



UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS  
International General Certificate of Secondary Education

CANDIDATE  
NAME

CENTRE  
NUMBER

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**COMBINED SCIENCE**

**0653/21**

Paper 2 (Core)

**October/November 2013**

**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 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.

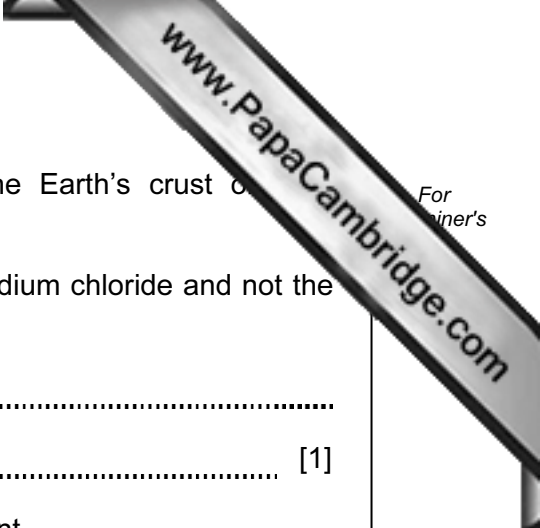
A copy of the Periodic Table is printed on page 24.

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





1 Sodium chloride is obtained from underground deposits in the Earth's crust or from aqueous solutions such as sea water.

(a) (i) Explain why the Earth's crust contains the compound sodium chloride and not the uncombined elements, sodium and chlorine.

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

(ii) State **one** difference between a compound and an element.

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

(iii) Describe how crystals of sodium chloride could be obtained from a salt solution.

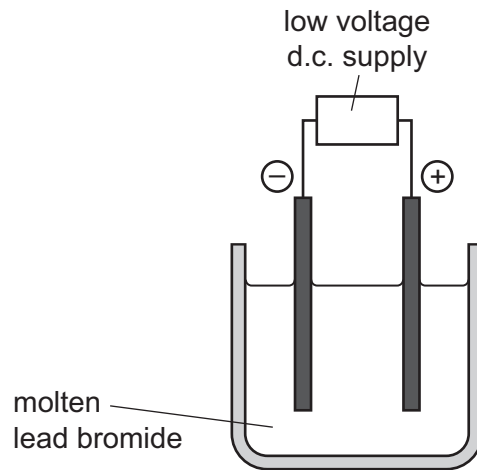
.....  
.....  
..... [2]

(b) The chemical formula of the compound calcium fluoride is  $\text{CaF}_2$ .

Explain the meaning of the numbers in this formula.

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

- (c) Fig. 1.1 shows apparatus used to separate the element lead from the compound lead bromide.



**Fig. 1.1**

- (i) Name the process shown in Fig. 1.1.

..... [1]

- (ii) Explain why an orange-coloured gas is observed rising from the molten lead bromide during the process.

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

2 Fig. 2.1 shows the inside of a refrigerator.

The temperature inside the freezing compartment is  $-20^{\circ}\text{C}$  and the temperature in the rest of the refrigerator is  $+5^{\circ}\text{C}$ .

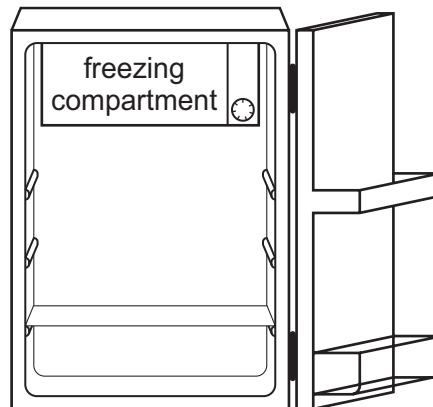


Fig. 2.1

(a) The air in the refrigerator is cooled by convection.

Draw **one** arrow on Fig. 2.1 to show the movement of the air cooled by the freezing compartment. [1]

(b) The volume of air in the refrigerator is  $0.15\text{ m}^3$ .

The density of air is  $1.26\text{ kg/m}^3$ .

Calculate the mass of air in the refrigerator.

State the formula that you use and show your working.

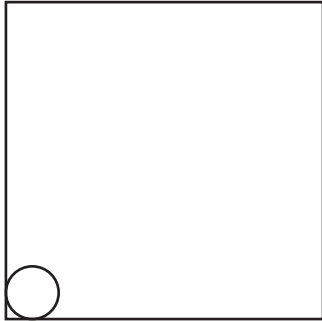
formula

working

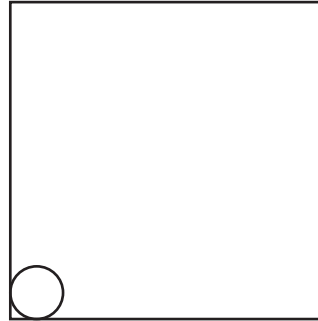
..... kg [2]

- (c) (i) Complete the diagrams to show the arrangement of water molecules in solid ice and in liquid water.

