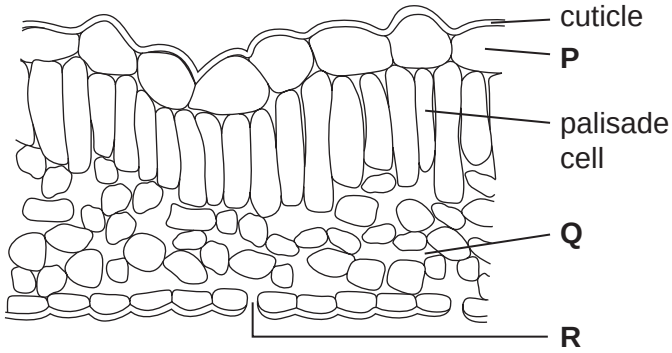


Fig. 5.2

(i) Name the parts labelled **P**, **Q** and **R** on Fig. 5.2.

P .....

Q .....

R ..... [3]

For Examiner's Use

(ii) Leaf **A** was taken from a part of the tree that was always in the shade.
Leaf **B** was taken from a part of the tree that received plenty of sunlight.

Both leaves are put into bright light.

Using Fig. 5.2, suggest in which leaf photosynthesis will happen faster in these conditions. Explain your answer.

leaf .....

explanation .....

..... [1]

(iii) Suggest why leaf **B** has a thicker cuticle than leaf **A**.

.....

.....

..... [2]

(iv) Describe how carbon dioxide travels to a palisade cell in a leaf.

.....

.....

.....

..... [3]

(c) The differences between leaf **A** and leaf **B** are an example of variation.

State whether this variation is caused by

- genes,
- the environment,
- both genes and environment together.

Explain your answer.

cause of variation .....

explanation .....

..... [2]

6 **(a)** Solutions of substances in water are acidic, neutral or alkaline.

Choose pH values from the list below to complete Table 6.1.

list of pH values **2** **5** **7** **9** **13**

Table 6.1

liquid	description	pH
sodium chloride solution	neutral	
lemonade (a fizzy drink)	weakly acidic	

[2]

(b) A student used the apparatus shown in Fig. 6.1 to investigate the reaction between dilute hydrochloric acid and magnesium.

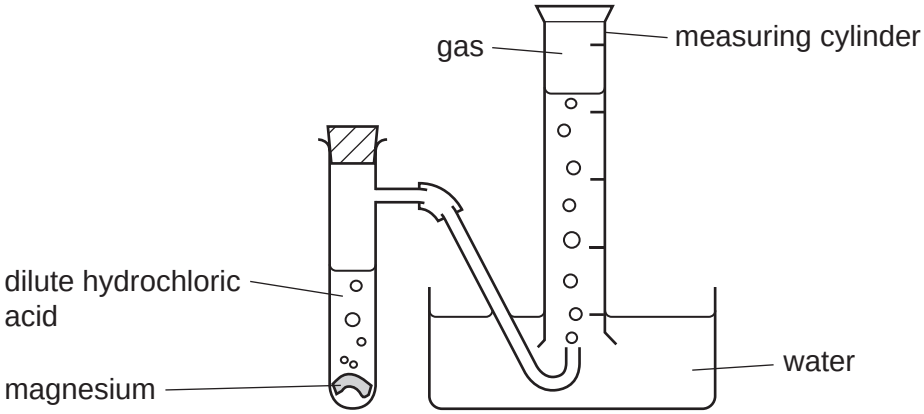


Fig. 6.1

(i) The student made several observations and measurements during her investigation.

Suggest and explain an observation which would show that the reaction between magnesium and dilute hydrochloric acid is *exothermic*.

.....

.....

..... [2]

For Examiner's Use

(ii) State **two** changes which the student could make to the reaction conditions so that the gas collected more **slowly** in the measuring cylinder.

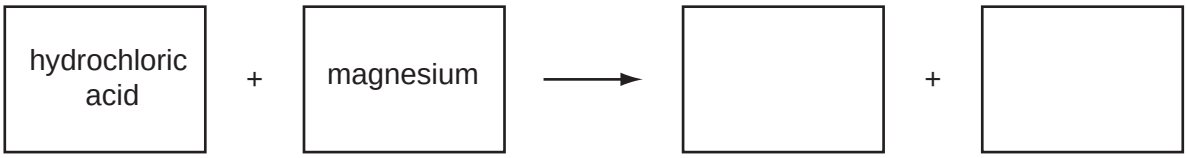
1 .....

.....

2 .....

..... [2]

(iii) Complete the word equation for the reaction between dilute hydrochloric acid and magnesium.



[2]

(c) Magnesium, Mg, is a metallic element.

(i) Explain the meaning of both words in the term *metallic element*.

metallic .....

.....

element .....

