



UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS
International General Certificate of Secondary Education

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COMBINED SCIENCE

0653/21

Paper 2 (Core)

October/November 2011

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 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 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.

For Examiner's Use	
1	
2	
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7	
8	
9	
Total	

This document consists of **20** printed pages.



- 1 The chemical reaction involved in the manufacture of ammonia requires an iron catalyst.

Fig.1.1 shows a simplified diagram of the reaction vessel in which ammonia is made.

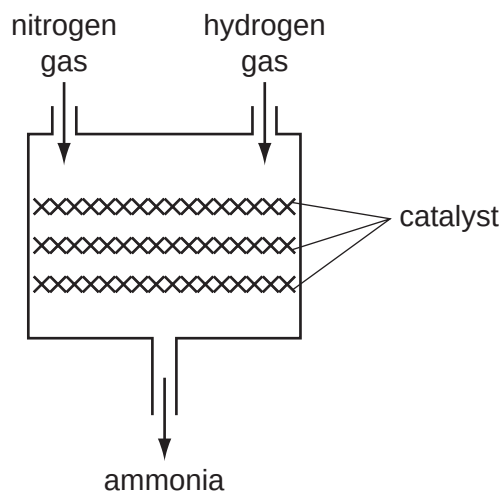


Fig. 1.1

- (a) (i) Explain the meaning of the term *catalyst*.

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

- (ii) Iron is a member of the family of metals which lies between scandium and zinc in the Periodic Table.

Name this family of metals. [1]

- (iii) The iron catalyst is prepared by reacting iron oxide with hydrogen gas.

The balanced symbolic equation for this reaction is shown below.



State the total number of atoms shown on the **left hand side** of this equation.

..... [1]

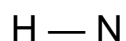
- (iv) State the number of hydrogen molecules shown in the equation in (iii).

..... [1]

- (v) Explain why the reaction in (iii) is an example of a *redox reaction*.

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

- (b) (i) Complete the displayed (graphical) chemical formula of an ammonia molecule, NH_3 , which has been started below.



[2]

- (ii) A student states that an ammonia molecule contains **covalent** chemical bonds between its atoms.

Explain whether or not the student is correct.

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

- 2 (a) The arrows in Fig. 2.1 show the horizontal forces acting on a car moving forward. In each case the length of the arrow indicates the size of the force.

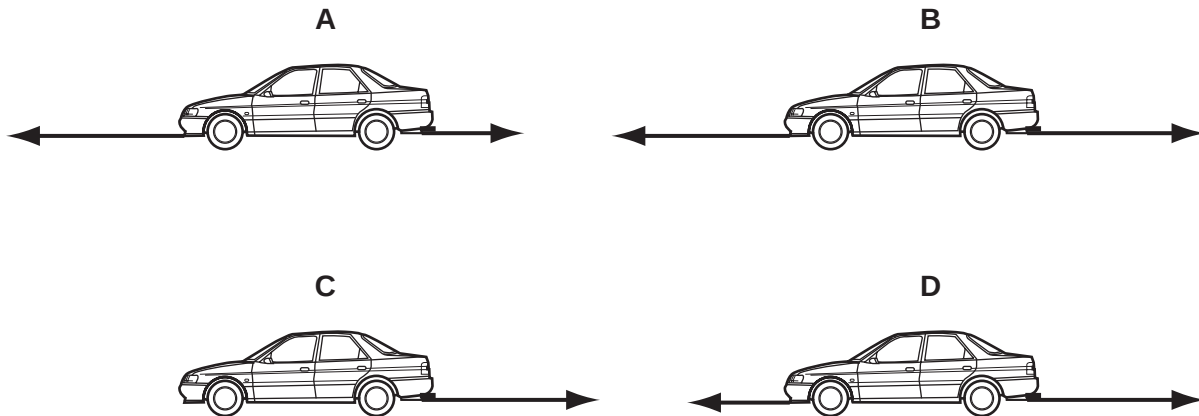


Fig. 2.1

- (i) State which of the diagrams out of **A**, **B**, **C** and **D** show a car that is slowing down.

..... [2]

- (ii) Explain how you decided on your answer to (i).

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

- (iii) There are other forces acting on the cars that are **not** horizontal.

Name **one** of these forces. [1]

- (b) The car has a radiator. This contains hot water that has been heated by passing it through the hot car engine.

The purpose of the radiator is to cool down the water. The radiator is painted black.

- (i) State the method by which heat is transferred from the hot water to the radiator.

..... [1]

- (ii) Explain why the radiator is painted black.

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

(c) Fig. 2.2 shows a racing car.

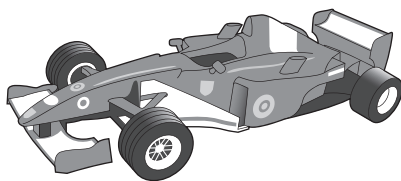


Fig. 2.2

The car took 1.5 hours to complete a race of 330 kilometres.

Calculate the average speed of the car in kilometres per hour.

State the formula that you use and show your working.

formula used

working

..... km/h [2]

(d) Fig. 2.3 shows the speed–time graph for the racing car over a short period of time.