One molecule has been drawn for you in each box. Each diagram should contain at least twelve water molecules.



solid ice



liquid water

[2]

- (ii) Each sentence describes either a solid, a liquid or a gas.

In the right hand column write the letter **S** for solid, **L** for liquid or **G** for gas to match the description.

description	<b>S, L or G</b>
It cannot flow.	
It cannot transfer heat by convection.	
It contains particles which are widely separated.	
It expands the most when heated.	
It fills a closed container.	
It has a fixed volume but not a fixed shape.	

[2]

- 3 The concentration of glucose in the blood does not normally vary much. The hormone adrenaline causes blood glucose concentration to increase.

(a) (i) Define the term *hormone*.

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

(ii) State **one** effect of adrenaline on the body, other than increasing the concentration of glucose in the blood.

..... [1]

- (b) Researchers investigated how adding fibre to foods affected the concentration of glucose in the blood after eating.

Fig. 3.1 shows the results that they obtained for two different types of cornflakes. Cornflakes contain a lot of starch.

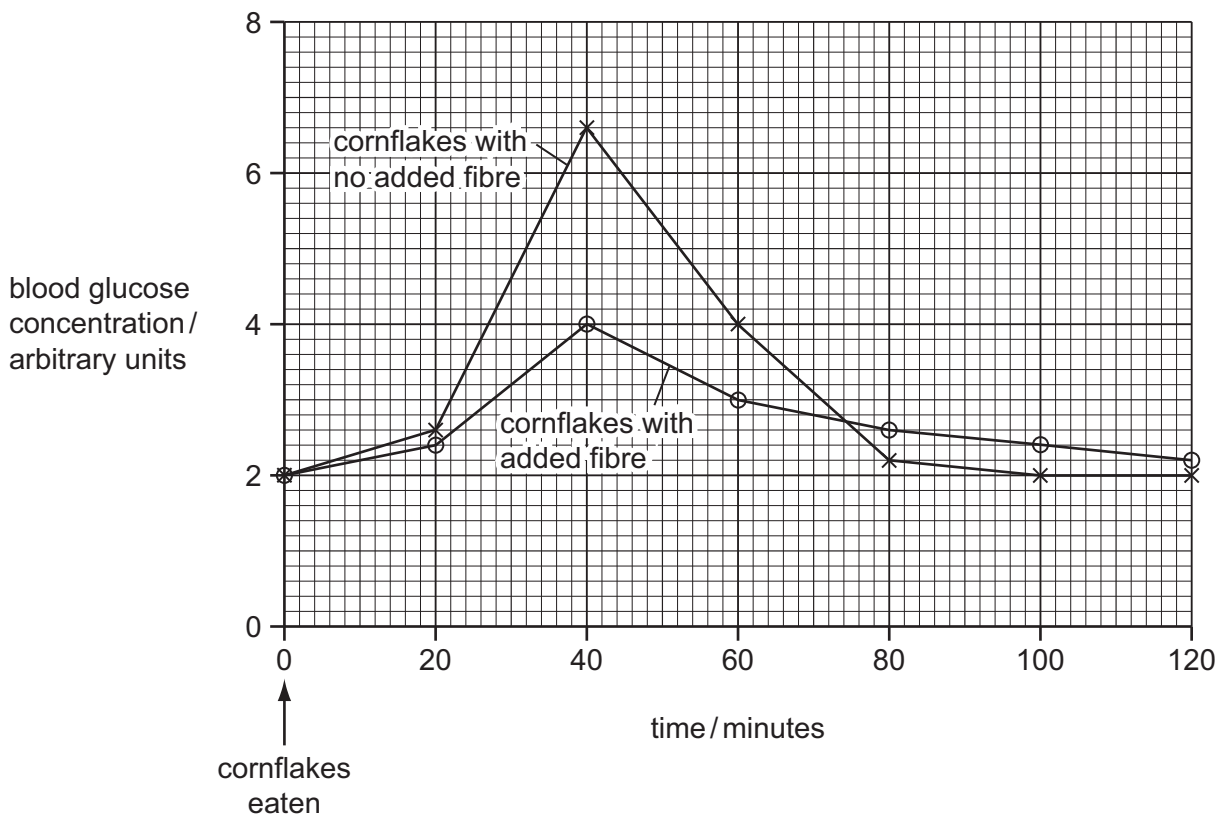


Fig. 3.1

Use the information in Fig. 3.1 to help you to answer the following questions.

