Cambridge IGCSE

Cambridge International Examinations
Cambridge International General Certificate of Secondary Education

CANDIDATE NAME

CENTRE NUMBER

CANDIDATE NUMBER

8382434717

COMBINED SCIENCE **0653/22**

Paper 2 (Core) **May/June 2015**

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 an HB soft pencil for any diagrams, graphs, tables or rough working.
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 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.

This document consists of **21** printed pages and **3** blank pages.

DC (LK/CGW) 98908/3

CAMBRIDGE International Examinations

1 **(a)** Table 1.1 gives some facts about one atom of the element sodium and the position of sodium in the Periodic Table.

Table 1.1

element	Group	proton number	nucleon number
sodium	I	11	23

(i) From the information in Table 1.1, deduce the following information about the atomic structure of sodium.

the number of electrons in a sodium atom ....

the number of neutrons in this sodium atom .... [2]

(ii) Deduce the number of electrons a sodium atom loses when it forms an ion.

number of electrons lost ....

explanation ....

.... [1]

(b) Fig. 1.1 shows a demonstration of the reaction between hydrogen and the oxygen in air.

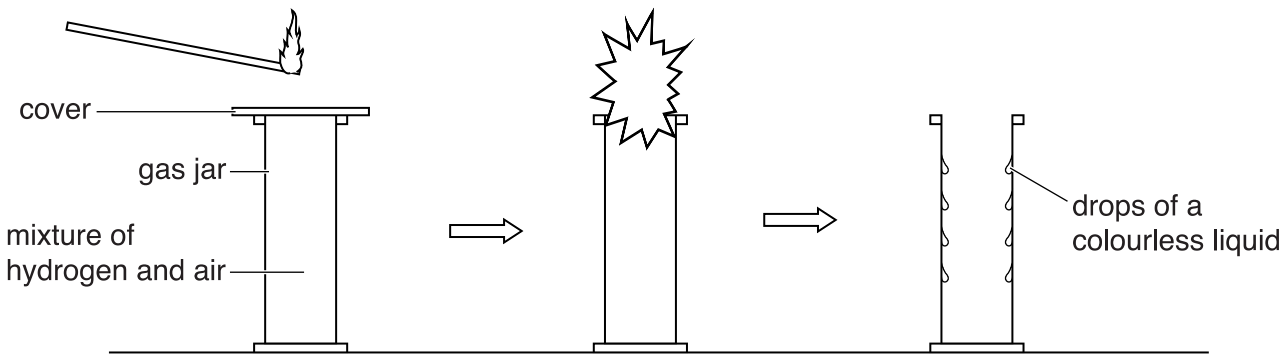


Fig. 1.1

A burning splint is placed over a gas jar containing a mixture of hydrogen and air.

The cover is removed.

The mixture explodes.

(i) Drops of a colourless liquid are observed inside the gas jar.

Describe a chemical test and the result of this test that shows that the liquid is wa

test ....

....

result ....[2]

(ii) Write a word equation for the reaction between hydrogen and oxygen.

....[1]

(iii) State the type of bond formed between hydrogen and oxygen atoms in this reaction. Explain your answer.

type of bond ....

explanation ....

....[2]

2 **(a)** Most large molecules in living organisms are made by joining many smalle[illegible]s together. An example of this is glycogen which is made from glucose molecules[illegible] length of glycogen is shown in Fig. 2.1.

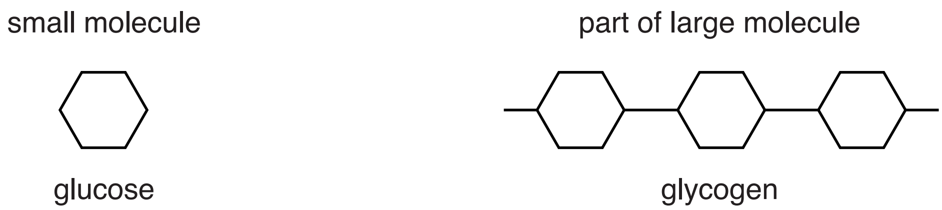


Fig. 2.1

Some of the small molecules that join together to make large molecules in living organisms are shown in Fig. 2.2.

