



UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS
International General Certificate of Secondary Education

CANDIDATE
NAME

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NUMBER

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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 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.

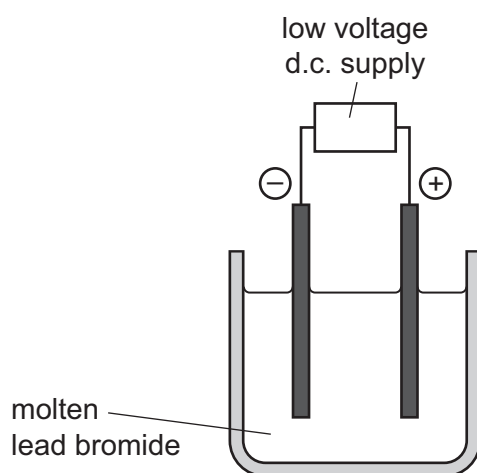


Fig. 1.1

- (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°C and the temperature in the rest of the refrigerator is $+5^{\circ}\text{C}$.

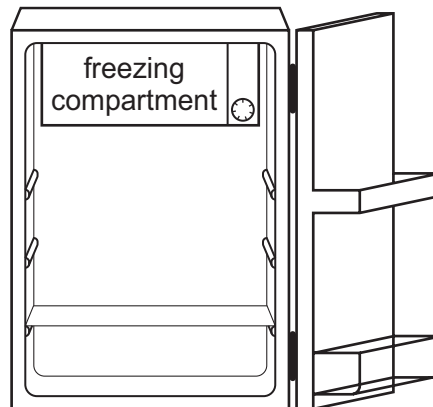


Fig. 2.1

- (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 m^3 .

The density of air is 1.26 kg/m^3 .

Calculate the mass of air in the refrigerator.

State the formula that you use and show your working.

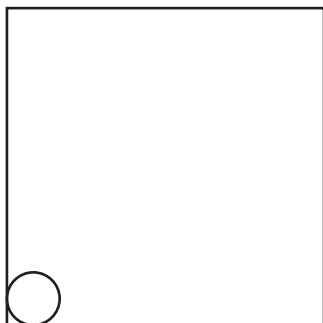
formula

working

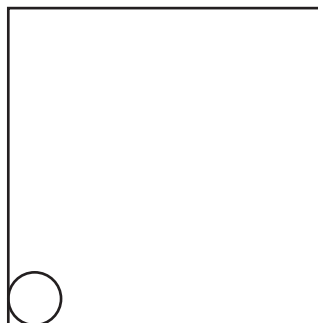
..... kg [2]

- (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	S, L or G
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.

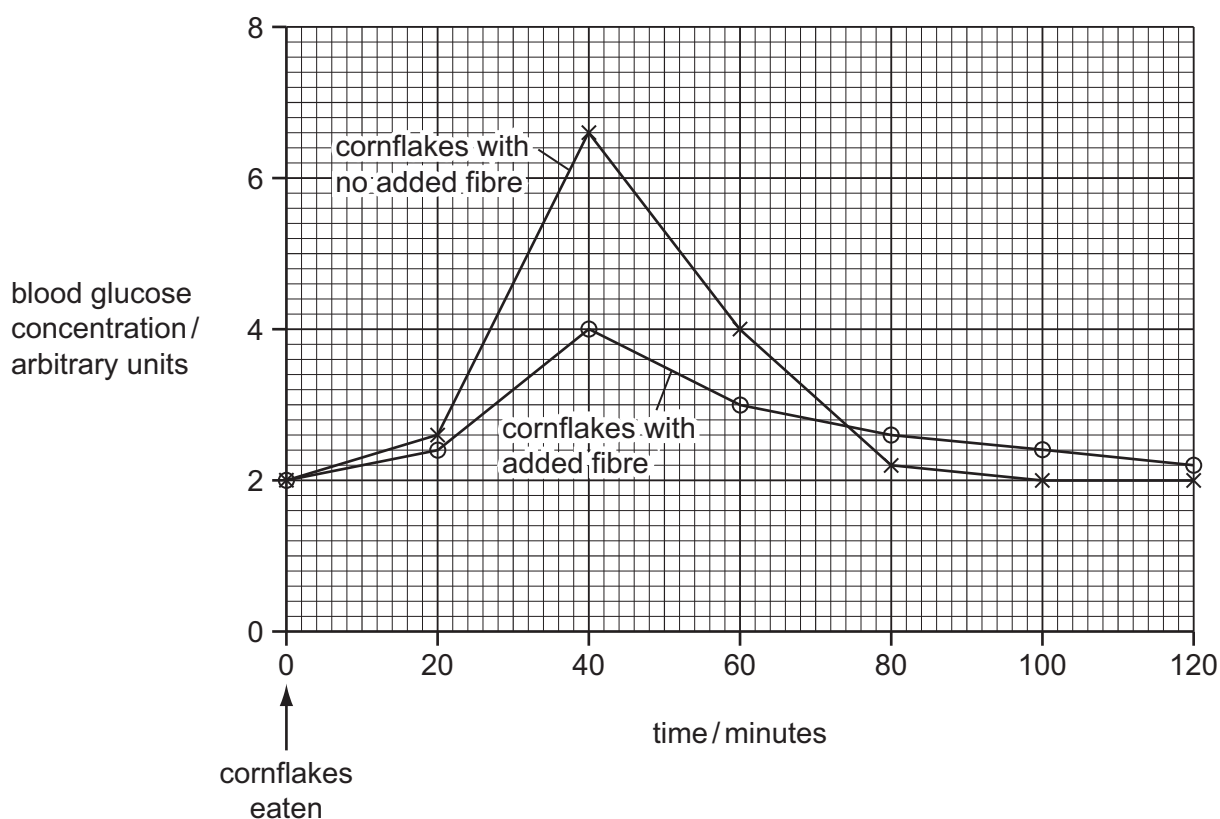


Fig. 3.1

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.

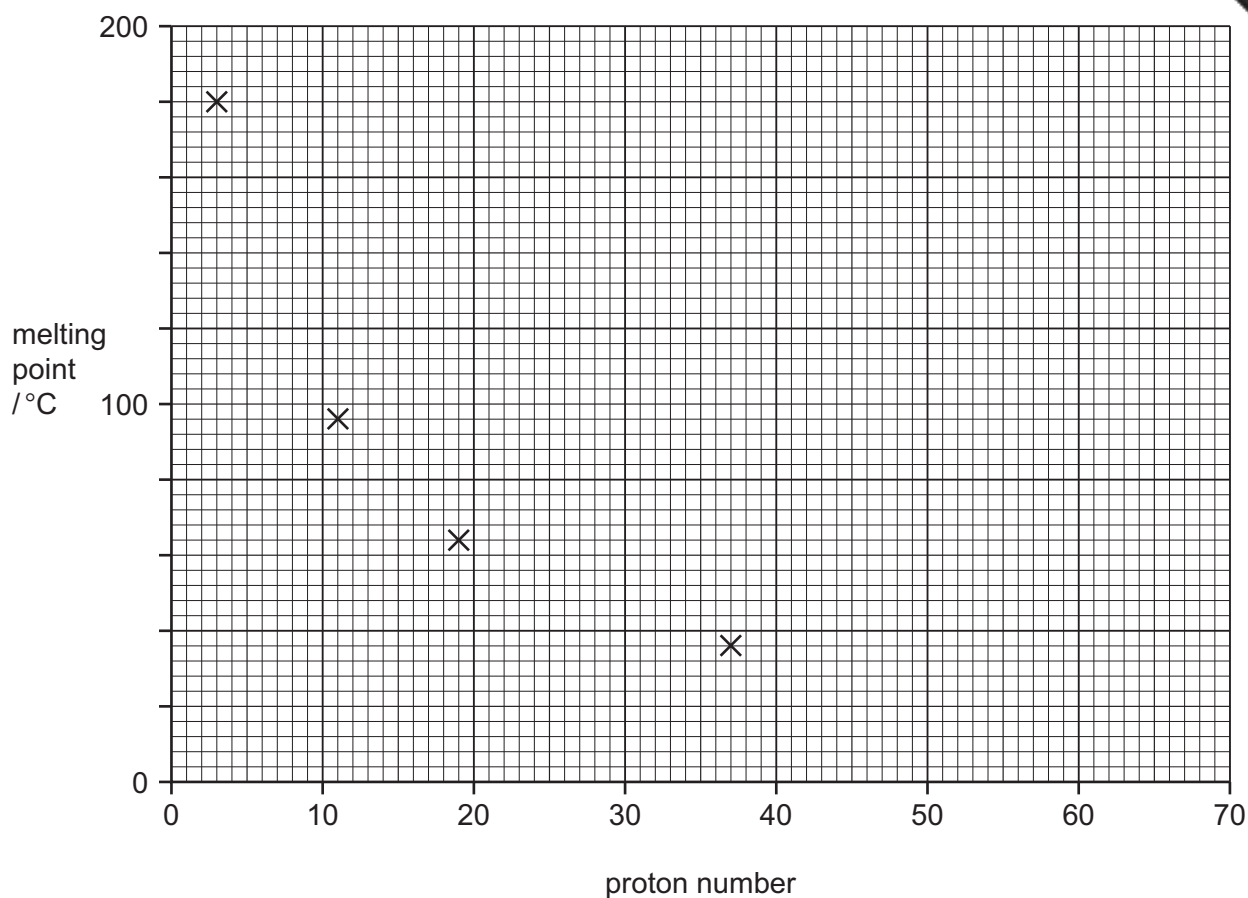


Fig. 4.2

- (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.