- (i) Describe how the blood glucose concentration changed after eating cornflakes with no added fibre.

.....  
.....  
.....  
.....  
..... [3]

- (ii) Describe how adding fibre to the cornflakes affected the changes in blood glucose concentration after eating.

.....  
.....  
.....  
..... [3]

- (c) Outline **one** other way in which fibre in the diet affects health.

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

- 4 Fig. 4.1 shows a period in the Periodic Table. Four elements are represented by which are not their usual chemical symbols.

group number	1	2	3	4	5	6	7	0
	W	X					Y	Z

Fig. 4.1

- (a) (i) State and explain which of the elements, chosen from **W**, **X**, **Y** and **Z**, are poor conductors of electricity.

element(s) .....

explanation .....

..... [2]

- (ii) One of the elements shown in Fig. 4.1 is **not** expected to form a compound with any of the others.

State and explain which **one** of the elements this is.

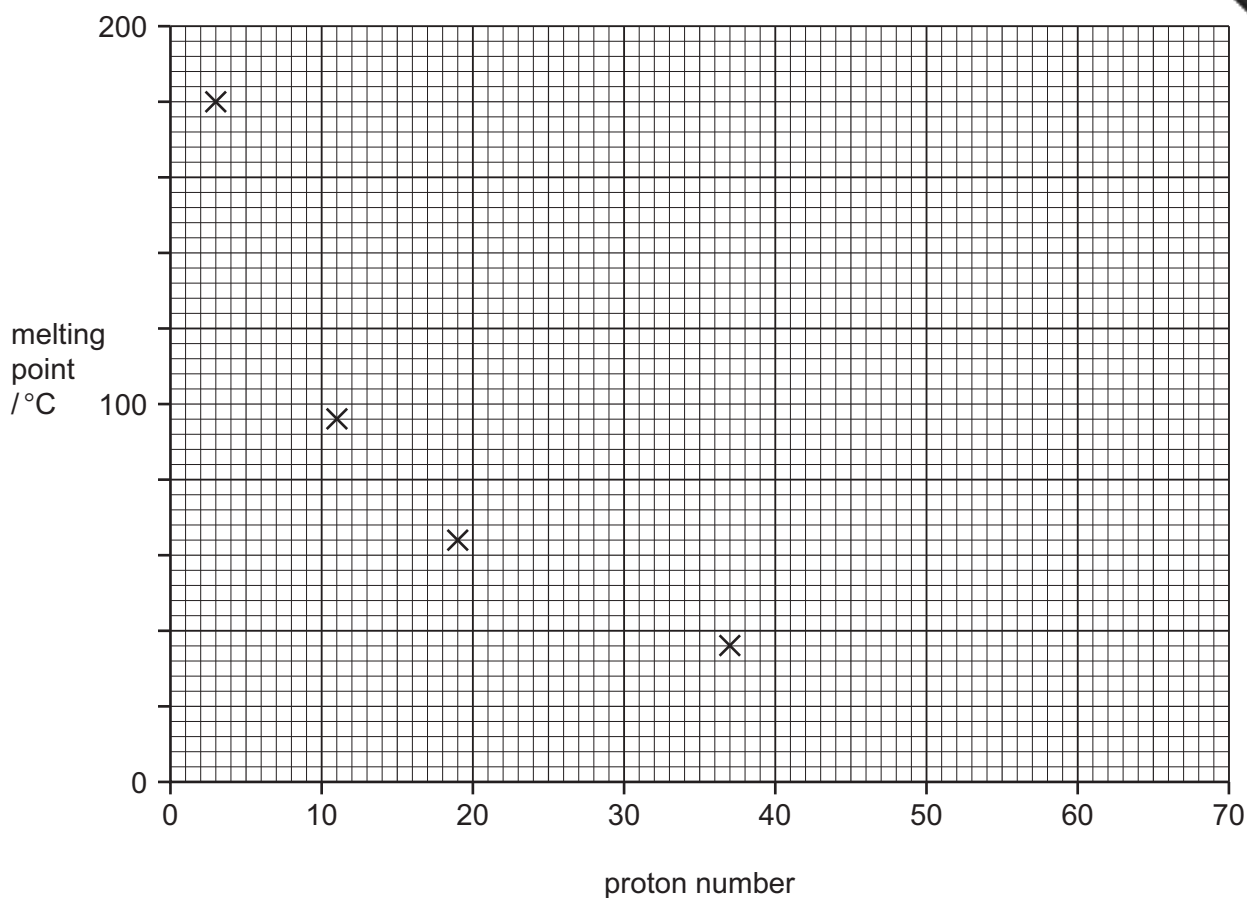
element .....

explanation .....