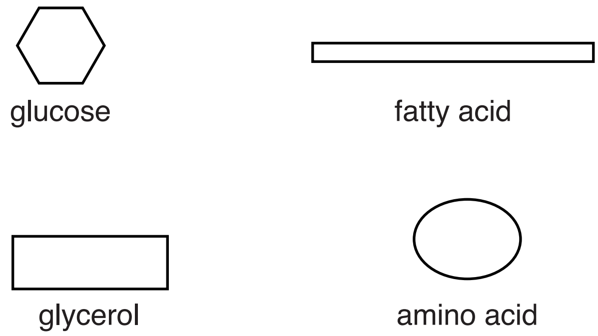


Fig. 2.2

(i) Select molecules from Fig. 2.2 and make drawings in Table 2.1 to show how protein and starch are made up. Your diagrams should be similar to Fig. 2.1.

Table 2.1

large molecule	small molecule	part of large molecule
protein		
starch		

[4]

(ii) Energy is needed in cells to build large molecules from small ones.

Describe how energy is released in cells for this process.

....

....

....[2]

(b) (i) A plant usually gets its nitrogen in the form of nitrate ions which are dissolved in the water in the soil.

Describe the path taken by nitrate ions from the soil to the leaves.

....

....

....[2]

(ii) Fig. 2.3 shows a Venus flytrap. This plant grows in areas where the soil d[illegible]e enough nitrogen. A source of the element nitrogen is needed to make proteins.

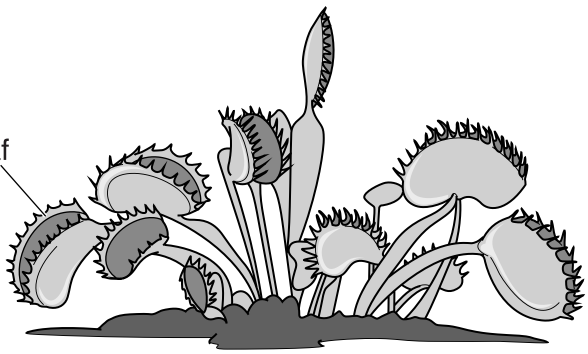
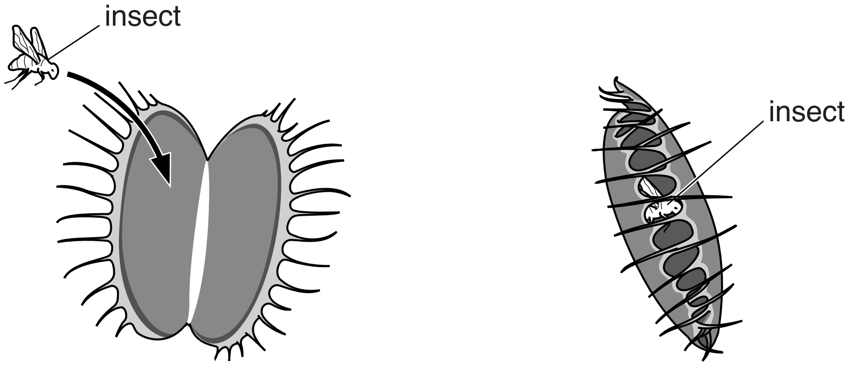


Fig. 2.3

The Venus flytrap captures and digests insects. The insect shown in Fig. 2.4 lands on the open leaf. The leaf then traps the insect by closing around it very quickly.



open leaf closed leaf

Fig. 2.4

State **two** characteristics of living things which the Venus flytrap shows when it traps a fly.

1 ....

2 ....[2]

(iii) When the leaves of the Venus flytrap are open they look like flowers in order to attract insects.

Suggest **two** features the leaves may have that would enable them to look like flowers.