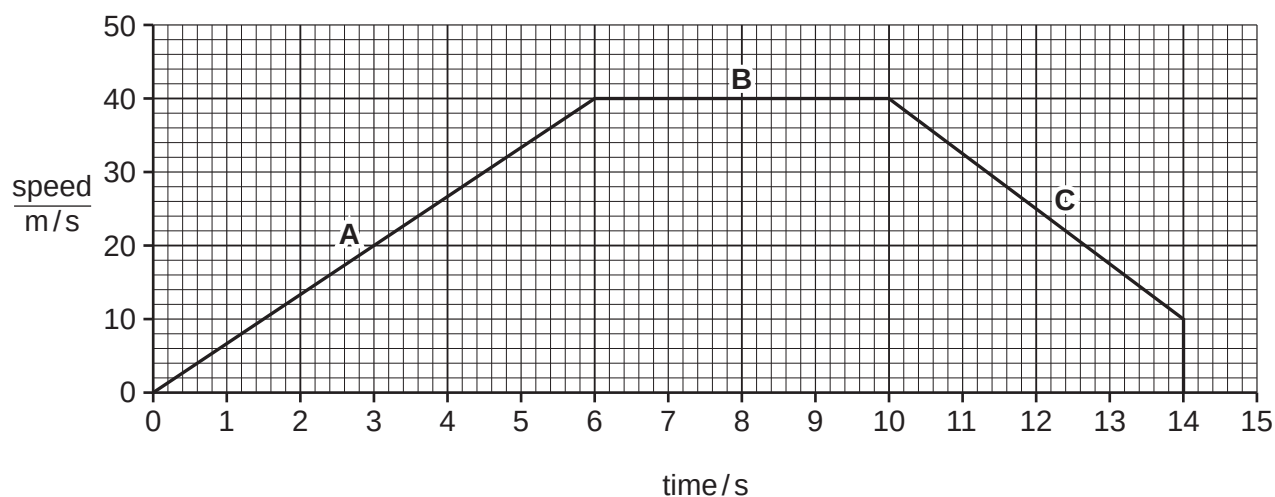


Fig. 2.3

Describe the motion of the racing car during

section **B**, ...

section **C**. [2]

3 Rice and cassava are important parts of a person's diet in some parts of the world.

(a) Table 3.1 shows the main nutrients present in 100g of white rice and 100g of cassava.

Table 3.1

nutrient	white rice	cassava
protein/g	5.0	1.2
carbohydrate/g	58.6	34.7
fat/g	0.4	0.3

(i) Which of the nutrients listed in Table 3.1 can provide energy?

..... [1]

(ii) A diet that consists mostly of rice is better for a young child than a diet that consists mostly of cassava.

Use the information in Table 3.1 to explain **one** reason why this is so.

.....

 [2]

(iii) Carbohydrates include sugars and starch.

Describe how a student could test a sample of cooked rice to find out if it contains reducing sugar.

.....

 [3]

(b) Fig. 3.1 shows a cassava plant.

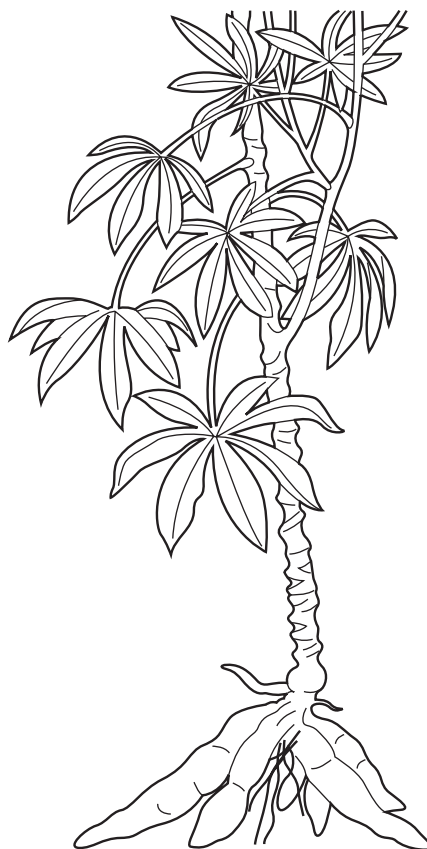


Fig. 3.1

The cassava plant makes food in its leaves.

(i) Describe how food is made by photosynthesis in a plant's leaves.

.....

.....

..... [2]

(ii) Suggest and explain **one** way, visible in Fig. 3.1, in which the structure of a cassava plant's leaves helps them to carry out photosynthesis.

.....

.....

..... [2]

- 4 (a) Fig. 4.1 shows an incomplete diagram of the electromagnetic spectrum.

radio waves		infra-red	visible light		X-rays	
-------------	--	-----------	---------------	--	--------	--

Fig. 4.1

- (i) Complete the diagram using terms from the list:

gamma radiation

microwaves

ultraviolet

[2]

- (ii) State **one** use for

infra-red radiation,

.....

microwaves.

..... [2]

- (b) Gamma radiation and X-rays are two examples of ionising radiation.

- (i) Explain the meaning of the term *ionising radiation*.

.....

..... [2]

- (ii) Explain why ionising radiation can be harmful to living things.

.....

.....