..... [2]



- (b) Fig. 4.2 shows the melting points of four metallic elements from the same group in the Periodic Table.



**Fig. 4.2**

- (i) State the number of the group that contains the elements whose melting points are shown in Fig. 4.2.

Explain your answer briefly.

group number .....

explanation .....

[2]

- (ii) Use the Periodic Table on page 24 to name the element in Fig. 4.2 that has the lowest melting point.

..... [1]

- (c) (i) Copper oxide is a black solid which is insoluble in water.

A student added excess dilute sulfuric acid to some copper oxide and warmed the mixture.

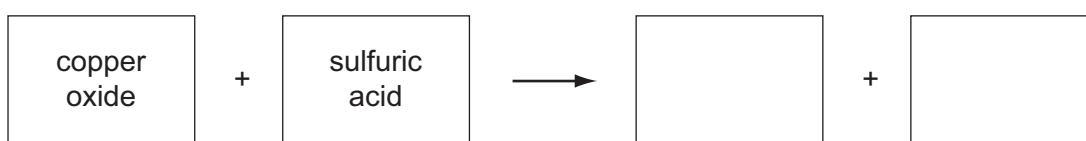
The copper oxide disappeared and a clear blue solution remained.

State **one** observation which shows that a chemical change has occurred.

.....

..... [1]

- (ii) Complete the **word** chemical equation for the reaction between copper oxide and dilute sulfuric acid.



[2]

**Please turn over for Question 5.**

5 Fig. 5.1 shows a solar-powered vehicle which travelled 3000 km in 30 hours.

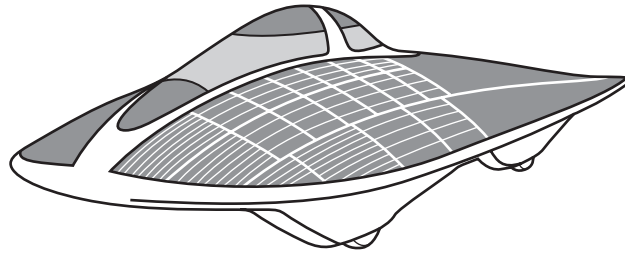


Fig. 5.1

(a) Calculate the average speed of the vehicle in km/hr.

State any formula that you use and show your working.

formula

working

..... km/hr [2]

(b) Fig. 5.2 shows a speed / time graph for part of the journey.

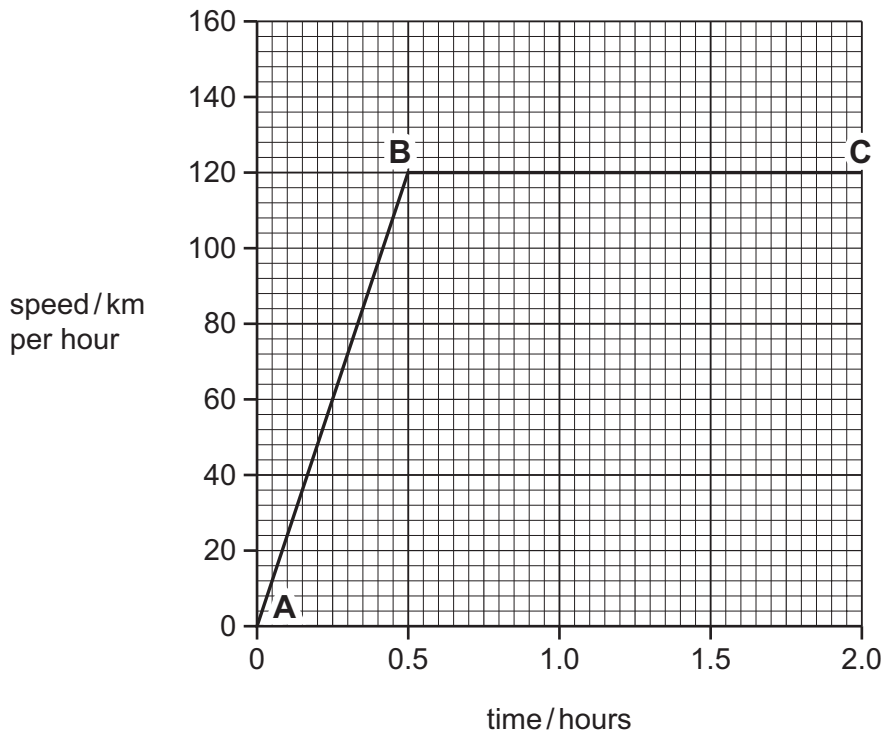


Fig. 5.2

(i) What was the maximum speed of the vehicle?

..... km/hr [1]

(ii) Describe the movement of the vehicle between **A** and **B**.