1 ....

2 ....[2]

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Question 3 continues over the page.

3 The pole vault is an athletics event in which the athlete attempts to get over a very [illegible]h the help of a long pole.

Fig. 3.1 shows an athlete at five stages during a pole vault.

Fig. 3.1

The athlete runs with his pole, places the pole in the ground and pushes himself upwards. He rises to the height of the bar, remains there for a brief moment, then falls over the bar to the landing mat.

Fig. 3.2 shows a simplified graph of the athlete's speed during the pole vault.

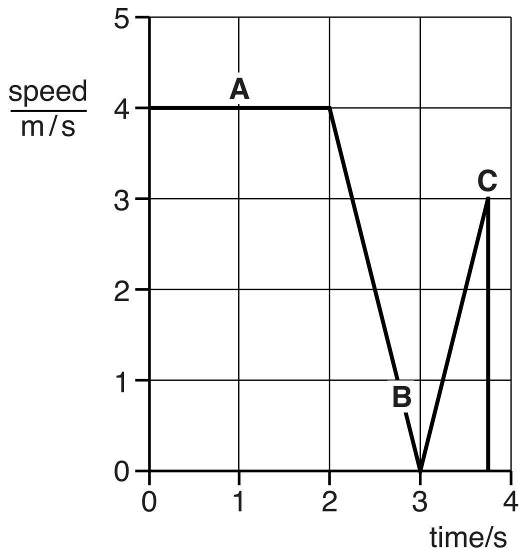


Fig. 3.2

(a) The letters **A**, **B** and **C** on the graph in Fig. 3.2 correspond to three of the five stages in the pole vault shown in Fig. 3.1.

Explain why **A** on the graph corresponds to stage 1.

....

....[1]

(b) The energy of the athlete changes during this pole vault. He starts with chemical [illegible] muscles.

State the main energy changes that follow between stages 3 and 5 before he lands o[illegible] mat.

from chemical energy to kinetic energy to .... energy

to .... energy [2]

(c) **(i)** Describe the motion of the athlete between points **B** and **C**.

....[1]

(ii) Explain why the motion described in **(i)** occurs between points **B** and **C**.

....[1]

(d) Calculate the distance travelled by the athlete in the first 2 seconds shown on the graph in Fig. 3.2.

State the formula that you use and show your working.

formula:

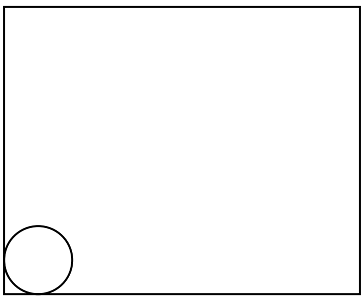
working:

distance = ... m [2]

(e) The pole used by the athlete is made of metal.

In the box below, draw a diagram to show the arrangement of atoms in the solid metal.

One atom has been drawn for you. You need to draw at least 11 more.



[2]

4 **(a)** Fig. 4.1 shows a sample of rock containing bands of iron oxide.

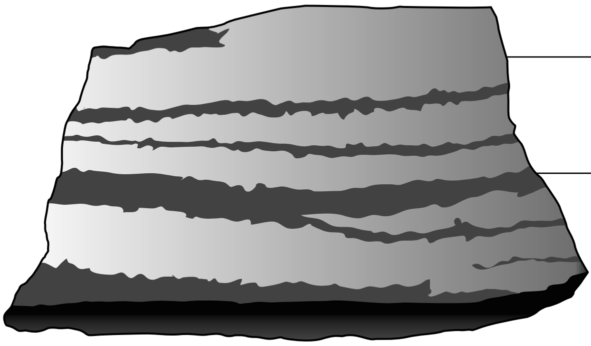


Fig. 4.1

Some information about the formation of this rock is shown below:

- this rock was formed about 2.5 billion years ago;
- oxygen was produced by bacteria in the oceans;
- iron compounds were dissolved in the oceans;
- iron compounds were oxidised by reacting with oxygen to make insoluble iron oxide;
- iron oxide settled on the ocean bed to produce the dark layers in the rock.