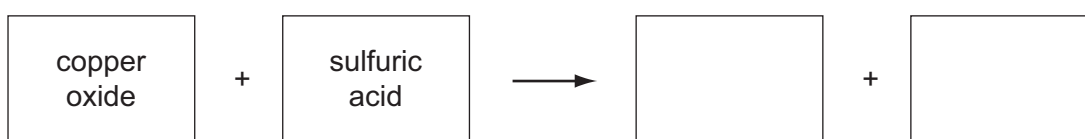
The copper oxide disappeared and a clear blue solution remained.

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.

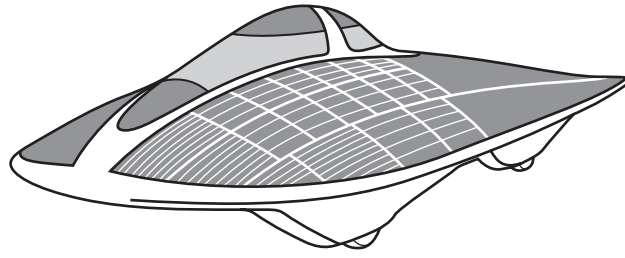


Fig. 5.1

- (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.

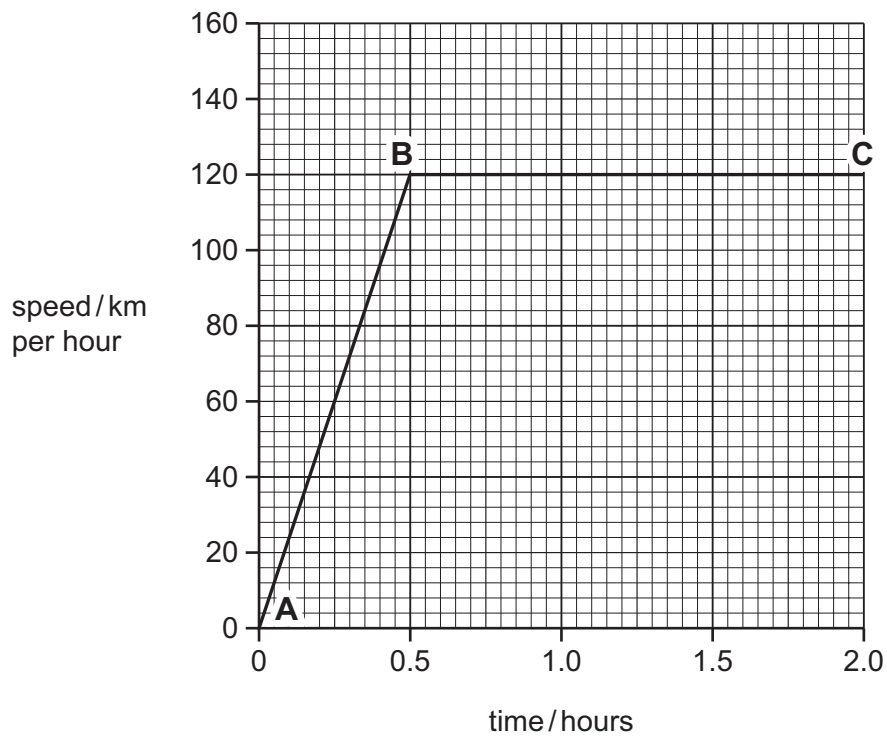


Fig. 5.2

- (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.

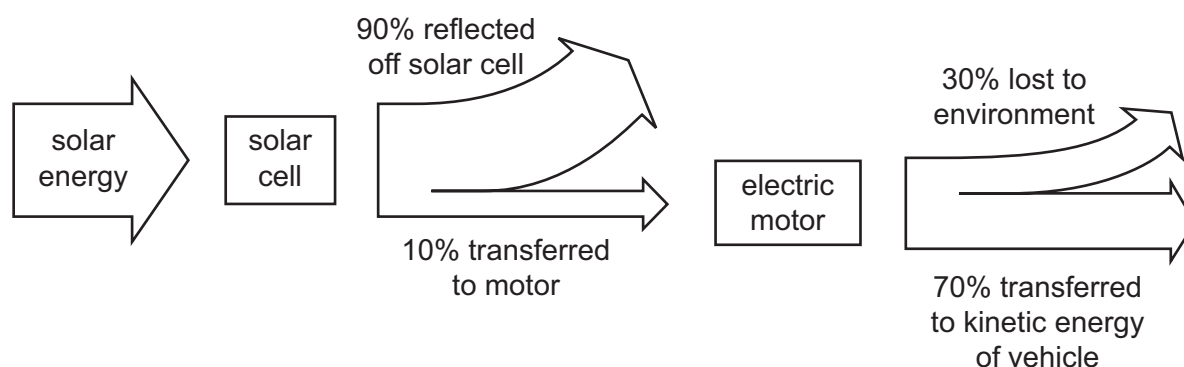


Fig. 5.3

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.

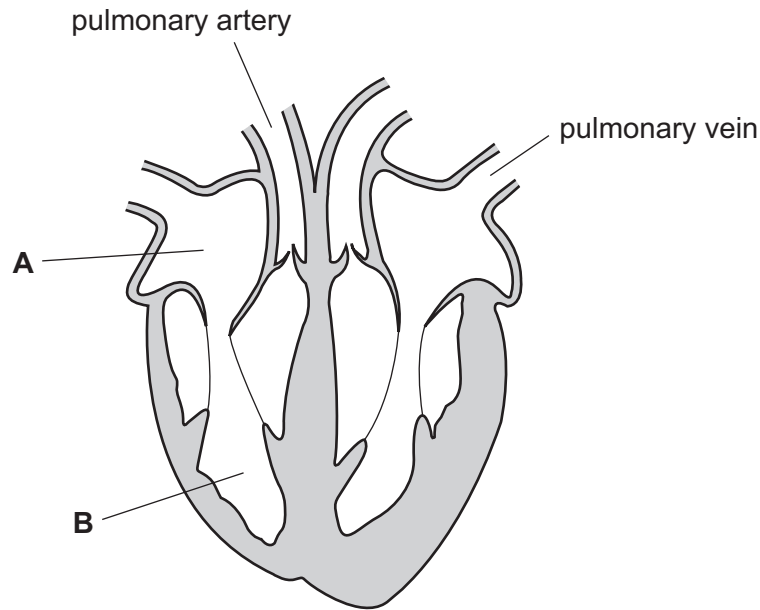


Fig. 6.1

- (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.

..... [1]

- (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.

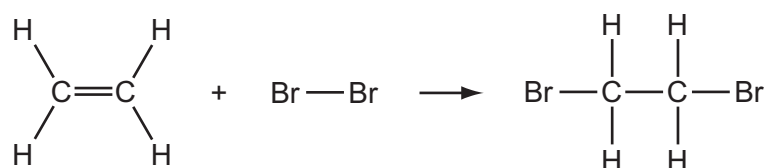
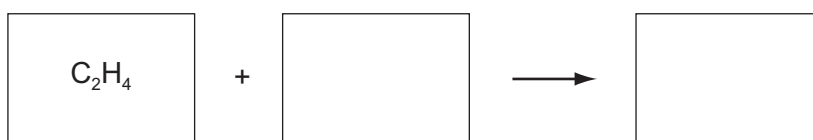


Fig. 7.1

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 .

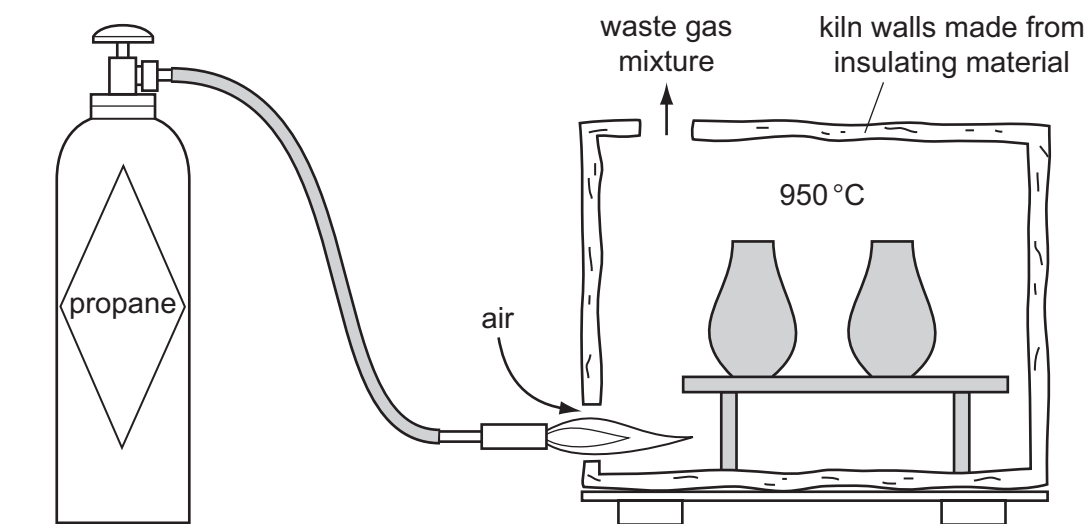


Fig. 7.2

- (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.

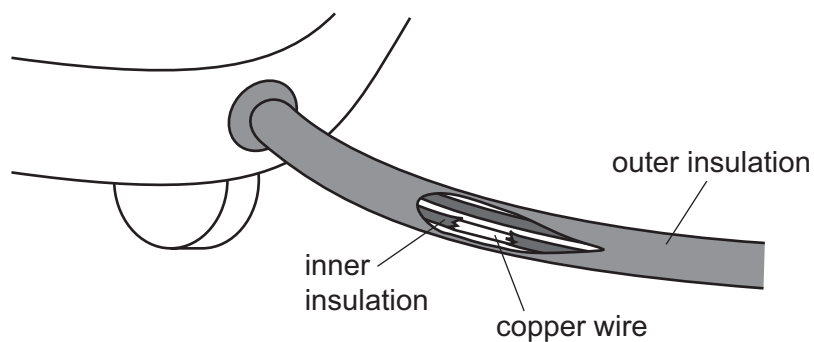


Fig. 8.1

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 .