..... [2]

(ii) Name **one** other element which is in the same group of the Periodic Table as magnesium.

..... [1]

(iii) An atom of magnesium has a nucleon (mass) number of 26.

Calculate the number of neutrons in this magnesium atom.

Use the Periodic Table on page 24.

Show your working.

..... [1]

For Examiner's Use

7 **(a)** A racing car is being driven in a race.

The graph in Fig. 7.1 shows the speed of the car over a 26 second period.

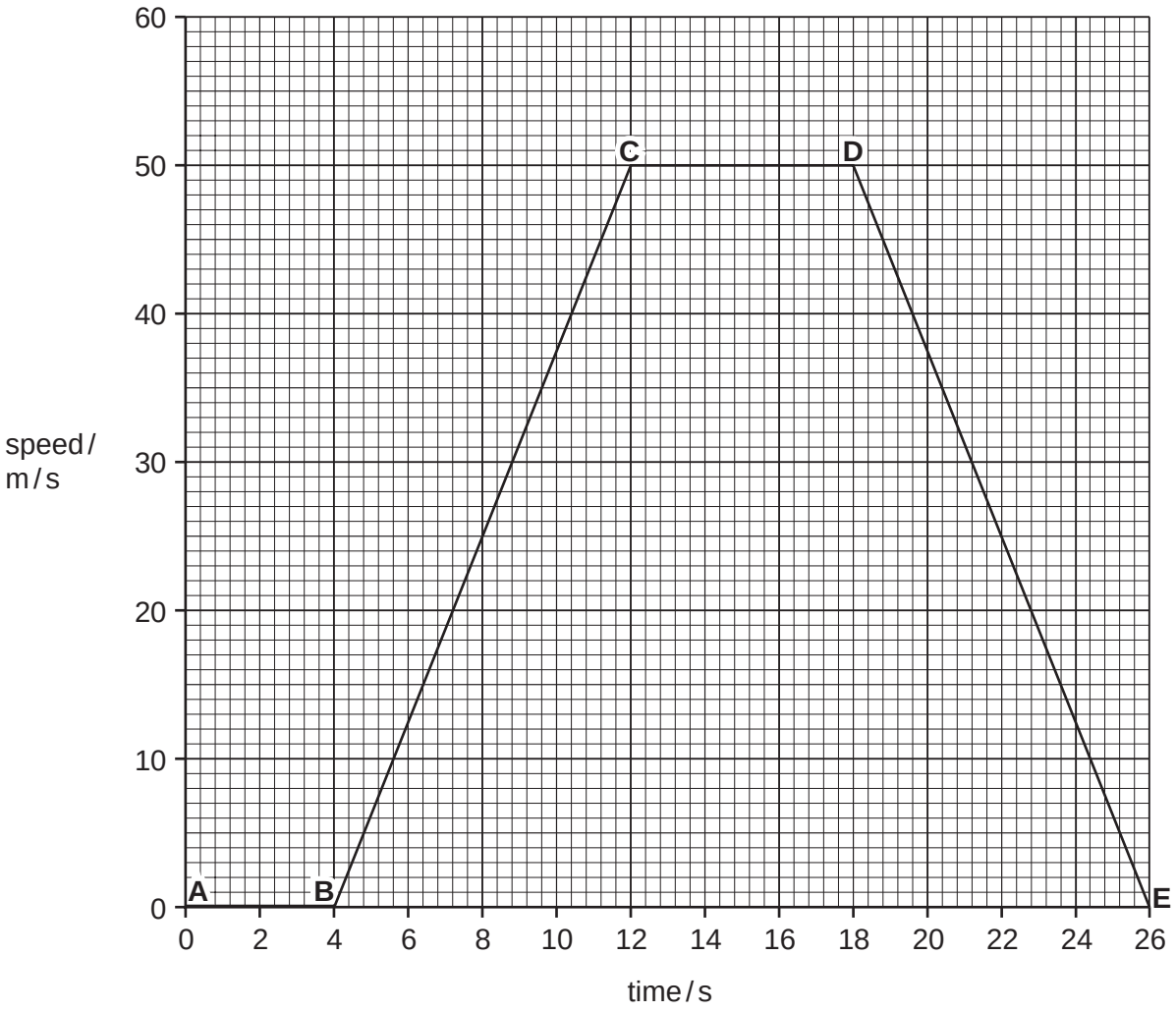


Fig. 7.1

(i) Between which points on the graph is the car not moving?

..... [1]

(ii) State the speed of the car between **C** and **D**.

..... m / s [1]

For Examiner's Use

(iii) The mass of the car and driver is 600 kg.

Calculate the momentum of the car between **C** and **D**.

State the formula that you use and show your working.

formula

working

..... kg m / s [2]

(iv) Calculate the acceleration of the car between **B** and **C**.

Show your working.