(i) State **one** physical change and **one** chemical change that occurred when the rock shown in Fig. 4.1 was formed.

physical change ....

....

chemical change ....

....[2]

(ii) Describe the difference between a physical change and a chemical change.

....

....[1]

(b) Fig. 4.2 shows the approximate composition of the Earth's atmosphere 3 billion y

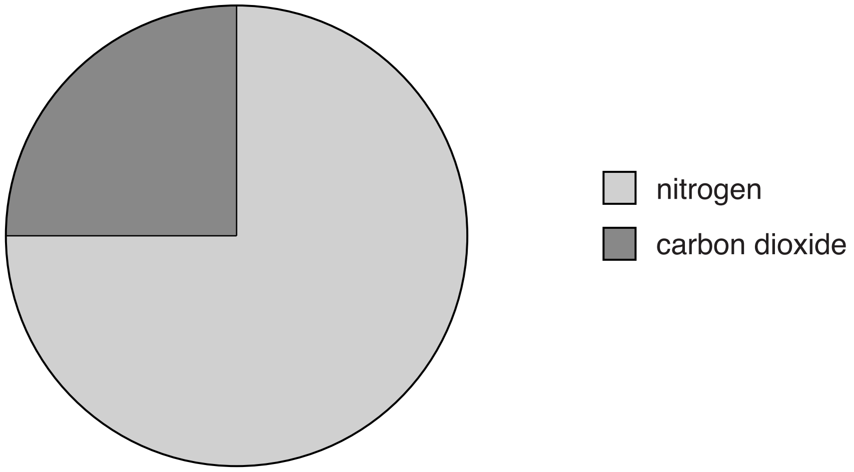


Fig. 4.2

Describe **two** differences and **one** similarity between this and our present day atmosphere.

difference 1 ....

difference 2 ....

similarity ....[3]

(c) Another type of rock contains copper oxide.

When a piece of this rock is added to dilute hydrochloric acid, the pH of the solution increases. Explain why this occurs.

....

....[1]

(d) Copper metal can be extracted from the rock containing copper oxide.

(i) Explain why the extraction of copper from copper oxide is called *reduction*.

....[1]

(ii) Describe how copper can be extracted from copper oxide in the laboratory.

....

....

....[2]

5 Fig. 5.1 shows the internal structure of the heart.

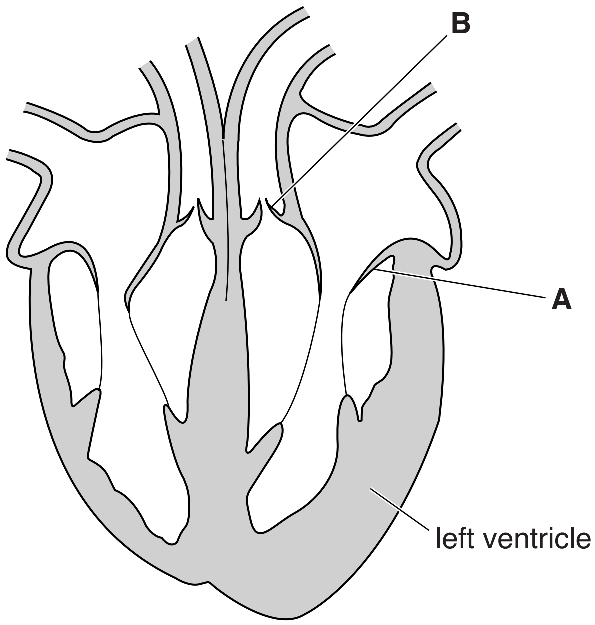


Fig. 5.1

(a) On Fig. 5.1

(i) draw a label line and the letter **P** to show the pulmonary artery, [1]

(ii) draw arrows to show the direction of blood flow through the **left** side of the heart. [2]

(b) (i) **A** and **B** are valves. Describe the function of the valves in the heart.