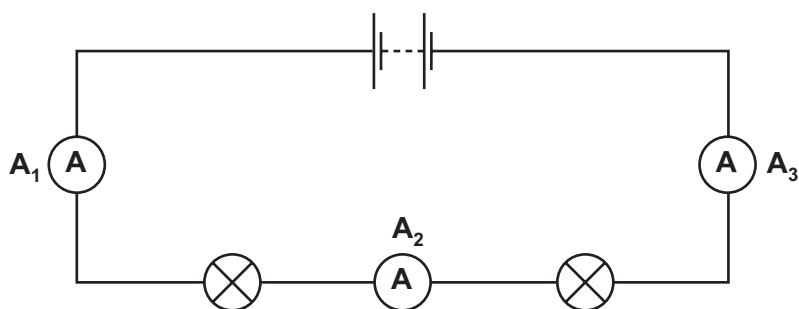


Fig. 8.2

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

..... Ω [2]

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

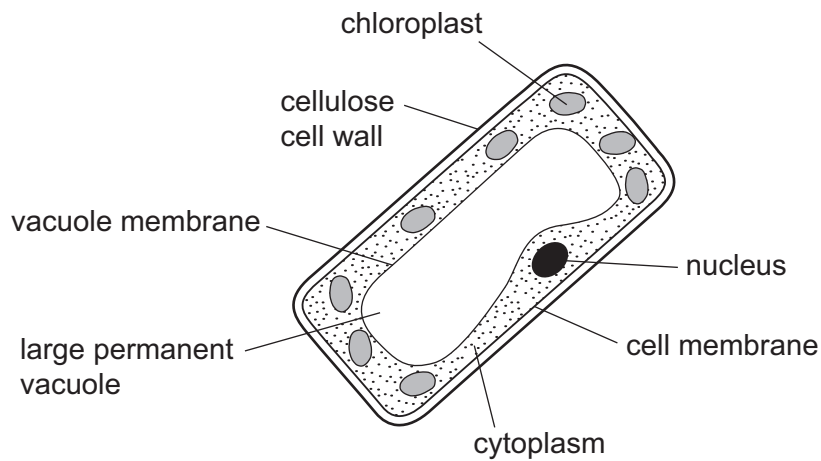


Fig. 9.1

- (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.

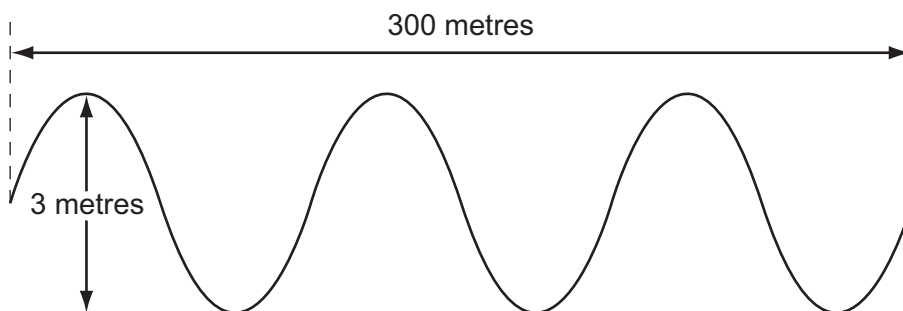


Fig. 10.2

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 H Hydrogen																
3 7 Li Lithium	4 9 Be Beryllium											5 11 B Boron	6 12 C Carbon	7 14 N Nitrogen	8 16 O Oxygen	9 19 F Fluorine	2 4 He Helium	
11 23 Na Sodium	12 24 Mg Magnesium											13 27 Al Aluminium	14 28 Si Silicon	15 31 P Phosphorus	16 32 S Sulfur	17 35.5 Cl Chlorine	18 40 Ar Argon	
19 39 K Potassium	20 40 Ca Calcium	21 45 Sc Scandium	22 48 Ti Titanium	23 51 V Vanadium	24 52 Cr Chromium	25 55 Mn Manganese	26 56 Fe Iron	27 59 Co Cobalt	28 59 Ni Nickel	29 64 Cu Copper	30 65 Zn Zinc	31 70 Ga Gallium	32 73 Ge Germanium	33 75 As Arsenic	34 79 Se Selenium	35 80 Br Bromine	36 84 Kr Krypton	
37 85 Rb Rubidium	38 88 Sr Strontium	39 89 Y Yttrium	40 91 Zr Zirconium	41 93 Nb Niobium	42 96 Mo Molybdenum	43 101 Tc Technetium	44 101 Ru Ruthenium	45 103 Rh Rhodium	46 106 Pd Palladium	47 108 Ag Silver	48 112 Cd Cadmium	49 115 In Indium	50 119 Sn Tin	51 122 Sb Antimony	52 128 Te Tellurium	53 127 I Iodine	54 131 Xe Xenon	
55 133 Cs Caesium	56 137 Ba Barium	57 139 La Lanthanum	72 178 Hf Hafnium	73 181 Ta Tantalum	74 184 W Tungsten	75 186 Re Rhenium	76 190 Os Osmium	77 192 Ir Iridium	78 195 Pt Platinum	79 197 Au Gold	80 201 Hg Mercury	81 204 Tl Thallium	82 207 Pb Lead	83 209 Bi Bismuth	84 209 Po Polonium	85 209 At Astatine	86 209 Rn Radon	
87 226 Fr Francium	88 226 Ra Radium	89 227 Ac Actinium																
58-71 Lanthanoid series																		
90-103 Actinoid series																		
a X b a = relative atomic mass X = atomic symbol b = proton (atomic) number																		
Key																		
		175 Lu Lutetium																
		173 Yb Ytterbium																
		169 Tm Thulium																
		167 Er Erbium																
		165 Ho Holmium																
		162 Dy Dysprosium																
		159 Tb Terbium																
		157 Gd Gadolinium																
		152 Eu Europium																
		150 Sm Samarium																
		144 Nd Neodymium																
		141 Pr Praseodymium																
		140 Ce Cerium																
		138 La Lanthanum																
		136 Ce Cerium																
		134 Pr Praseodymium																
		132 Nd Neodymium																
		130 Pm Promethium																
		128 Sm Samarium																
		126 Eu Europium																
		124 Gd Gadolinium																
		122 Tb Terbium																
		120 Dy Dysprosium																
		118 Ho Holmium																
		116 Er Erbium																
		114 Tm Thulium																
		112 Yb Ytterbium																
		110 Lu Lutetium																
		108 Yb Ytterbium																
		106 Tm Thulium																
		104 Er Erbium																
		102 Tm Thulium																
		100 Yb Ytterbium																
		98 Lu Lutetium																
		96 Yb Ytterbium																
		94 Tm Thulium																
		92 Yb Ytterbium																
		90 Lu Lutetium																
		88 Yb Ytterbium																
		86 Tm Thulium																
		84 Yb Ytterbium																
		82 Lu Lutetium																
		80 Yb Ytterbium																
		78 Lu Lutetium																
		76 Yb Ytterbium																
		74 Tm Thulium																
		72 Yb Ytterbium																
		70 Lu Lutetium																
		68 Yb Ytterbium																
		66 Tm Thulium																
		64 Yb Ytterbium																
		62 Lu Lutetium																
		60 Yb Ytterbium																
		58 Lu Lutetium																
		56 Yb Ytterbium																
		54 Tm Thulium																
		52 Yb Ytterbium																
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		42 Lu Lutetium																
		40 Yb Ytterbium																
		38 Tm Thulium																
		36 Yb Ytterbium																
		34 Lu Lutetium																
		32 Yb Ytterbium																
		30 Tm Thulium																
		28 Yb Ytterbium																
		26 Lu Lutetium																
		24 Yb Ytterbium																
		22 Tm Thulium																
		20 Yb Ytterbium																
		18 Lu Lutetium																
		16 Yb Ytterbium																
		14 Tm Thulium																
		12 Yb Ytterbium																
		10 Lu Lutetium																
		8 Yb Ytterbium																
		6 Tm Thulium																
		4 Yb Ytterbium																
		2 Lu Lutetium																

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

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

The volume of one mole of any gas is 24 dm³ at room temperature and pressure (r.t.p.).



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* 5 2 5 0 3 2 8 4 2 9 *

COMBINED SCIENCE

0653/22

Paper 2 (Core)

October/November 2013

1 hour 15 minutes

Candidates answer on the Question Paper.

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At the end of the examination, fasten all your work securely together.

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This document consists of **19** printed pages and **1** blank page.



- 1 (a) Fig. 1.1 shows apparatus that can be used to test the electrical conductivity materials contained in the beakers **Q**, **R** and **S**.