..... [1]

(c) Fig. 5.3 shows the energy flow diagram for the solar-powered vehicle.

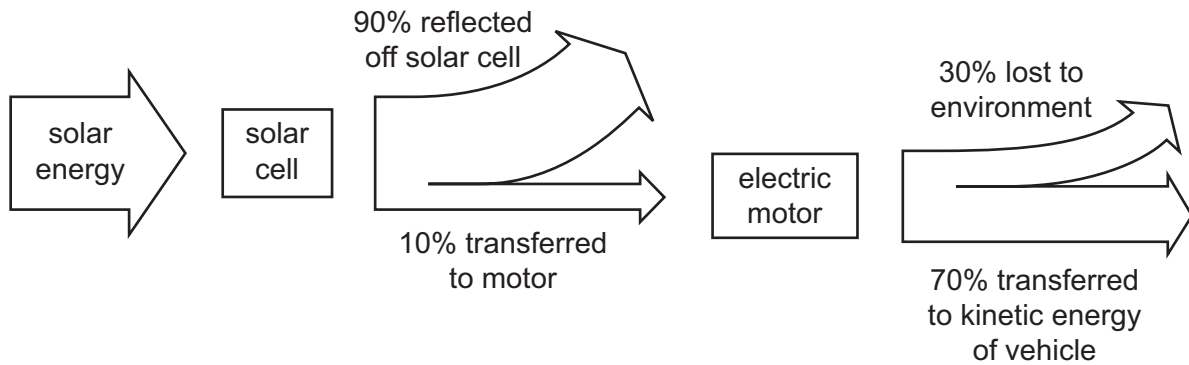


Fig. 5.3

During part of the journey, the **solar cell** receives 1 000 000 joules of solar energy.

Calculate the number of joules transferred as kinetic energy to the **vehicle**.

Show your working.

..... J [2]

(d) Solar energy is a renewable energy source.

(i) Name **one** other renewable energy source.

..... [1]

(ii) Describe **one** advantage to the environment of using solar energy as a renewable energy source.

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

6 Fig. 6.1 shows a section through the heart.

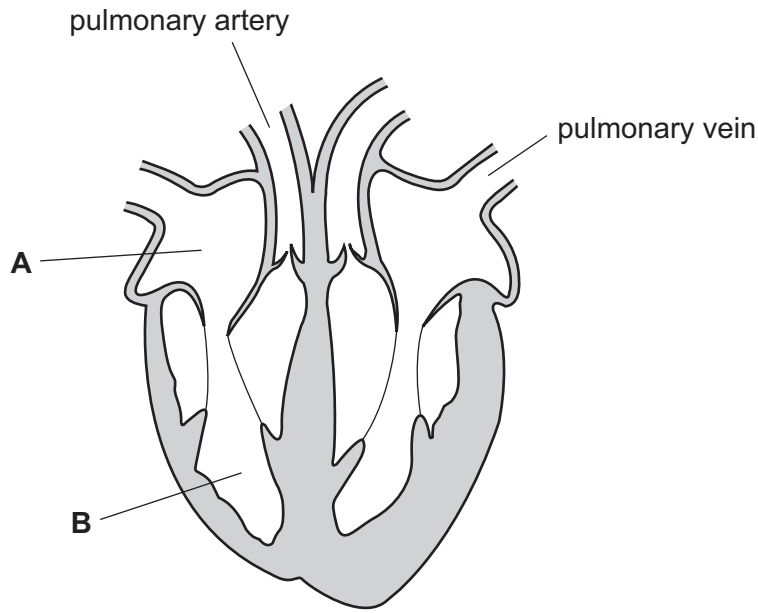


Fig. 6.1

(a) Name the parts labelled **A** and **B**.

**A** .....

**B** ..... [2]

(b) The walls of the heart are made of muscle.

Explain how this muscle pushes blood out of the heart.

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

(c) Suggest why the muscle of the upper chambers of the heart is thinner than the muscle of the lower chambers of the heart.

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

(d) When the heart is beating more quickly than usual, it uses a lot of oxygen.

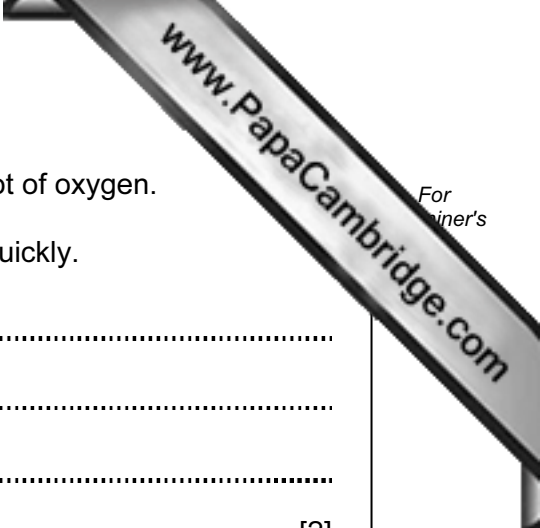
Suggest why the heart uses more oxygen when it is beating quickly.