....

....[1]

(ii) Explain why valve **A** closes when the left ventricle contracts.

....

....[1]

(c) The red cells in the blood contain haemoglobin.

Describe the function of haemoglobin.

....

....[1]

(d) The blood also contains platelets.

Describe the function of platelets and explain why this is important.

....

....

....[2]

6 **(a)** Electromagnetic waves have many uses.

Name **one** type of electromagnetic wave and state one example of a use for that wave.

name ....

use ....

....[2]

(b) Fig. 6.1 shows apparatus called a ripple tank. This is used by students for experiments to investigate water waves.

The electric motor causes the board to vibrate. At a constant speed of rotation the motor produces waves at a constant rate.

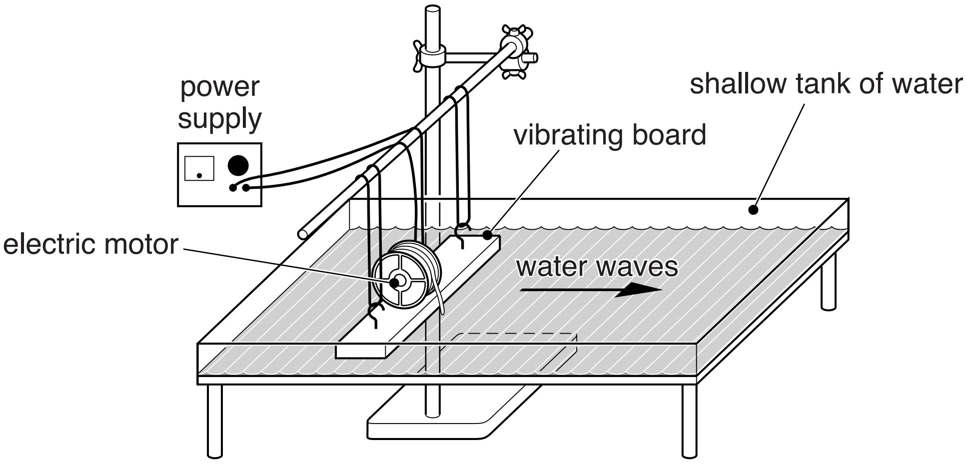


Fig. 6.1

Fig. 6.2 shows a close-up side view of some water waves during an experiment in the tank.

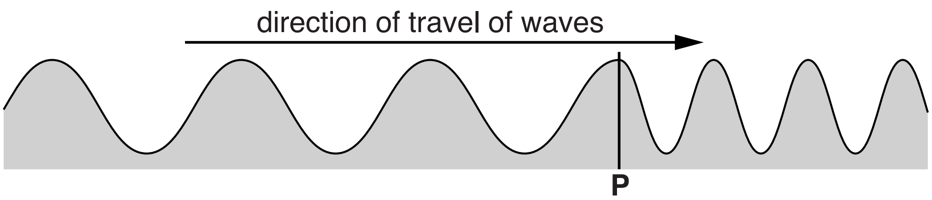


Fig. 6.2

(i) Describe what is meant by wave motion, using the water waves shown in Fig. 6.2 as an example.

....

....

....[2]

(ii) Fig. 6.2 shows a change in the wave pattern at point **P**.

From the diagram in Fig. 6.2 state

one property of the wave motion that changes at point **P** and describe how this changes.

....

....

one property of the wave motion that does not change at point **P**.

....
[3]

(c) As the speed of the motor is increased, the board vibrates more rapidly.

When the board is vibrating at 10 vibrations per second, the students cannot hear any sound.

When the board is vibrating at 30 vibrations per second, the students can hear a sound with a low pitch.

Explain why the students cannot hear any sound when the board makes 10 vibrations per second.

....

....[1]

7 **(a)** A copper compound contains two carbon atoms and four oxygen atoms for e[illegible]r atom.

Write the chemical formula for the compound.

....[2]

(b) Fig. 7.1 shows the electrolysis of copper chloride solution.