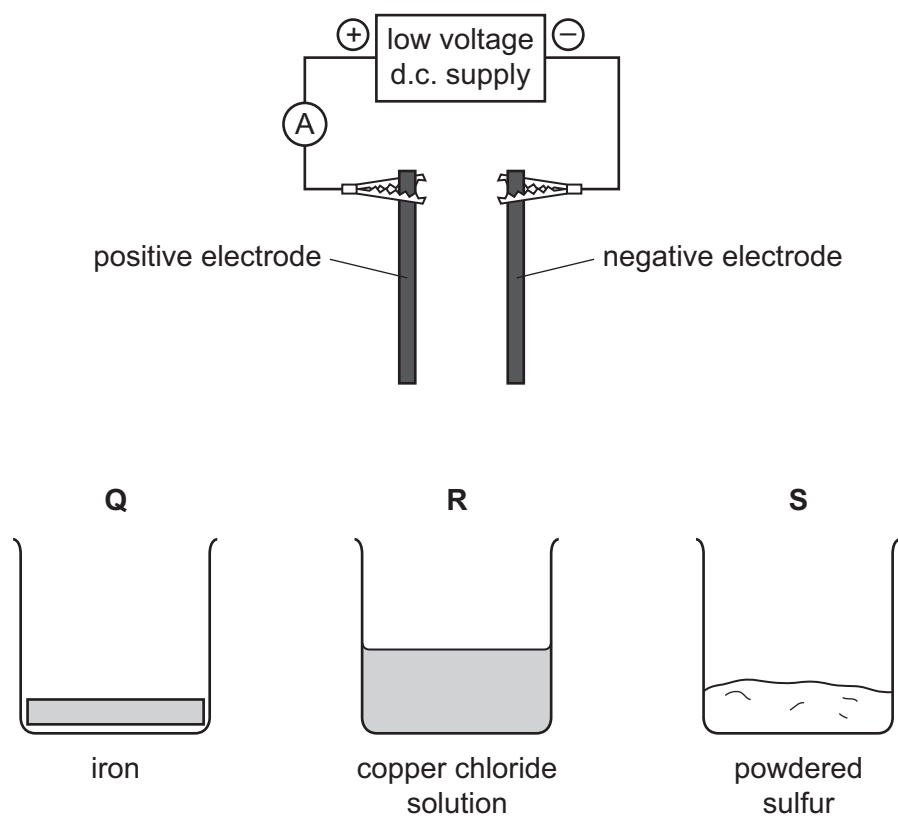


Fig. 1.1

- (i) The contents of beakers **Q** and **S** are tested for electrical conductivity by lowering the electrodes into the beakers.

Predict and explain the results.

beaker **Q**

prediction

explanation

beaker **S**

prediction

explanation [3]

- (ii) When the electrodes are lowered into the solution in beaker **R**, the following observations are made.

- Bubbles of gas form on the surface of the positive electrode.
- A layer of an orange solid appears on the surface of the negative electrode.

Name the gas that forms and the substance in the orange layer.

gas

orange layer [2]

- (iii) State the name of the process described in (ii).

..... [1]

- (b) Fig. 1.2 shows names and molecular structure diagrams of some compounds containing carbon.

Draw straight lines to match the structures with names. One line has been drawn as an example.

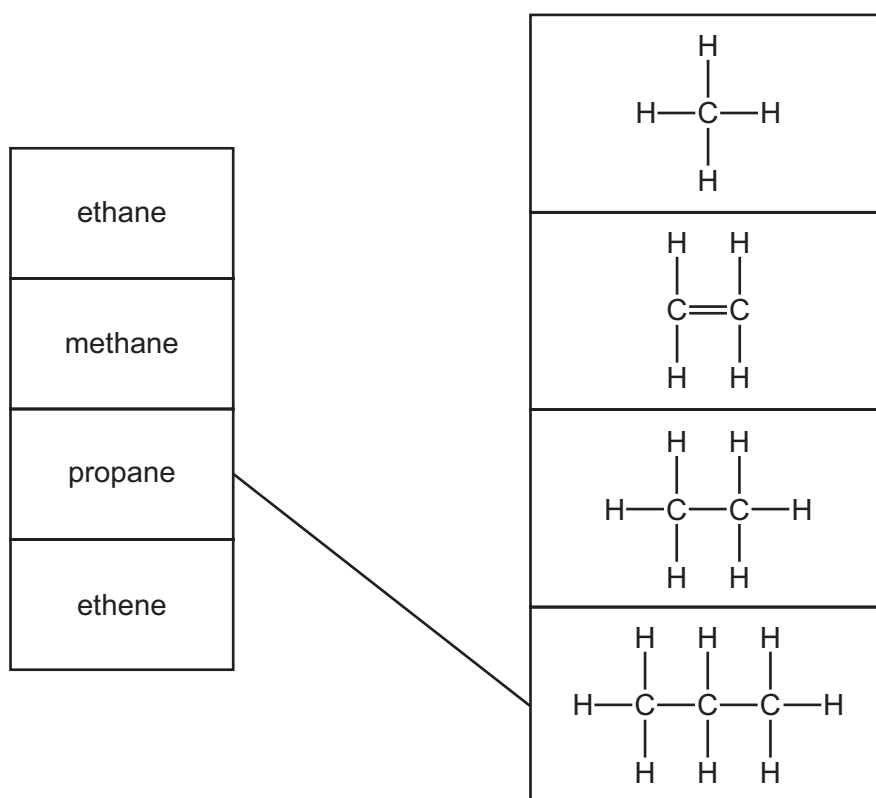


Fig. 1.2

[2]

- (c) Fig. 1.3 shows the structure of one molecule of a type of compound called (chlorofluorocarbon).

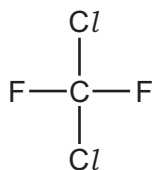


Fig. 1.3

- (i) State the chemical formula of the molecule whose structure is shown in Fig. 1.3.

..... [1]

- (ii) Explain whether or not the molecule in Fig. 1.3 is an example of a hydrocarbon.

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

- 2 (a) Use the words or phrases below to complete the sentences.

amplitudes frequencies slows down speed speeds up

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

- (i) Light when it travels from air to glass.
- (ii) In the electromagnetic spectrum, the waves are arranged in order of
.....
- (iii) 20 Hz to 20 000 Hz is the approximate human range of audible
.....
- (iv) The of sound waves determines the loudness
of the sounds.

[4]

- (b) Fig. 2.1 shows a demonstration of sound transmission using a bell jar.

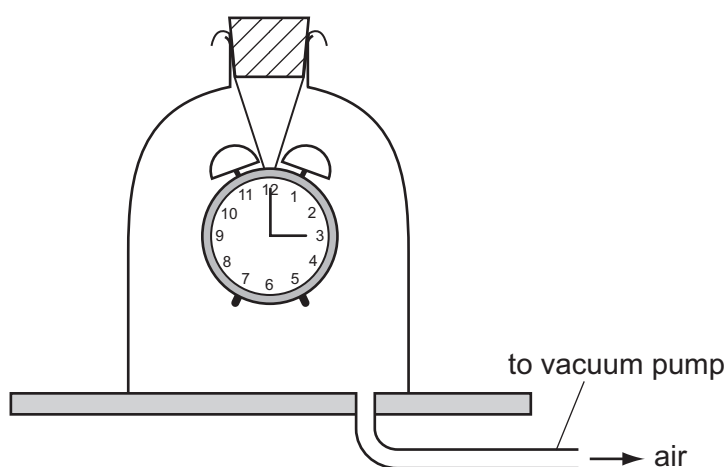


Fig. 2.1

As the air is removed from the bell jar, the ringing sound from inside the bell jar gets quieter. When all the air has been removed, the bell cannot be heard.

Explain these observations.

.....

.....

.....

.....

[3]

- 3 (a) Fig. 3.1 shows cross-sections of a root and a stem.

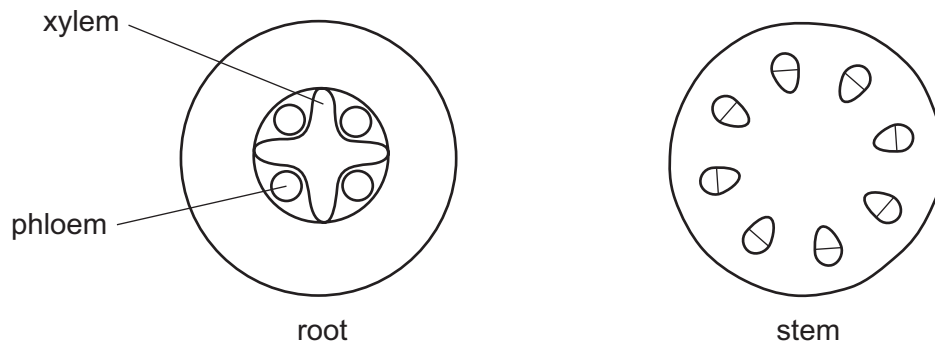


Fig. 3.1

- (i) On Fig. 3.1, use label lines to indicate the positions of the xylem and phloem on the diagram of the stem. [2]
- (ii) Describe the functions of xylem and phloem.

xylem

.....

.....

phloem

.....

.....

[4]

- (b) The roots of most plants have root hairs near their tips.

Researchers grew two types of plants, **A** and **B**, in soil with different concentrations of phosphate ions. They measured the mean number of root hairs in a small area of the roots, and also the mean length of the root hairs.

Table 3.1 shows their results.

Table 3.1

type of plant	phosphate concentration	mean number of root hairs per unit area	mean length of root hairs / micrometres
A	low	1.26	175
	high	1.70	149
B	low	1.41	225
	high	1.85	52

- (i) Describe **two** ways in which the addition of phosphate ions to the soil affects the root hairs in type **A** plants.

1

.....

2

..... [2]

- (ii) Compare the effect of adding phosphate ions to the soil for type **A** plants and for type **B** plants.

.....

.....

..... [2]

- (iii) Explain why a reduction in the length of its root hairs could reduce the rate of growth of a plant.

.....

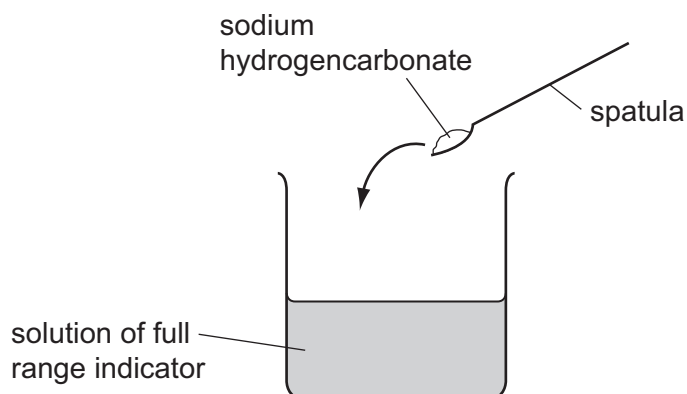
.....