..... m/s^2 [2]

For Examiner's Use

(b) A wheel on a car needs changing. Fig. 7.2 shows a spanner of length 0.3 m being used to turn a wheel nut.

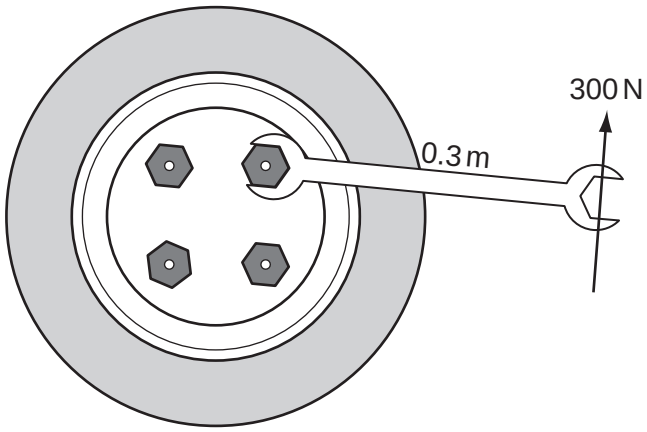


Fig. 7.2

(i) Calculate the turning effect (moment) of the spanner.

State the formula that you use and show your working.

formula

working

..... Nm [2]

(ii) Give **two** ways in which you can increase the spanner's turning effect.

1 .....

2 ..... [2]

(c) A car has been painted blue. Blue is a primary colour of light.

Name the **two** other primary colours of light.

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

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Please turn over for Question 8.

For Examiner's Use

8 Sprinters need fast reflexes to make a good start in a 100 m race. They respond to the sound of the starting gun by pushing off from their starting blocks as fast as they can.

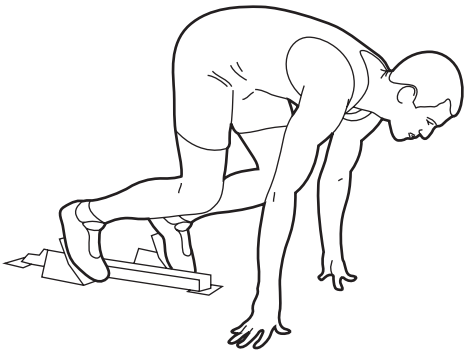

Fig. 8.1

(a) Choose the correct word from the list to identify the stimulus, receptor and effector in this response.

ear **eye** **muscle** **sprinter** **sound**

stimulus .....

receptor .....

effector ..... [3]

(b) The time between the starting gun being fired and the runner pushing off from the starting blocks is known as the reaction time.

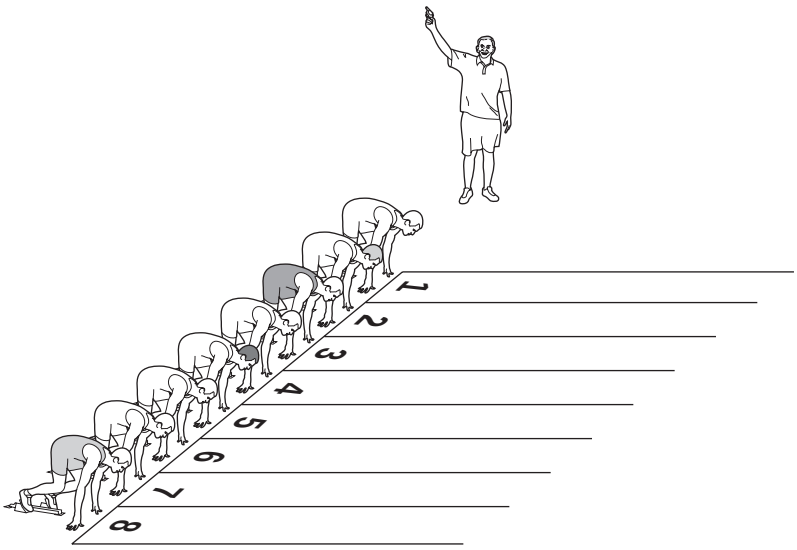

Fig. 8.2

The reaction time is made up of:

- the time taken for the sound from the starting gun to reach the runner's ear,
- plus the time taken for a nerve impulse to pass from the ear to the brain,
- plus the time taken for a nerve impulse to pass from the brain to the leg muscles.

(i) A runner in lane 1 is 2 m from the starting gun. Sound travels at 330 m / s.

Calculate the time taken for the sound to reach the runner's ear.

Show your working.

..... s [2]

Table 8.1 shows the reaction times of the runners in lane 1 and lane 8 in the heats (qualifying races) for a 100 m race.