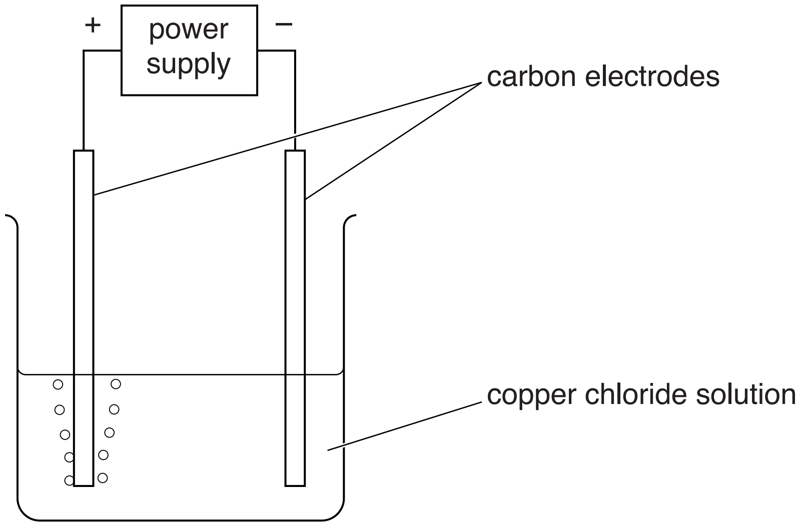


Fig. 7.1

Copper is deposited on one of the electrodes.

(i) Describe the appearance of the copper that is deposited.

....

....[1]

(ii) State the polarity of the electrode where the copper is deposited.

.... [1]

(iii) State the name of the electrode where the copper is deposited.

.... [1]

(c) A student carries out experiments to compare the reactivity of some metals.

Fig. 7.2 shows test-tubes containing pieces of calcium and magnesium.
Some water is added to each test-tube.

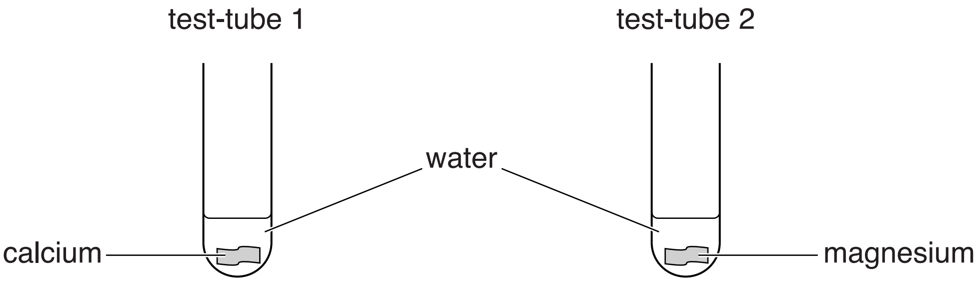


Fig. 7.2

Describe what the student observes in each test-tube and state, with a reason, which metal is the more reactive.

test-tube 1 ....

test-tube 2 ....

This means that .... is the more reactive metal because

....

....[2]

(d) **(i)** Use the Periodic Table on page 24 to write the first three members of Group I, the alkali metals, in order of reactivity.

most reactive ………………………

………………………

least reactive ……………………… [1]

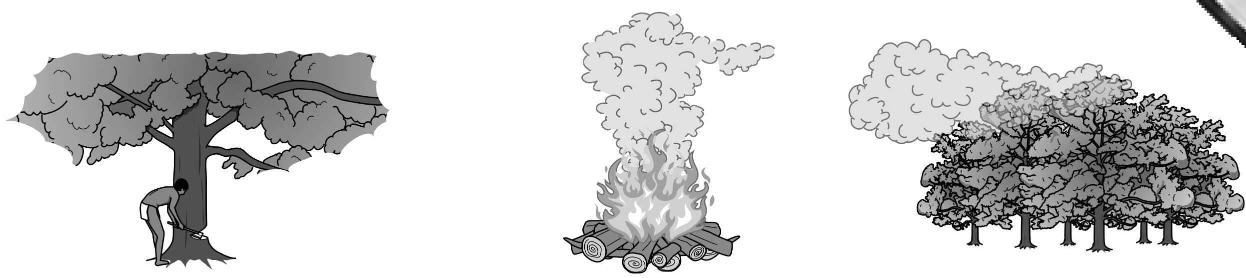
(ii) When a piece of sodium is dropped into a trough of water it melts, skims over the surface and produces bubbles of gas.