.....

.....

..... [3]

- 4 Sodium hydrogencarbonate, NaHCO_3 , is a white solid compound which is soluble in water.
- (a) A student adds some sodium hydrogencarbonate to a beaker which contains an aqueous solution of full range indicator (Universal Indicator).



When the sodium hydrogencarbonate dissolves, the solution changes colour from green to blue.

- (i) State and explain briefly how the pH of the mixture changes when the sodium hydrogencarbonate dissolves.

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

- (ii) The student then adds excess dilute hydrochloric acid to the blue solution.

Apart from an increase in volume, state **two** observations that are made when the acid is added.

1
.....
2
..... [2]

- (b) Fig. 4.1 shows apparatus a teacher uses to demonstrate the heating of sodium hydrogencarbonate.

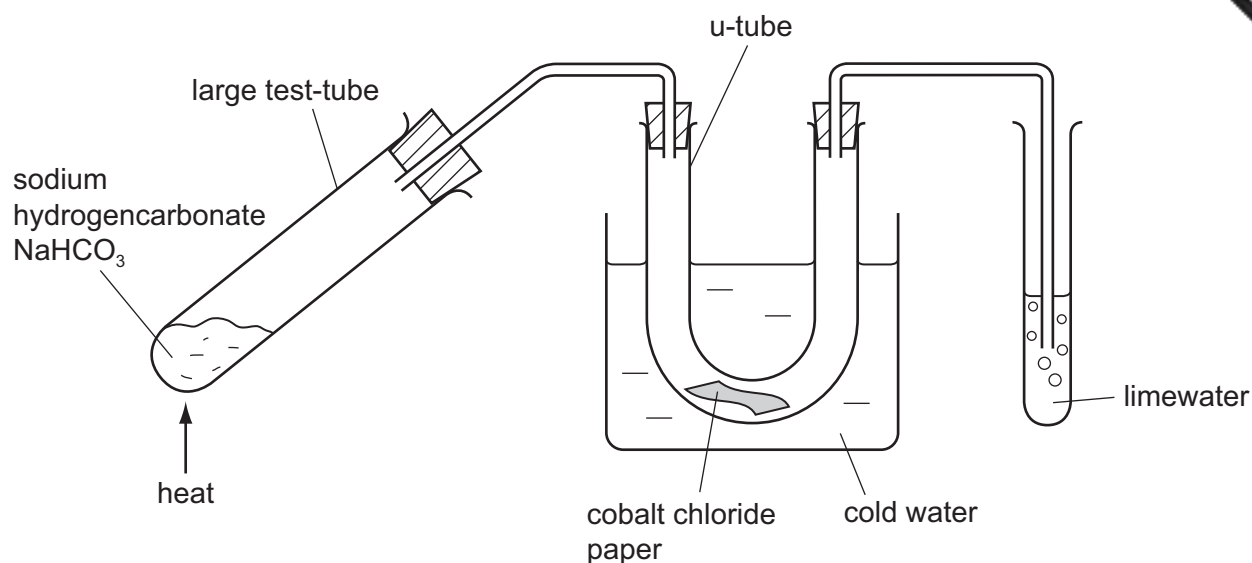


Fig. 4.1

The solid is heated strongly for a few minutes.

- The cobalt chloride paper changes colour from blue to pink.
- A gas bubbles out through the limewater, turning it cloudy.

After the reaction, a white solid, sodium carbonate, remains in the large test-tube.

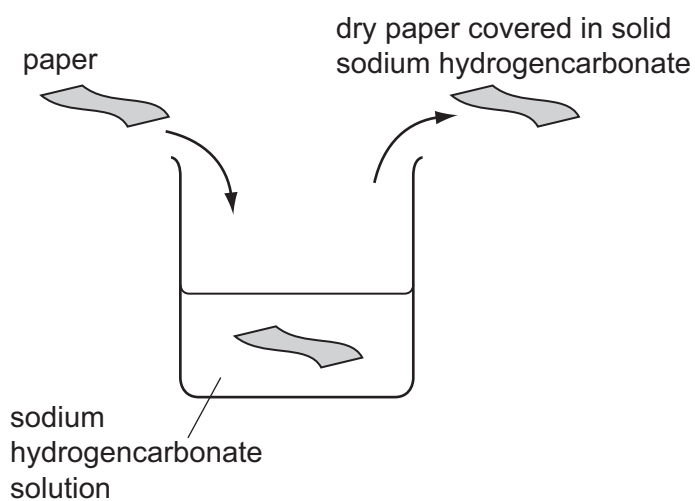
- (i) Explain how the observations show that both water and carbon dioxide are produced.

.....

.....

..... [2]

- (ii) A student places a piece of paper into a solution of sodium hydrogencarbonate. She removes the paper and allows it to dry. She notices that crystals of solid sodium hydrogencarbonate are left on the paper.



The student found that it is now difficult to set fire to the paper.

Use the results of the experiment in Fig. 4.1 to suggest why the student finds it difficult to get the paper to burn.

.....

.....

.....

..... [2]

- 5 (a) Fig. 5.1 shows a bicycle with two lights **A** and **B** at the front.

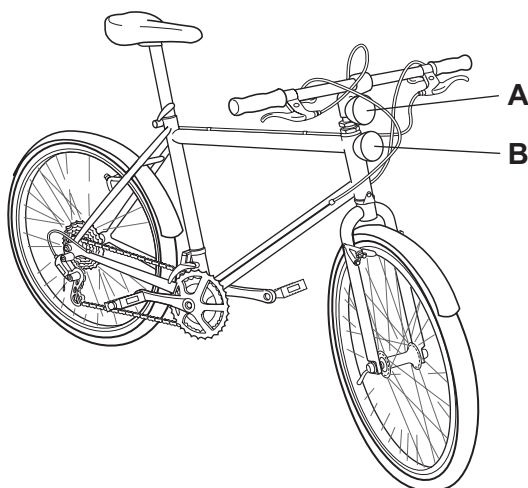


Fig. 5.1

Fig. 5.2 shows the circuit used to power the two lights.

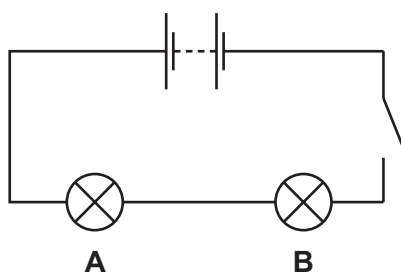


Fig. 5.2

- (i) State the name given to this type of circuit arrangement.

..... [1]

- (ii) To calculate the resistance of light **A**, the current flowing through it and the voltage across it must be measured.

On Fig. 5.2, using the correct symbols, draw an ammeter and a voltmeter correctly connected to make these measurements. [4]

- (iii) The resistance of light **A** in the circuit is 5Ω and the resistance of light **B** is 10Ω . For
miner's

Calculate the combined resistance of the two lights.

State the formula that you use and show your working.

formula

working

..... Ω [2]

- (b) The bicycle was made from a block of aluminium alloy of mass 9000g and volume 3000cm^3 .

Calculate the density of aluminium in g/cm^3 .

State the formula that you use and show your working.

formula

working

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

- (c) The bicycle is ridden by a cyclist. The cyclist is cooled by sweating.

Explain, in terms of particles, how sweating cools his body.

.....

.....

..... [1]

- 6 Fig. 6.1 shows the male reproductive system.

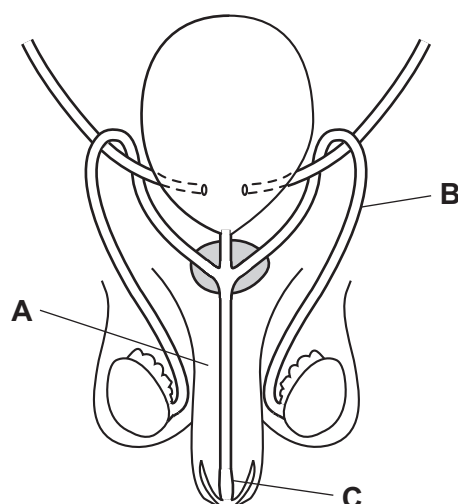


Fig. 6.1

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

A

B

C [3]

- (b) An infection may block the tube labelled **B**. If the tube on the other side is also blocked, the man may be unable to have children.

Explain why.

.....

.....

..... [2]

- (c) HIV/AIDS is a disease that can be passed on by sexual intercourse.

- (i) What does HIV stand for?

..... [1]

- (ii) State **one** way in which a man with HIV/AIDS can avoid passing it to another person.

..... [1]

- 7 (a) The elements chlorine, bromine and iodine are found in Group 7 of the Periodic Table.
- (i) Complete Table 7.1 by writing the physical state (solid, liquid or gas) at room temperature (20 °C) of the elements.