..... [2]

- (c) Some types of food are treated with gamma radiation. The radiation kills the microorganisms that make food decay

- (i) Explain why gamma radiation can be used for this, even when the fruit is packed in boxes.

.....
 [1]

- (ii) Fig. 4.2 shows how a conveyor belt can be used to move the boxes of fresh fruit past the radioactive source.

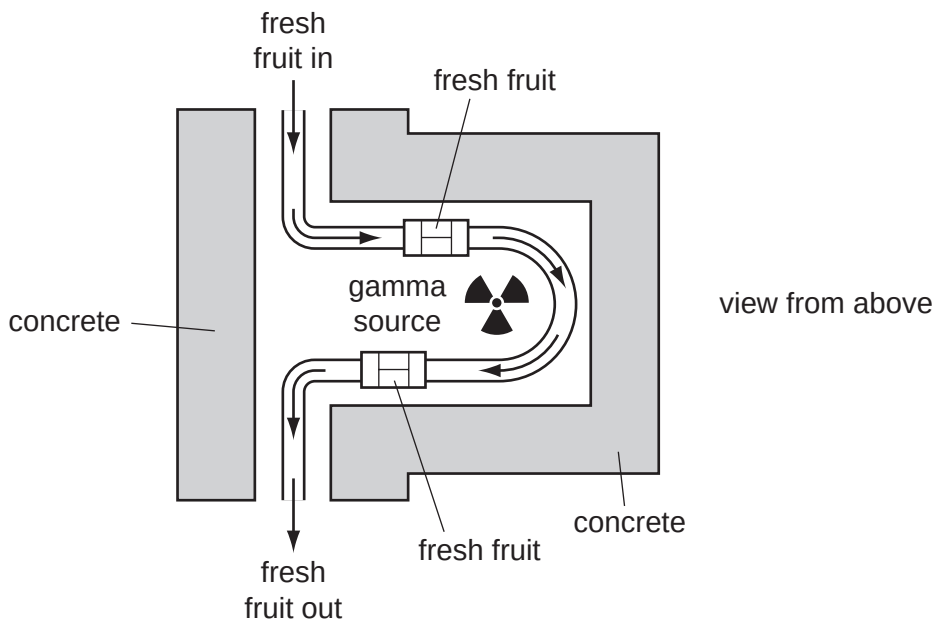


Fig. 4.2

Suggest why concrete is used to surround the radioactive source.

.....
 [1]

- 5 Fig. 5.1 shows a piece of magnesium ribbon which a student has just dropped into a container of dilute sulfuric acid.

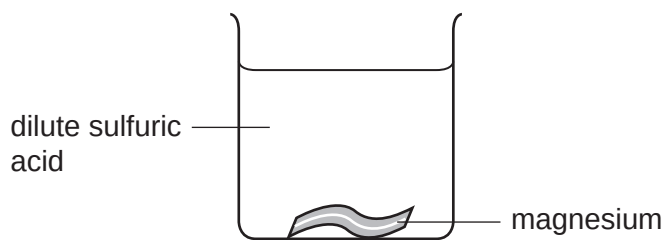


Fig. 5.1

- (a) (i) Describe **two** observations about this reaction which the student could make.

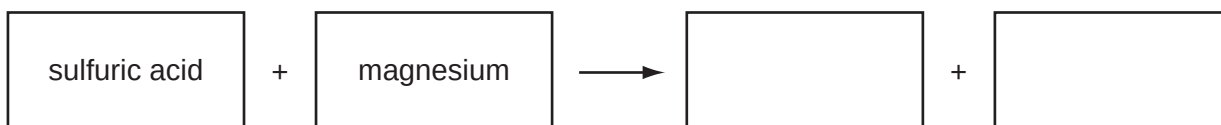
1

.....

2

..... [2]

- (ii) Complete the **word** chemical equation for the reaction in (i).



[2]

- (iii) State the **name** of the element which is present in both hydrochloric acid and sulfuric acid.

..... [1]

(b) Containers for dilute sulfuric acid are often made of poly(ethene). Poly(ethene) is a synthetic polymer which is formed from hydrocarbon monomers.

- (i) Suggest **one** property of poly(ethene) which makes it suitable for making sulfuric acid containers.

..... [1]

- (ii) One method of dealing with waste poly(ethene) is to burn it.

Predict **two** compounds which will be produced when poly(ethene) is burnt.

1

2 [2]

- (iii) Suggest **one** advantage of burning as a means of dealing with waste poly(ethene).

.....

..... [1]

- 6 Fig. 6.1 shows part of the human nervous system.

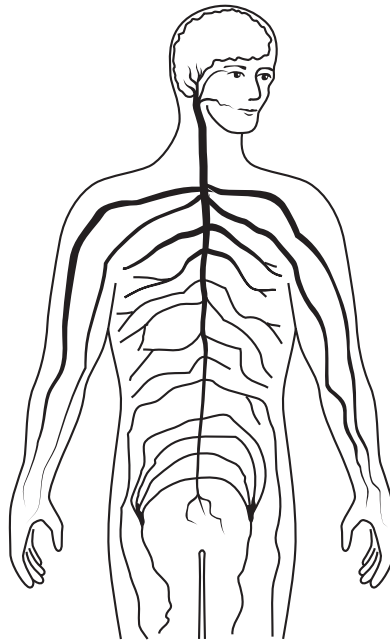


Fig. 6.1

- (a) On Fig. 6.1, use label lines to indicate and name the **two** parts of the central nervous system. [2]
- (b) If a person touches a hot pan with his finger, signals pass from his hand, through the central nervous system, to a muscle in his arm. The muscle contracts and moves the arm away.