Describe how the observations would be different if a piece of potassium is used instead of sodium.

....

....[1]

8 **(a)** Large areas of forest are cleared in some parts of the world so that the land can be used to grow crops. Fig. 8.1 shows the burning of trees to clear forests.



1. trees being felled   2. combustion of wood   3. wind carries smoke to neighbouring trees

Fig. 8.1

When the trees burn, smoke is produced that contains carbon particles. The wind carries the smoke to neighbouring trees. This affects the rate of photosynthesis in these trees.

Complete the sentences below using words from the list.

You may use each word once, more than once, or not at all.

carbon dioxide **chlorophyll** **increased** **light**

oxygen **reduced** **unchanged** **water**

The rate of photosynthesis is .... because particles of carbon landing on

the upper surface of the leaves prevent .... being absorbed by the leaf.

The rate of photosynthesis is .... because particles of carbon blocking

the stomata in the leaves prevent .... being absorbed by the leaf. [4]

(b) Deforestation causes the concentration of carbon dioxide in the Earth's atmosphere to increase.

Describe one consequence of an increase in the carbon dioxide concentration of the Earth's atmosphere.

....

....[1]

(c) Describe the undesirable effects of deforestation on the animal life in the forest.

....

....

....[2]

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Question 9 continues over the page.

9 A student is building a model motorcycle.

Fig. 9.1 shows a circuit he designs for the electrical equipment he wants on the motorcycle.

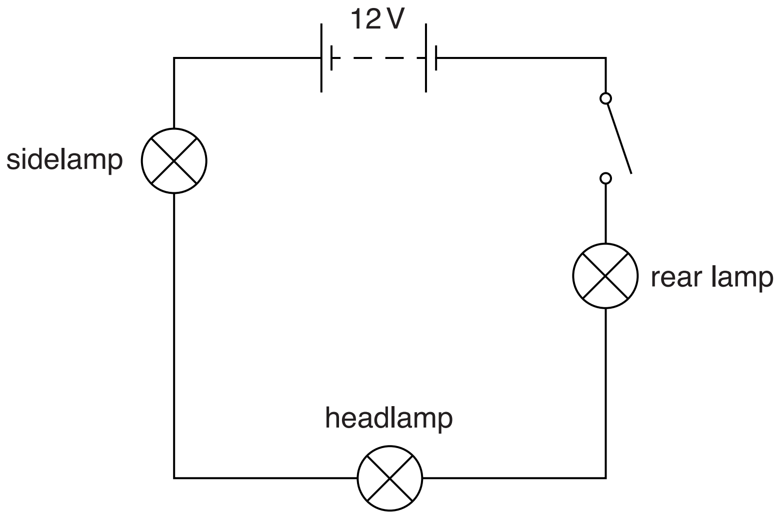


Fig. 9.1

(a) Fig. 9.2 shows the lamps he uses for his model. The markings on the lamps are shown below the pictures.