Table 7.1

element	physical state
bromine	
iodine	

[1]

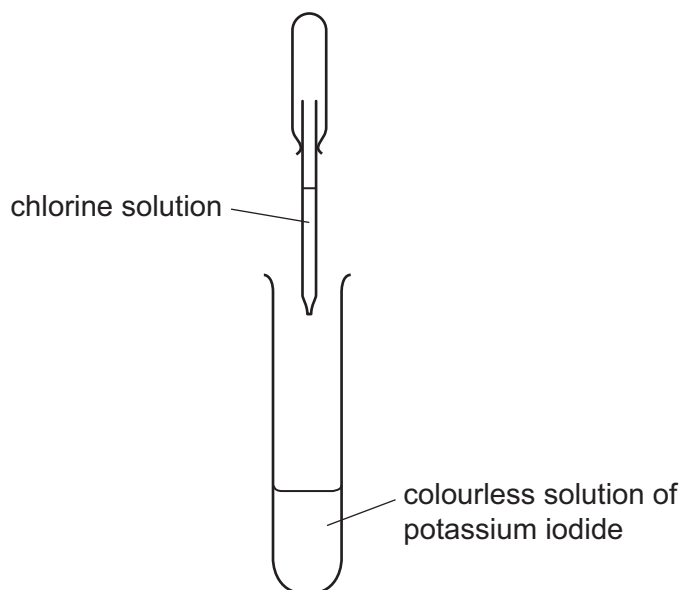
- (ii) Explain why an iodine atom is larger and heavier than a bromine atom.

.....

.....

..... [2]

- (iii) An aqueous solution containing chlorine is added to a colourless solution of potassium iodide.



Describe and explain briefly what is observed in this reaction.

observation

explanation

[2]

- (b) Explain why a dilute solution of chlorine is usually added to drinking water before it is supplied to homes.

.....

.....

..... [2]

- (c) Helium is a gas found in Group 0 of the Periodic Table.

Some helium is added to a flask containing chlorine and left for a few days.

Predict and explain whether the flask now contains a mixture of the two elements or a compound.

.....

.....

..... [2]

8 (a) Fig. 8.1 shows a car moving along a road.

- (i) Draw and label arrows on Fig. 8.1 to show the directions of the driving and friction forces acting on the car. [1]

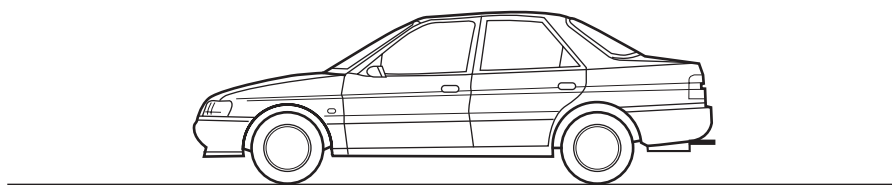


Fig. 8.1

- (ii) State **one** source of friction on the moving car.

..... [1]

- (iii) The driving and friction forces are balanced.

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

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

- (iv) Describe the movement of the car when these forces are balanced.

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

- (v) Apart from the driving and friction forces there are other forces acting on the car.

Name **one** of these forces.

..... [1]

- (b) (i) The car travels a distance of 400 m down a hill in 25 seconds.

Calculate the average speed of the car.

State the formula that you use and show your working.

formula

working

..... m/s [2]

- (ii) The car is going faster at the bottom of the hill than it was at the top.

State the type of energy which the car has gained. [1]

- (iii) State the type of energy which the car will have lost as it travels down the hill.

..... [1]

- 9 (a) Fig. 9.1 shows a food web in the Antarctic Ocean.

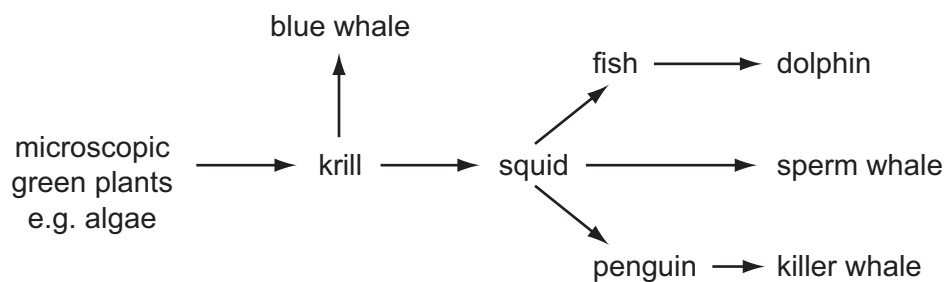


Fig. 9.1

- (i) State the term used for organisms such as the microscopic green plants that make their own organic nutrients.

..... [1]

- (ii) Name **one** organic nutrient that is made by the green plants.

..... [1]

- (iii) State what is shown by the arrows in the food web.

..... [1]

- (b) Fishing boats catch large quantities of krill in the Antarctic Ocean.

Suggest how this could affect the numbers of the organisms in the food web in Fig. 9.1.

.....

.....

.....

..... [2]

- (c) There is concern that global warming will damage the environment in the Antarctic Ocean.

Name **two** gases that contribute to global warming.

1

2

[2]

Group

Key

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

*58-71 Lanthanoid series
90-103 Actinoid series

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COMBINED SCIENCE

0653/23

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 20.

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



1 Fig. 1.1 shows a root hair cell.

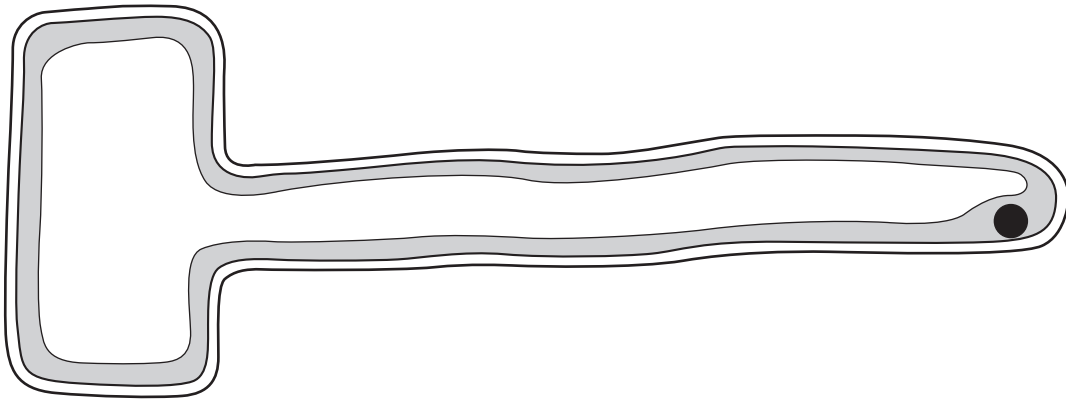


Fig. 1.1

(a) Use the letters **A**, **B** and **C** to label these parts of the root hair cell in Fig. 1.1.

A the cell membrane

B the part that contains chromosomes

C a structure that is **not** present in animal cells

[3]

(b) Name **two** substances that are absorbed by root hair cells.

1

2

[2]

- (c) Fig. 1.2 shows part of a plant stem from which the outer layer, including the pith, has been removed.

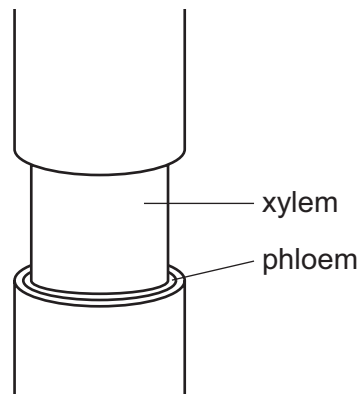


Fig. 1.2

- (i) State the function of phloem.

.....

.....

..... [2]

- (ii) Suggest why this treatment would cause the roots of the plant to die.

.....

.....

.....

..... [2]

- 2 (a) Table 2.1 shows information about some chemical elements and their positions in the Periodic Table.

Table 2.1

element	group number in the Periodic Table
oxygen	6
calcium	2
lithium	1
sulfur	6
fluorine	7

- (i) State the noble (inert) gas that is in the same period of the Periodic Table as sulfur.

..... [1]

- (ii) Select **two** elements from Table 2.1 whose atoms form ionic chemical bonds with each other and explain your answer.

..... and

explanation

..... [2]

- (b) Fig. 2.1 shows a diagram of an atom.

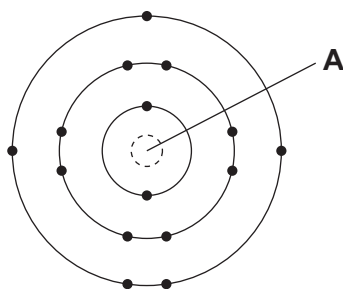


Fig. 2.1

- (i) Name structure **A** in Fig 2.1. [1]

- (ii) State the proton number of the atom in Fig. 2.1.

Explain your answer briefly.

proton number

explanation

..... [2]

- 3 Fig. 3.1 shows a circuit used to measure the current passing through a resistor when the voltage across it is changed.

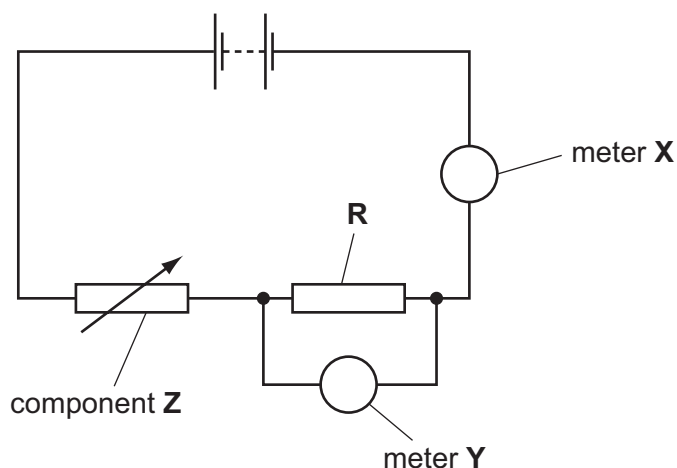


Fig. 3.1

- (a) Describe the purpose of component **Z** in the circuit.

..... [1]

- (b) The meters shown in the circuit give readings of 0.6 A and 8.0 V.

State which meter, **X** or **Y**, gives the reading of 0.6 A.