State the correct biological term for each of the following descriptions.

- (i) the cells in the finger that detect the hot pan and send signals to the central nervous system

..... [1]

- (ii) an organ such as a muscle that responds to the signals

..... [1]

(c) A nerve cell has a nucleus and a cell surface membrane.

(i) Name **one** type of cell in the human body that does **not** contain a nucleus.

..... [1]

(ii) The nucleus contains DNA. State the function of DNA.

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

(iii) Outline **one** function of the cell surface membrane.

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

- 7 Fig. 7.1 shows some data about the percentage by mass of elements in the Earth's crust.

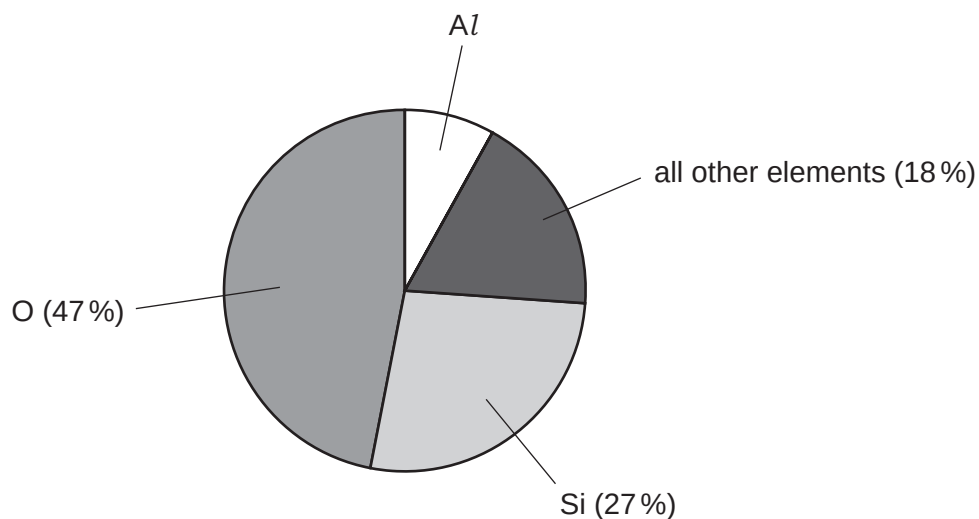


Fig. 7.1

- (a) State the percentage by mass of aluminium in the Earth's crust.

..... [1]

- (b) Fig. 7.2 shows a diagram of an ion of element E.

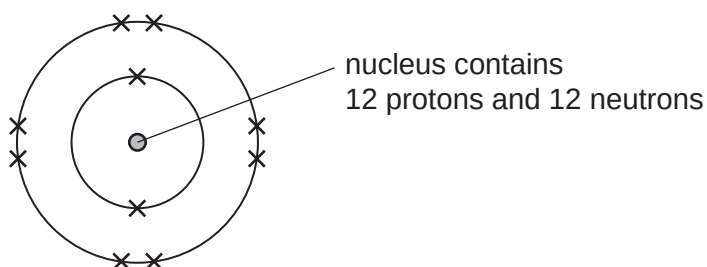


Fig. 7.2

- (i) Name element E and explain how the diagram shows that the ion has a positive electrical charge.

name of element E

.....
.....

..... [3]

- (ii) Name the noble gas whose **atoms** have the same number of electrons as shown in Fig. 7.2

..... [1]

- (iii) Explain, in terms of electron configuration, why the atoms of all the noble gases are unreactive.

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

- (c) Fig. 7.3 shows a simplified diagram of a process which could be used to produce the reactive metal, sodium.

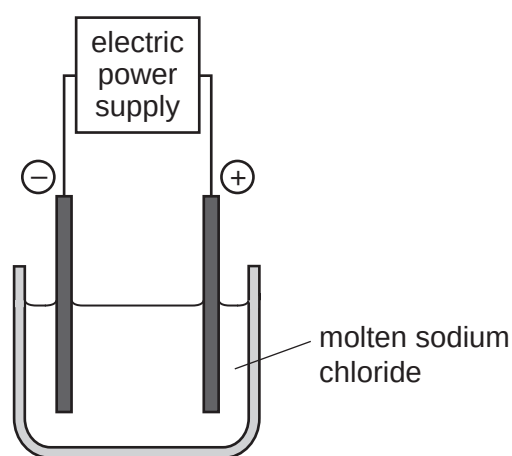


Fig. 7.3

- (i) Name the process shown in Fig. 7.3.

..... [1]

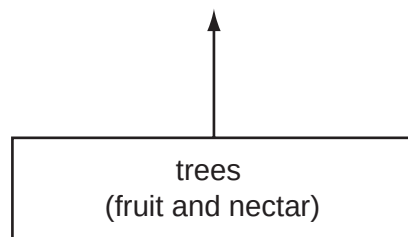
- (ii) Name the element which forms at the anode.