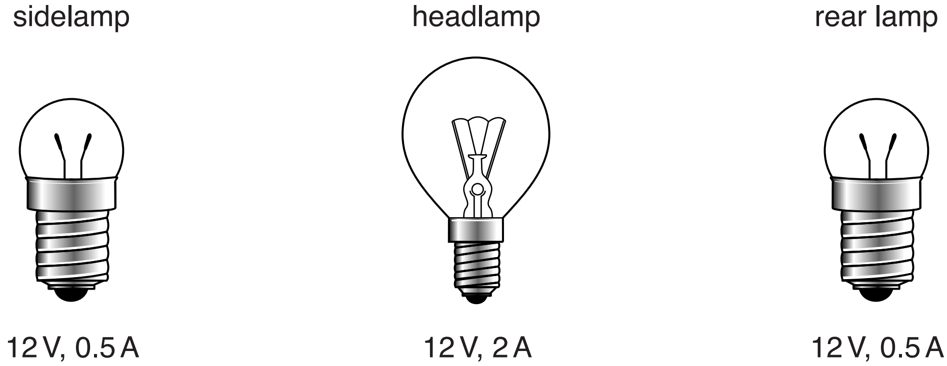


Fig. 9.2

State and explain what is meant by the quantity '12 V' on the lamps.

....

....[2]

(b) When the student switches on the circuit in Fig. 9.1, the lamps glow only very fa s not designed his circuit correctly.

On Fig. 9.3 complete the circuit diagram to show the sidelamp and rear lamp connecte that all the lamps glow brightly.

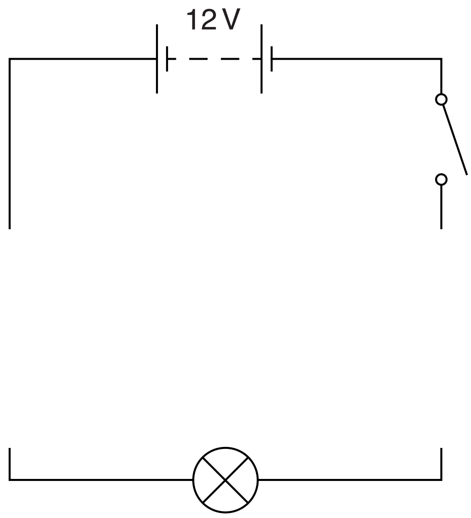


Fig. 9.3

[2]

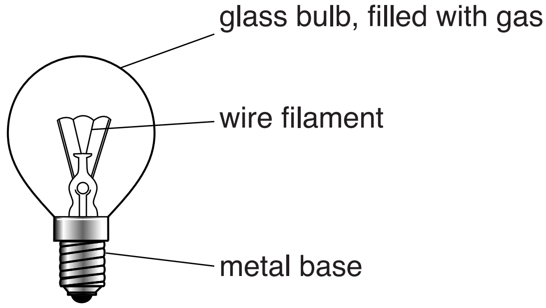
(c) The sidelamp is replaced with a new lamp that uses a lower current when connected to the 12 V battery.

State the property of the new lamp that is different from the old lamp in order to use less current and describe how it is different.

....

....[1]

(d) Each lamp contains a thin wire filament surrounded by a glass bulb attached to a
The space inside the glass bulb is filled with a gas. When the lamp is lit, the filamen
a very high temperature.



After the lamps have been lit for a few minutes, the glass bulbs become hot.

Describe and explain **two** ways by which heat energy can be transferred from the hot filament to the glass bulb.

1 ....

....

2 ....

.... [4]

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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	209 **Po** Polonium 84	210 **At** Astatine 85	222 **Rn** Radon 86
223 **Fr** Francium 87	226 **Ra** Radium 88	227 **Ac** Actinium 89 †															

140 **Ce** Cerium 58	141 **Pr** Praseodymium 59	144 **Nd** Neodymium 60	147 **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	231 **Pa** Protactinium 91	238 **U** Uranium 92	237 **Np** Neptunium 93	244 **Pu** Plutonium 94	243 **Am** Americium 95	247 **Cm** Curium 96	247 **Bk** Berkelium 97	251 **Cf** Californium 98	252 **Es** Einsteinium 99	257 **Fm** Fermium 100	258 **Md** Mendelevium 101	259 **No** Nobelium 102	260 **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 = atomic (proton) number

The volume of one mole of any gas is $24\,dm^3$ at room temperature and pressure (r.t.p.).