Explain your answer.

meter

explanation

..... [1]

- (c) Use the formula

$$\text{resistance} = \text{potential difference} / \text{current}$$

to calculate the resistance of the resistor.

State the units for your answer.

working

..... unit [2]

4 Soya beans are an important crop in Brazil.

- (a) Table 4.1 contains information about the tests used and results obtained when testing soya beans for protein, fat and starch.

Table 4.1

nutrient tested for	reagent	result	conclusion
protein		purple	
starch			contains starch
fat		milky white	

Complete the table.

[3]

- (b) Explain why protein is an important part of a balanced diet.

.....

.....

..... [2]

- (c) When a person eats soya beans, the beans are chewed in the mouth.

Explain why this makes it easier for enzymes in the digestive system to digest the beans.

.....

.....

..... [2]

- (d) Large areas of rainforest have been cleared in Brazil, to provide more land for growing soya beans.

State **two** ways in which cutting down the rainforest can harm the environment.

1

.....

2

..... [2]

- 5 (a) A student placed four equally-sized pieces of different metals into colourless liquids contained in four test-tubes **P**, **Q**, **R** and **S**.

Fig. 5.1 shows what the student observed.

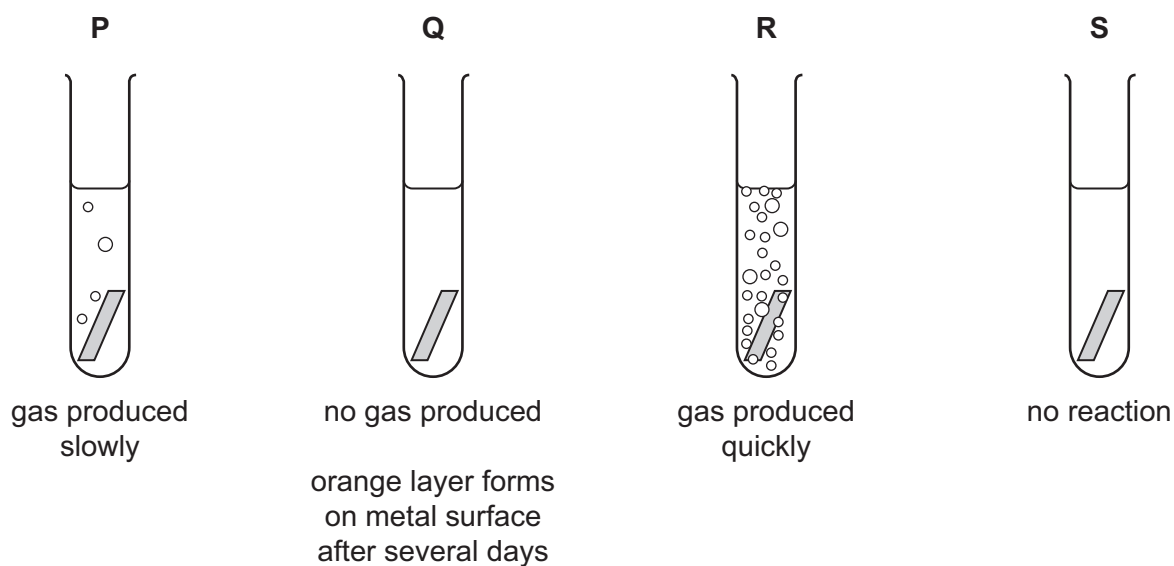


Fig. 5.1

- (i) Suggest which of the test-tubes in Fig. 5.1 contained water to which a piece of iron was added.

Explain your answer.

test-tube

explanation

.....

.....

..... [3]

- (ii) The colourless liquid in test-tube **R** was dilute hydrochloric acid.

Suggest the name of the metal that was added to test-tube **R** and name the gas that was produced.

metal

gas [2]

- (iii) Test-tube **P** contained the same concentration of dilute hydrochloric acid at the same temperature as test-tube **R**.

Suggest a reason why gas was produced more slowly in test-tube **P** than in test-tube **R**.

.....
 [1]

- (b) Gasoline and diesel are mixtures of liquid hydrocarbons obtained from petroleum by the process of fractional distillation.

- (i) State **one** difference in the properties of the hydrocarbons in gasoline that allows them to be separated by fractional distillation.

.....
 [1]

- (ii) State the main use of gasoline and explain, in terms of its chemical properties, why it is suitable for this use.

use

explanation

..... [2]

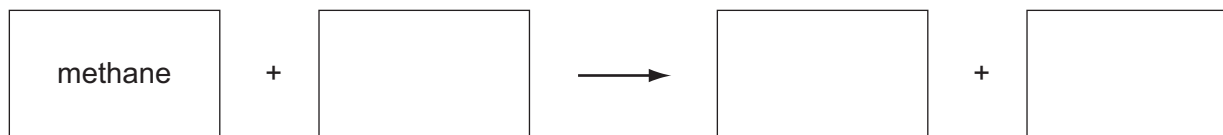
- (c) Natural gas contains mainly methane.

- (i) Complete the diagram of the structure of one molecule of methane.



[1]

- (ii) Complete the **word** chemical equation for the complete combustion of methane.



[2]

- 6 (a) Fig. 6.1 gives information about the uses of different types of electromagnetic waves and their effects on living tissue.

Draw lines to link each electromagnetic wave with its effect on living tissue and its use. One has been completed as an example.

uses	type of radiation	effects on tissue
screening luggage	X-rays	activates sensitive cells in retina
security marking	microwave	kills cancerous cells
satellite communication	ultra violet	heats water in tissues
seeing	visible light	causes tanning of skin

Fig. 6.1

[4]

- (b) Electromagnetic waves are transverse waves. Water waves are also transverse.

Draw a diagram of a transverse wave on the axes below. Label the amplitude and **one** wavelength on your diagram.



[3]

- (c) Fig. 6.2 shows a person looking into a mirror and seeing an image.

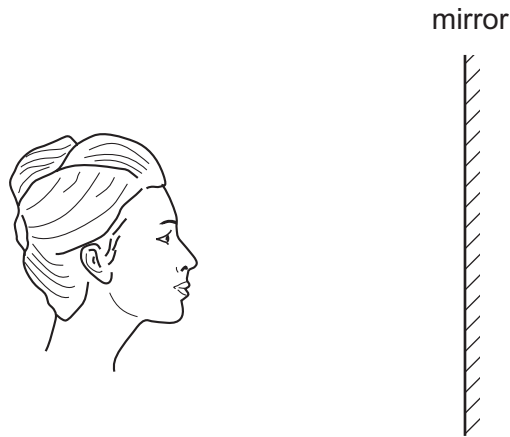


Fig. 6.2

- (i) Write the letter **X** on Fig. 6.2 to show the position of the image of the person's nose. [2]
- (ii) Select **three** words or phrases from the list that describe the image correctly.

larger than object	real	same size as object
smaller than object	upright	upside down
		virtual

.....

..... [3]

- 7 Fig. 7.1 shows the contents of the human thorax (chest).

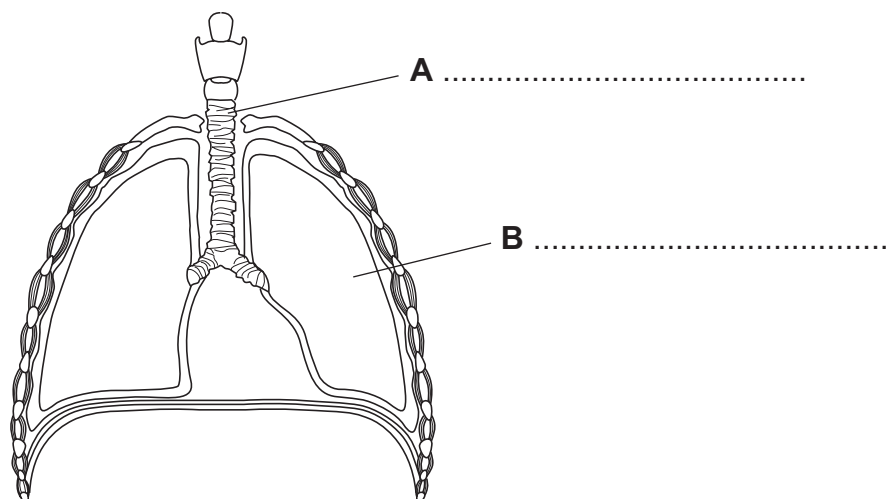


Fig. 7.1

- (a) On Fig. 7.1, name structures **A** and **B**. [2]

- (b) Oxygen diffuses into the blood from the alveoli inside the lungs. Carbon dioxide diffuses into the alveoli from the blood.

- (i) Define the term *diffusion*.

.....

 [2]

- (ii) Name the component of blood that transports dissolved carbon dioxide.

..... [1]

- (iii) When a person is doing vigorous exercise, the concentration of carbon dioxide in the blood increases.

Explain why this happens.

.....

 [2]

- (iv) Suggest how this will affect the rate of diffusion of carbon dioxide from the blood to the alveoli.

Explain your answer.

effect on rate of diffusion

explanation

..... [2]

- 8 (a) Fig. 8.1 shows apparatus a student used to investigate the reaction between nitric acid and excess calcium carbonate.

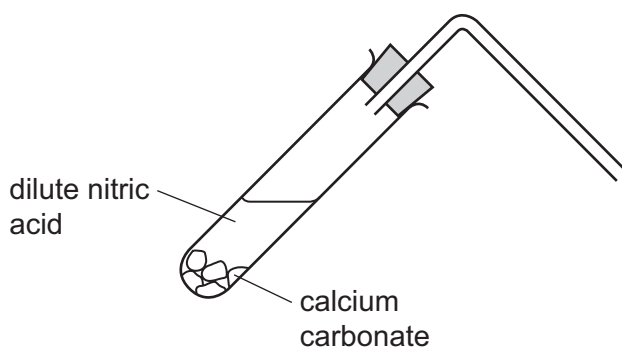


Fig. 8.1

- (i) Describe how the student could show that the reaction in Fig. 8.1 produced carbon dioxide. You may complete the diagram to help you answer this question.