..... [1]

- 8 The golden lion tamarin is a species of monkey that lives in forests in Brazil. It includes fruits and nectar from trees. Its predators include snakes, bamboo rats and owls.



- (a) (i) In the space below, complete the food web, using the information above.



[3]

- (ii) On your food web, draw a circle around the producer.

[1]

- (b) The nectar that the monkeys eat is made by flowers that grow on some of the trees in the forests. The fruits that the monkeys eat develop from the flowers.

Fig. 8.1 shows a section through a flower.

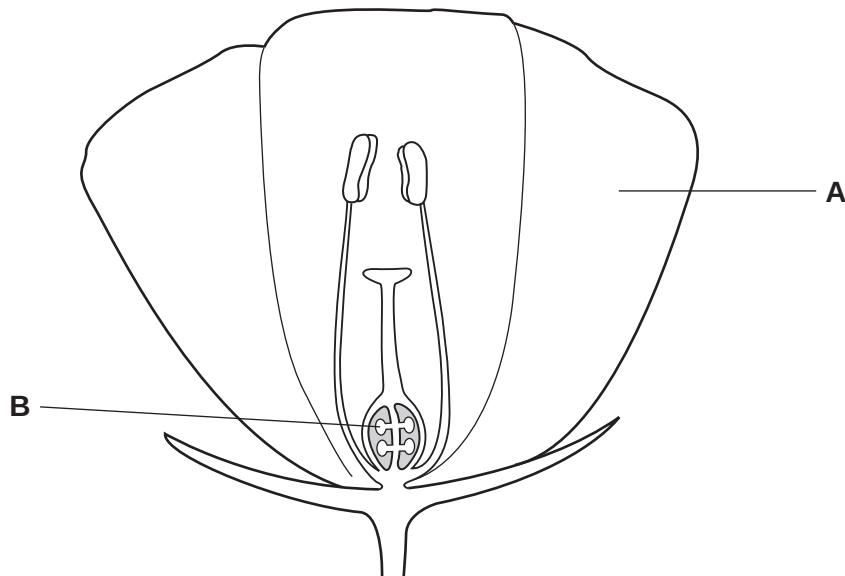


Fig. 8.1

- (i) Name the parts labelled **A** and **B**.

A

B [2]

- (ii) On Fig. 8.1, label the part that produces pollen, using a label line and the letter **P**. [1]

- (iii) On Fig. 8.1, label the part that will develop into a fruit, using a label line and the letter **F**. [1]

- (iv) Explain why the flower produces nectar.

.....

 [2]

- 9 (a) Fig. 9.1 shows the circuit diagram of a circuit which a student set up. He measured the current passing through the 2Ω resistor. The ammeter reading was 6 A.

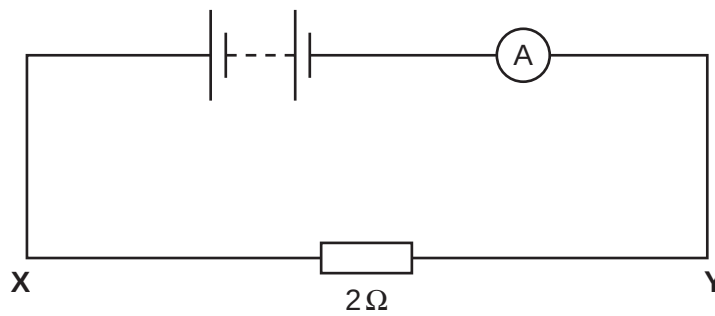


Fig. 9.1

- (i) Show that the voltage across the resistor was 12 V.

State the formula that you use and show your working.

formula used

working

[2]

- (ii) A 4Ω resistor is placed in series with the 2Ω resistor between X and Y.

Calculate the total resistance between X and Y.

State the formula that you use and show your working.

formula used

working

..... Ω [2]

- (b) Many countries are seeking alternatives to fossil fuels as energy sources for generating electricity.

Explain why it is necessary to find alternative energy sources for generating electricity.

.....

.....

.....

..... [2]