.....

.....

.....

..... [2]



- 7 (a) (i) Name a raw material that provides us with hydrocarbons.

.....

- (ii) Explain the meaning of the term *hydrocarbon*.

.....

..... [1]

- (iii) Fig. 7.1 shows the chemical equation for the reaction between ethene and bromine, set out as molecular structures.

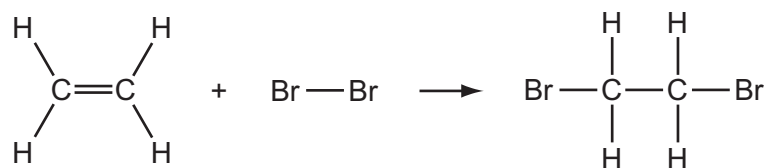
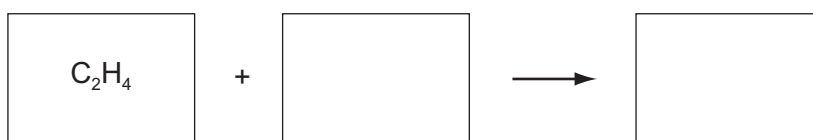


Fig. 7.1

Rewrite the information in Fig. 7.1 using chemical formulae. One chemical formula has been given.



[2]



(b) Propane is a gaseous hydrocarbon used as a fuel.

Fig. 7.2 shows a cross-section through a small furnace (kiln) in which items of pottery are being heated by a propane burner. The temperature inside the kiln is 950 °C.

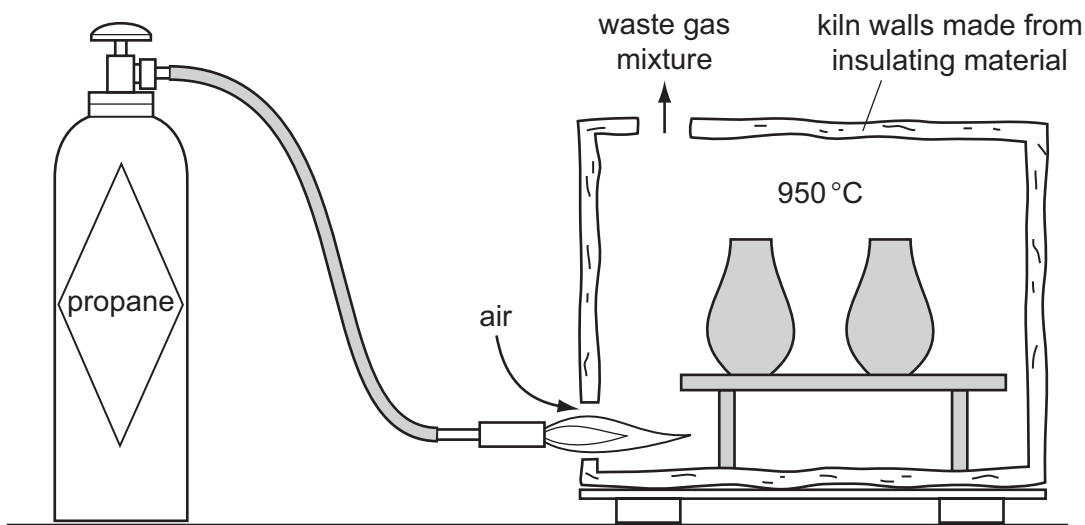


Fig. 7.2

(i) State which information from Fig. 7.2 shows that the combustion of propane is exothermic.

Explain your answer.

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

(ii) Suggest **two** compounds that have a higher concentration in the waste gas mixture than in the air drawn in at the bottom of the kiln.

Explain your answer briefly.

1 .....  
 2 .....  
 explanation .....  
 ..... [3]

8 (a) Complete Table 8.1 below by drawing the circuit symbol for each electrical component.

Table 8.1

name of component	circuit symbol
open switch	
resistor	
voltmeter	
fuse	

[2]

(b) Fig. 8.1 shows an electrical hazard.