Table 8.1

	reaction time / s							
	heat 1	**heat 2**	**heat 3**	**heat 4**	**heat 5**	**heat 6**	**heat 7**	**heat 8**
lane 1	0.133	0.146	0.170	0.160	0.186	0.176	0.149	0.147
lane 8	0.228	0.223	0.188	0.195	0.178	0.199	0.163	0.167

(ii) Draw a ring around the heat that shows anomalous results. [1]

(iii) In which lane did the runners have the longer reaction times? Suggest a reason for this.

lane .....

reason .....

..... [1]

For Examiner's Use

(c) During a sprint race, a runner's muscle cells use anaerobic respiration.

(i) Explain what is meant by *anaerobic respiration*.

.....

.....

..... [2]

(ii) Name the waste substance that is made when anaerobic respiration takes place in human cells.

..... [1]

(iii) Describe how the body gets rid of this waste substance after the race is over.

.....

.....

..... [2]

For Examiner's Use

9 Fig. 9.1 shows part of the water cycle.

P shows where liquid water is evaporating into water vapour which rises and then condenses back into drops of liquid water in clouds.

Q shows where rain is falling. The rainwater collects in streams and rivers which flow over rocks in the Earth's crust.

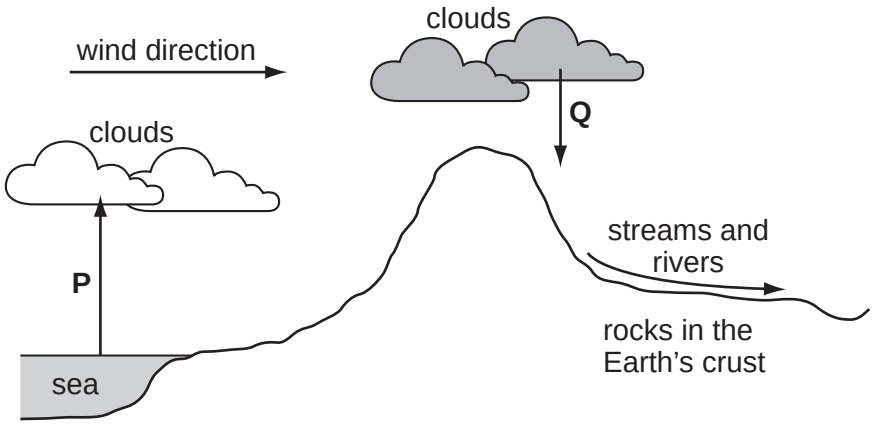

Fig. 9.1

(a) State briefly what happens to the rising water vapour, **P**, in Fig. 9.1 which causes it to condense.

.....

[1]

(b) Water molecules contain the elements hydrogen and oxygen.

A student thinks that the oxygen in water should relight a glowing wooden splint.

Explain why a glowing wooden splint does **not** relight when placed into a test-tube full of water vapour.

.....

.....

.....

[2]

For Examiner's Use

(c) The rocks in the Earth's crust undergo weathering and erosion which are important processes in the formation of clay.

(i) State what must be done to objects made of clay to change them into rigid ceramic objects such as dinner plates.

.....

[1]

(ii) Carbon is a non-metallic element.

Explain why rainwater which contains dissolved carbon dioxide causes chemical weathering of limestone rocks.

.....

.....

.....

.....

[3]

For Examiner's Use

(d) Fig. 9.2 shows a simplified diagram of a machine used to wash dishes.

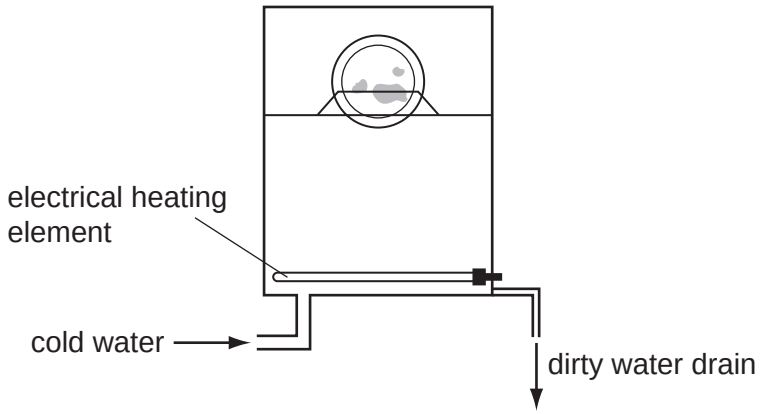

Fig. 9.2

In this machine the water, which is to be used to clean the dishes is first heated to a high temperature and then a detergent is added.

(i) Describe **one** disadvantage of using hard water rather than soft water in this machine.

.....

..... [1]

(ii) Name a metallic element whose compounds cause hardness in water.

..... [1]

(iii) Explain briefly the advantage of adding a detergent to the water in the machine.

.....

..... [1]

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 †															
				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

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

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.).