DATA SHEET
The Periodic Table of the Elements

Group																			
I	II							III	IV	V	VI	VII	0						
		1 H Hydrogen												4 He Helium					
7 Li Lithium	9 Be Beryllium													11 B Boron	12 C Carbon	14 N Nitrogen	16 O Oxygen	19 F Fluorine	20 Ne Neon
23 Na Sodium	24 Mg Magnesium													27 Al Aluminium	28 Si Silicon	31 P Phosphorus	32 S Sulfur	35.5 Cl Chlorine	40 Ar Argon
39 K Potassium	40 Ca Calcium	45 Sc Scandium	48 Ti Titanium	51 V Vanadium	52 Cr Chromium	55 Mn Manganese	56 Fe Iron	59 Co Cobalt	59 Ni Nickel	64 Cu Copper	65 Zn Zinc	70 Ga Gallium	73 Ge Germanium	75 As Arsenic	79 Se Selenium	80 Br Bromine	84 Kr Krypton		
85 Rb Rubidium	88 Sr Strontium	89 Y Yttrium	91 Zr Zirconium	93 Nb Niobium	96 Mo Molybdenum	101 Ru Ruthenium	101 Rh Rhodium	103 Pd Palladium	106 Ag Silver	108 Cd Cadmium	112 In Indium	115 Sn Tin	119 Sb Antimony	122 Te Tellurium	127 I Iodine	131 Xe Xenon	137 Cs Caesium		
133 Fr Francium	137 Ba Barium	139 La Lanthanum	178 Hf Hafnium	181 Ta Tantalum	184 W Tungsten	186 Re Rhenium	190 Os Osmium	192 Ir Iridium	195 Pt Platinum	197 Au Gold	201 Hg Mercury	204 Tl Thallium	207 Pb Lead	209 Bi Bismuth	210 Po Polonium	210 At Astatine	222 Rn Radon		
226 Fr Francium	226 Ra Radium	227 Ac Actinium																	
58-71 Lanthanoid series																			
90-103 Actinoid series																			
a = relative atomic mass																			
X = atomic symbol																			
b = proton (atomic) number																			
Key	X																		
	a																		
	b																		

Key

a	X	b
---	---	---

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

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



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Answer **all** questions.

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

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The number of marks is given in brackets [] at the end of each question or part question.

For Examiner's Use	
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Total	

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



- 1 Coral reefs are found in shallow seawater. Limestone is a common type of rock found in Earth's crust. Both coral reefs and limestone are made mainly of the ionic compound calcium carbonate.

(a) A student used the apparatus shown in Fig. 1.1 to test a rock sample to discover whether or not it is limestone.

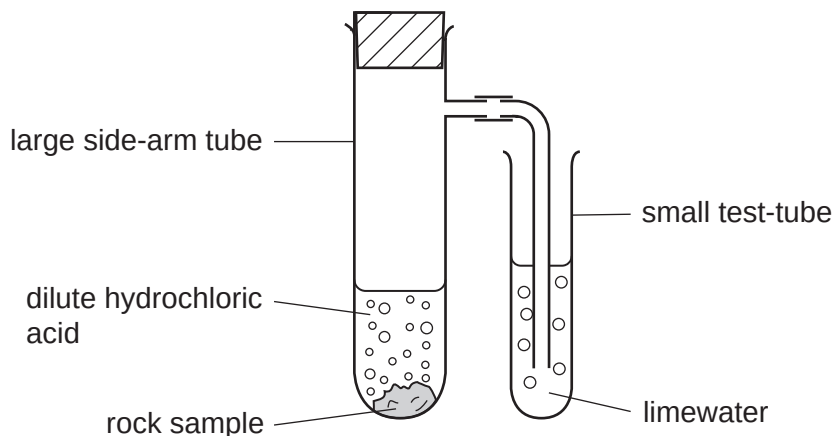


Fig. 1.1

The student observed that a gas was given off and that the limewater in the small test-tube became cloudy.

(i) Name the gas that was given off. [1]

(ii) State the chemical formula of hydrochloric acid.
..... [1]

(iii) After some time, the student observed that the gas stopped forming, but a small piece of the rock sample remained in the large side-arm tube.

Explain why gas stopped forming.

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

(iv) The student carried out a flame test on the solution that remained in the large side-arm tube. This test produced an orange-red colour.

Name the element that this observation suggests is contained in the rock sample.

..... [1]

- (b) In recent years, the amount of carbon dioxide dissolving in seawater has increased.

During this period, many coral reefs have become weakened and damaged.

- (i) State and explain briefly how an increase in carbon dioxide concentration will affect the pH of seawater.

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

- (ii) Suggest a reason why an increase in carbon dioxide concentration might be responsible for damage to coral reefs.

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

- 2 (a) Fig. 2.1 shows the horizontal forces acting on an aircraft moving along the runway. These forces are balanced.

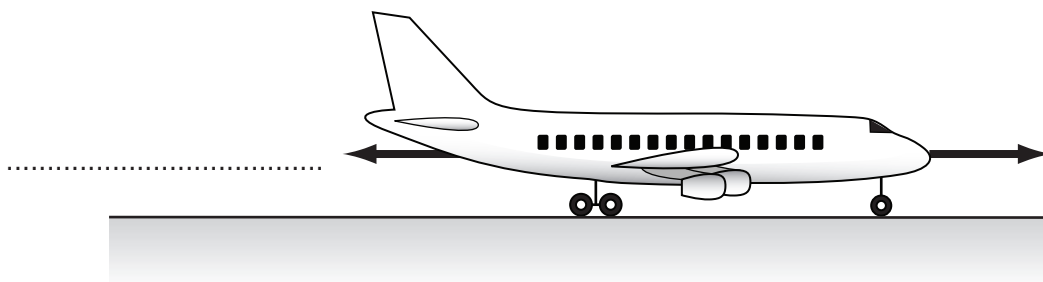


Fig. 2.1

- (i) The arrow to the right represents the driving force produced by the engines.

On the diagram, name the other force.

[1]

- (ii) Explain what is meant by the phrase *forces are balanced*.

.....
 [1]

- (iii) Describe the movement of the aircraft when these forces are balanced.