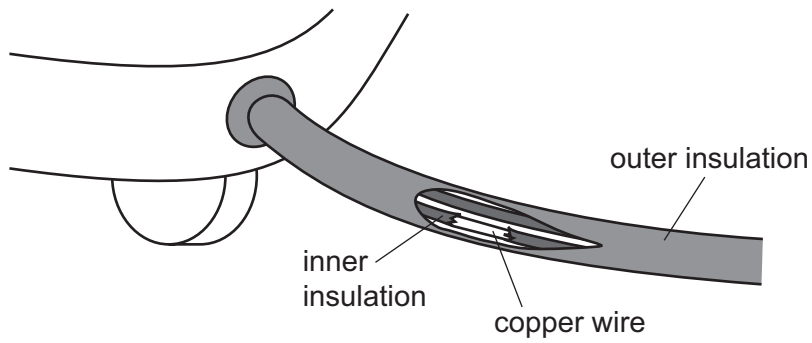


Fig. 8.1

State the hazard.

.....

.....

Explain why this situation is dangerous.

.....

.....

[2]

(c) In the circuit shown in Fig. 8.2 the reading on ammeter  $A_3$  is 0.5 A.

(i) State the current readings on ammeters  $A_1$  and  $A_2$ .

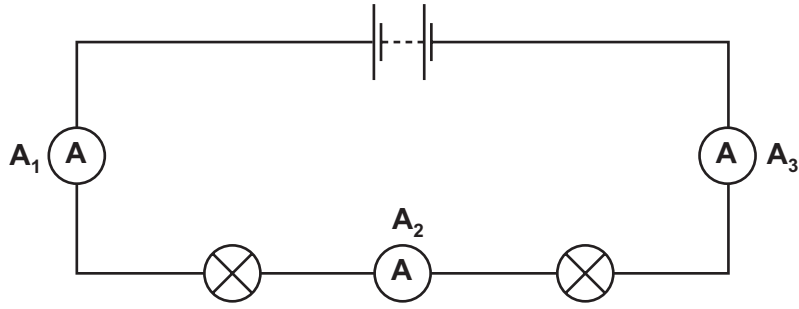


Fig. 8.2

$A_1$  ..... A

$A_2$  ..... A

[1]

(ii) Each lamp in the circuit has a resistance of  $5\ \Omega$ .

Calculate the combined resistance of the two lamps in the circuit.

State the formula that you use and show your working.

formula

working

.....  $\Omega$  [2]

9 (a) Fig. 9.1 shows a plant cell.

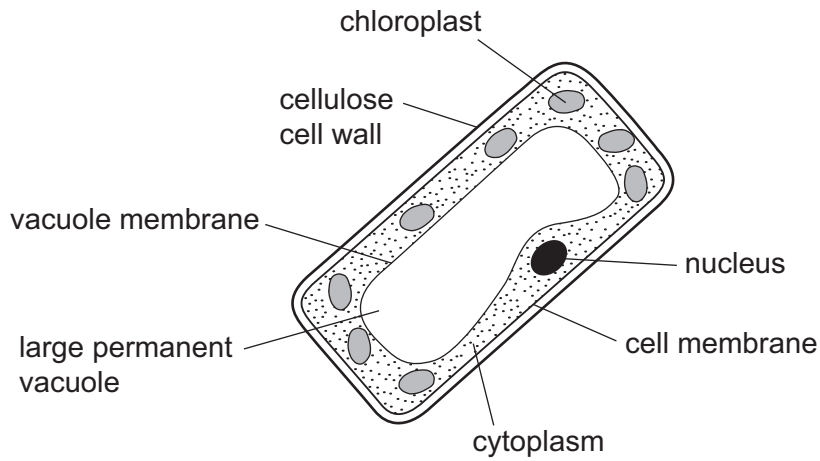


Fig. 9.1

(i) Describe the function of the cell membrane.

..... [1]

(ii) Name **two** structures labelled on Fig. 9.1 that are **not** found in animal cells.

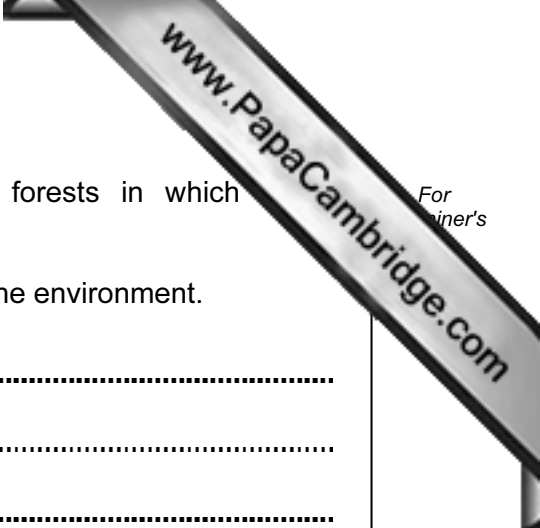
1 .....

2 .....