.....

 [2]

- (ii) At the end of the reaction the test-tube in Fig. 8.1 contains a solution of the compound calcium nitrate.

State the general name for compounds like calcium nitrate which are produced when an acid reacts with a metal carbonate.

..... [1]

- (iii) The chemical formula of calcium nitrate is $\text{Ca}(\text{NO}_3)_2$.

State the total number of atoms and the number of different elements that are shown combined together in this formula.

total number of atoms

number of different elements [2]

- (b) The student then carried out an investigation into the way that the rate of the reaction
(a) changed when he varied the concentration of the nitric acid.

Fig. 8.2 shows the apparatus the student used to measure the rate of reaction.

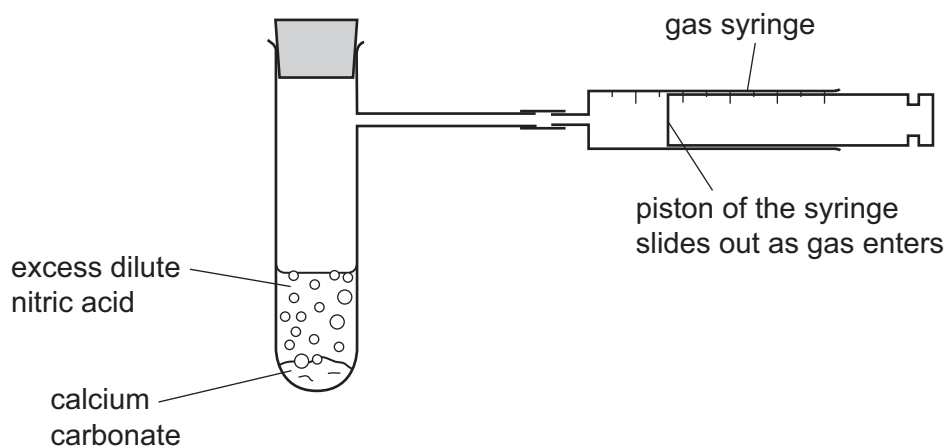


Fig. 8.2

The student measured the rate of reaction by finding how long it took for the gas syringe to fill with gas.

- (i) After he had completed several measurements, the student wrote the following correct conclusion in his notebook.

	Conclusion
	The higher the pH of the dilute nitric acid
	the longer it took for the gas syringe to
	fill with gas.

Explain this conclusion briefly.

.....

 [2]

- (ii) State **two** other variables that can affect the rate of reaction between dilute nitric acid and calcium carbonate.

1
 2 [2]

- 9 Fig. 9.1 shows a solar- powered golf cart used to carry golfers around a golf course.

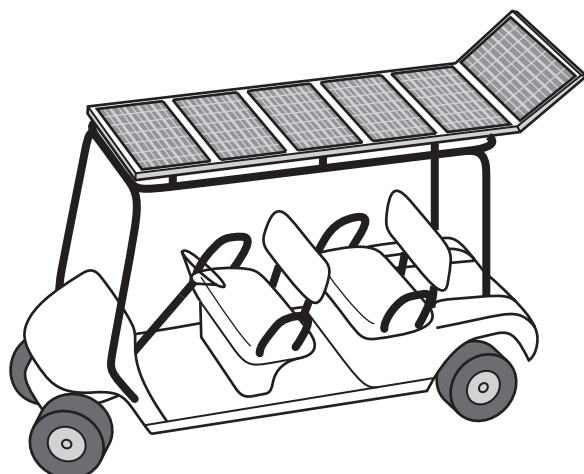


Fig. 9.1

- (a) As the cart moves around the course, the motion of the cart is measured.

Fig. 9.2 shows a distance / time graph for a small part of the journey lasting 60 seconds.

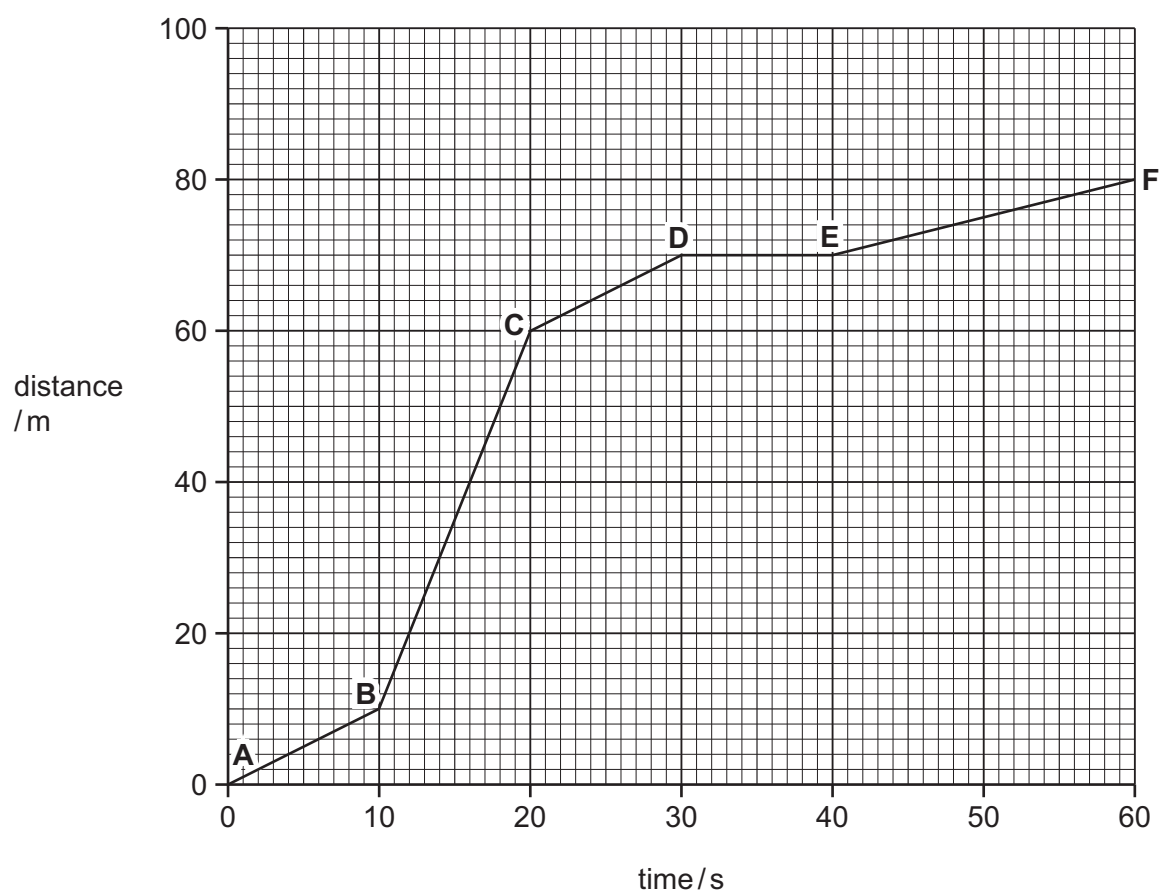


Fig. 9.2

- (i) Write down the total distance covered in 60 s. m [1]

- (ii) Describe the motion of the cart between **D** and **E**.

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

- (iii) During another part of the journey, the cart is accelerating.

State whether the forces acting on the cart are balanced or unbalanced.

Explain your answer.

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

- (b) The cart is powered by solar cells on its roof. The solar cells produce electrical energy used to charge the rechargeable batteries in the cart.

Name **one** other renewable energy resource that could produce electrical energy.

..... [1]

- (c) The golfer hits a golf ball with his club. The ball flies through the air.

- (i) State the form of energy given to the golf ball when the ball is hit.

..... [1]

- (ii) State the form of energy gained by the golf ball as it rises into the air after being hit.

..... [1]

- (d) The mass of a golf ball is 45g. The volume of a golf ball is 36 cm^3 .

Calculate the density of the golf ball.

State the formula that you use and show your working.

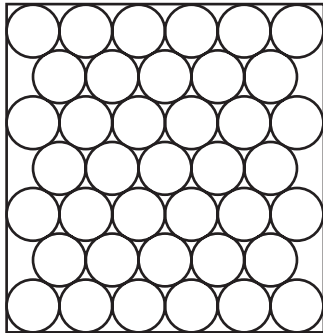
formula

working

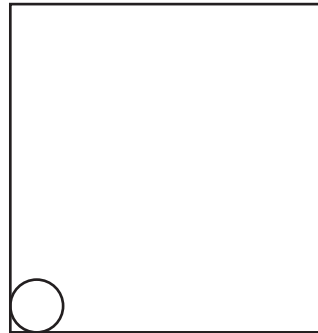
..... g/cm^3 [2]

- (e) The head of the golf club is made of solid metal. The air the golf ball is travelling through is a gas.

Complete Fig. 9.3 below to show the arrangement of particles in a gas. The diagram for a solid has been done for you.



solid



gas

Fig. 9.3

[2]

DATA SHEET

The Periodic Table of the Elements

Group																									
I	II											III	IV	V	VI	VII	0								
												1 H Hydrogen 1													
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	98 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 Cesium 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	210 Po Polonium 84	210 At Astatine 85	210 Rn Radon 86								
Fr 87	226 Ra Radium 88	227 Ac Actinium 89																							
58-71 Lanthanoid series																									
90-103 Actinoid series																									

Key

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

The volume of one mole of any gas is 24 dm³ at room temperature and pressure (r.t.p.).

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