.....
 [1]

- (b) In the air, the aircraft travels at 80 m/s for one hour.

Calculate the distance travelled.

State the formula that you use and show your working.

formula used

working

..... m [2]

- (c) People who fly frequently have greater exposure to ionising radiation than those who do not fly.

(i) Explain why exposure to ionising radiation may be harmful.

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

- (ii) This ionising radiation is cosmic radiation from outer space. This is one source of background radiation.

State **one** other natural source of background radiation.

..... [1]

- (d) The aircraft is able to navigate using radar. This involves using microwaves. These are part of the electromagnetic spectrum.

Name **one** other wave which is part of the electromagnetic spectrum and give a use for this radiation.

name

use [2]

- 3 (a) Complete the word equation for aerobic respiration.

oxygen + ... $\longrightarrow$ + ... [2]

- (b) Describe how oxygen is transported from the lungs to a cell in a human muscle.

.....

 [2]

- (c) An athlete ran on a treadmill at a slow speed for 5 minutes. She then ran on the same treadmill at a faster speed for 5 minutes.

Fig. 3.1 shows the volume of oxygen she used per minute during both runs.

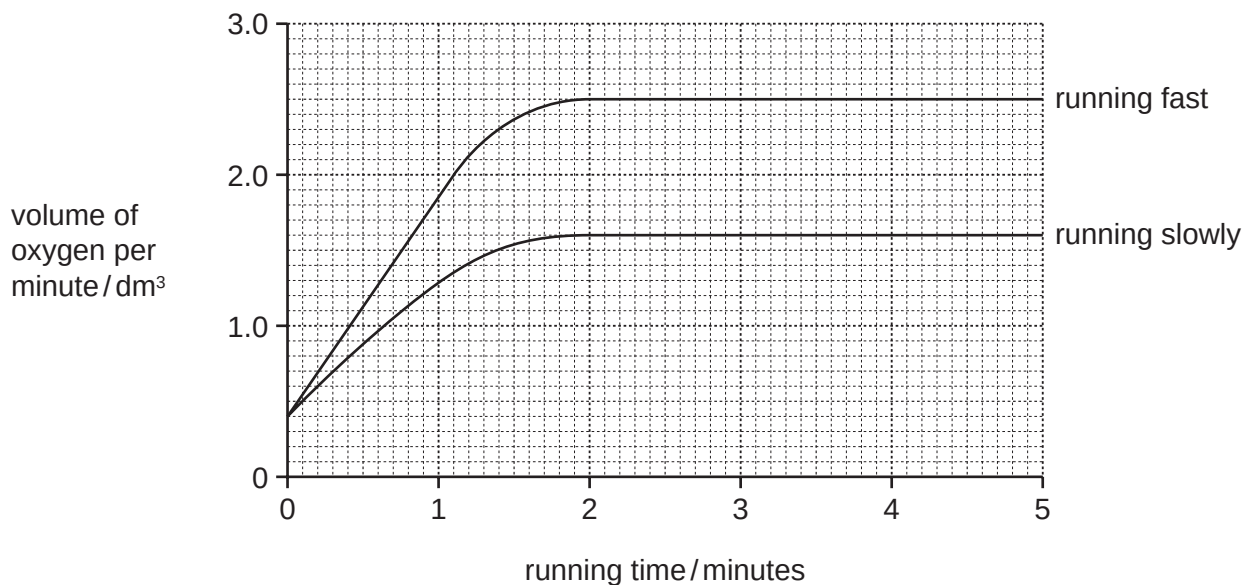


Fig. 3.1

- (i) State the volume of oxygen used per minute by the athlete before she began to run.

..... dm³ [1]

- (ii) Describe how the volume of oxygen used per minute during the fast run differs from the slow run.

.....

 [2]

- (iii) Suggest an explanation for the differences you have described in (ii).

.....

.....

..... [2]

- (d) Professional athletes do not smoke cigarettes because smoking can cause emphysema. This reduces the ability of oxygen to diffuse into the blood from the lungs.

Explain what is meant by *emphysema*.

.....

..... [1]

- 4 Fig. 4.1 shows an electric hairdryer.

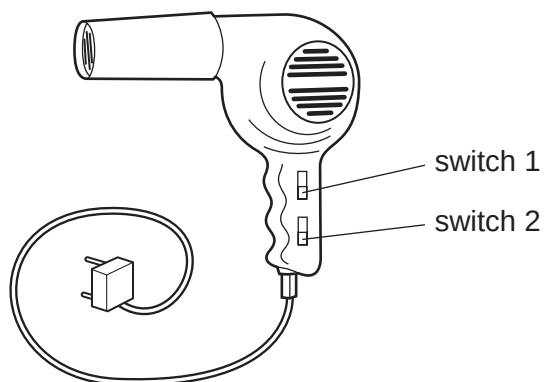


Fig. 4.1

- (a) Fig. 4.2 shows the circuit diagram for the hairdryer.