[2]

(iii) Describe how photosynthesis is carried out in the cell shown in Fig. 9.1.

.....  
.....  
.....  
.....  
.....  
.....  
..... [3]



(b) About one tenth of the Earth's surface is covered by forests in which photosynthesis takes place.

List **three** ways in which extensive deforestation could harm the environment.

1 .....

.....

2 .....

.....

3 .....

..... [3]

10 (a) Fig. 10.1 represents the electromagnetic spectrum.

gamma rays	X-rays	ultraviolet	visible light	infra red	microwaves	radio waves
------------	--------	-------------	---------------	-----------	------------	-------------

Fig. 10.1

Name the type of electromagnetic wave that is used

(i) to send a signal to a TV from a remote control,

..... [1]

(ii) to send satellite TV information.

..... [1]

(b) Fig. 10.2 represents a wave.

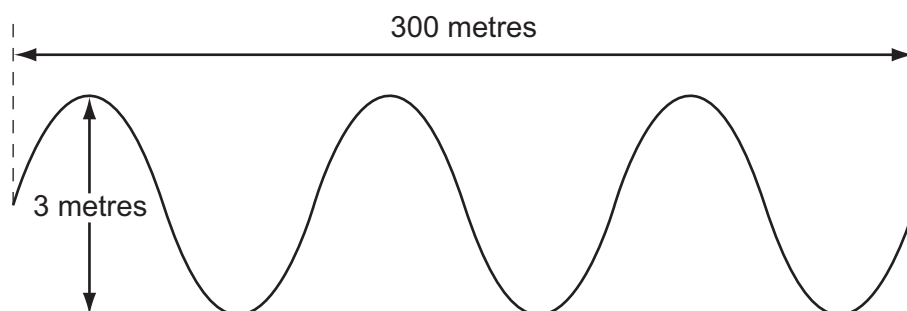


Fig. 10.2

Use Fig. 10.2 to find the

wavelength of the wave,

..... m

amplitude of the wave.

..... m

[2]



**DATA SHEET**  
**The Periodic Table of the Elements**

		Group															
I	II	III	IV	V	VI	VII	0										
		1 <b>H</b> Hydrogen 1										4 <b>He</b> Helium 2					
7 <b>Li</b> Lithium 3	9 <b>Be</b> Beryllium 4										19 <b>F</b> Fluorine 9	20 <b>Ne</b> Neon 10					
23 <b>Na</b> Sodium 11	24 <b>Mg</b> Magnesium 12	27 <b>Al</b> Aluminium 13	28 <b>Si</b> Silicon 14	31 <b>P</b> Phosphorus 15	32 <b>S</b> Sulfur 16	35.5 <b>Cl</b> Chlorine 17	40 <b>Ar</b> Argon 18										
39 <b>K</b> Potassium 19	40 <b>Ca</b> Calcium 20	70 <b>Ga</b> Gallium 31	73 <b>Ge</b> Germanium 32	75 <b>As</b> Arsenic 33	79 <b>Se</b> Selenium 34	80 <b>Br</b> Bromine 35	84 <b>Kr</b> Krypton 36										
85 <b>Rb</b> Rubidium 37	88 <b>Sr</b> Strontium 38	65 <b>Zn</b> Zinc 30	64 <b>Cu</b> Copper 29	59 <b>Ni</b> Nickel 28	106 <b>Pd</b> Palladium 46	108 <b>Ag</b> Silver 47	112 <b>Cd</b> Cadmium 48	115 <b>In</b> Indium 49	122 <b>Sb</b> Antimony 51	127 <b>I</b> Iodine 53	131 <b>Xe</b> Xenon 54						
133 <b>Cs</b> Caesium 55	137 <b>Ba</b> Barium 56	204 <b>Tl</b> Thallium 81	201 <b>Hg</b> Mercury 80	195 <b>Pt</b> Platinum 78	197 <b>Au</b> Gold 79	207 <b>Pb</b> Lead 82	209 <b>Bi</b> Bismuth 83	210 <b>Po</b> Polonium 84	210 <b>At</b> Astatine 85	210 <b>Rn</b> Radon 86							
226 <b>Ra</b> Radium 88	227 <b>Ac</b> Actinium 89										162 <b>Dy</b> Dysprosium 66	163 <b>Ho</b> Holmium 67	164 <b>Er</b> Erbium 68	165 <b>Tm</b> Thulium 69	167 <b>Yb</b> Ytterbium 70	173 <b>Lu</b> Lutetium 71	175 <b>Lr</b> Lawrencium 103

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

a = relative atomic mass  
X = atomic symbol  
b = proton (atomic) number

† The volume of one mole of any gas is 24 dm<sup>3</sup> at room temperature and pressure (r.t.p.).

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