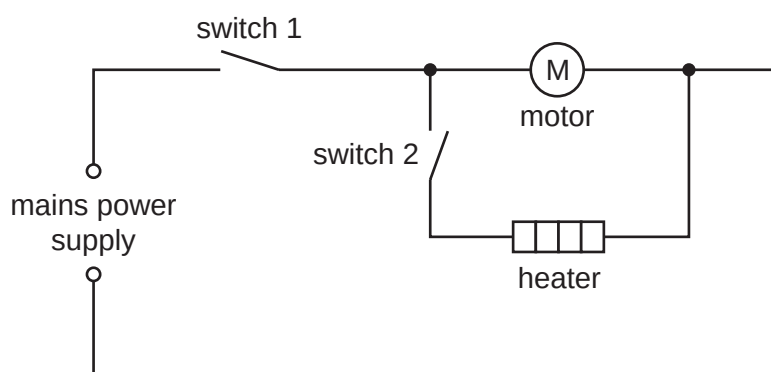


Fig. 4.2

- (i) State which of the switches must be closed (on) for the heater in the hairdryer to work.

..... [1]

- (ii) A student wanted to determine the resistance of the heater.

Fig. 4.3 shows the circuit he built to measure the current passing through the heater and the potential difference across the heater.

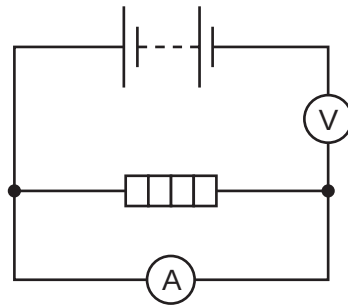


Fig. 4.3

His experiment did not work because his circuit was incorrect.

Draw the correct circuit in the space below.

[2]

- (b) The electricity used in the hairdryer was generated at a power station.

- (i) Name a fossil fuel that can be used in power stations.

..... [1]

- (ii) Power is transmitted from the power station over large distances.

A high voltage is always used. Explain why.

.....

..... [1]

The high voltage is produced by a transformer.

Fig. 4.4 shows a simple transformer.

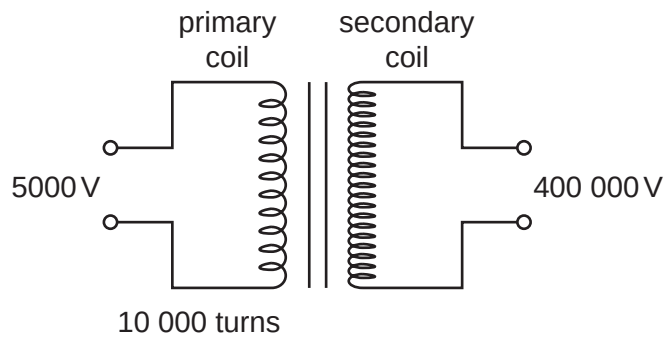


Fig. 4.4

(iii) Use the equation

$$V_p/V_s = N_p/N_s$$

to calculate the number of turns in the secondary coil.

Show your working.

number of turns = ... [1]

(iv) Transformers are also used between power lines and people's houses.

Explain why.

.....

 [2]

5 Fig. 5.1 shows a section through a flower.

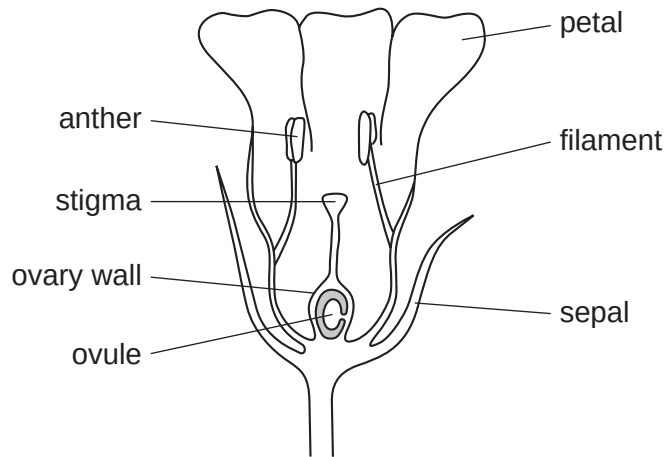


Fig. 5.1

(a) (i) State the function of each of the following parts of the flower.

petal
anther [2]

(ii) Name the part of the flower that

develops into a seed, ...
develops into a fruit. [2]

(b) Flowers are involved in sexual reproduction.

Complete the table to show whether each statement is true for asexual reproduction, sexual reproduction, both or neither.

Use a tick (✓) for a correct statement and a cross (✗) for an incorrect statement. You must write either a tick or cross in each space in the table.

The first statement has been completed for you.

statement	asexual reproduction	sexual reproduction
gametes are involved	✗	✓
new individuals are produced		
a zygote is produced		
offspring are always genetically identical		

- 6 Nordic gold is an alloy of four metals used to make coins.



Table 6.1 shows information about the metals contained in Nordic gold.

Table 6.1

metal	% by mass in Nordic gold	compound from which the metal is extracted
aluminium	5	Al_2O_3
copper		CuFeS_2
tin	1	SnO_2
zinc	5	ZnS

- (a) (i) Complete Table 6.1 by stating the percentage of copper in Nordic gold. [1]

- (ii) Suggest how Nordic gold could be made.

..... [1]

- (iii) In the right hand column, the elements present in compounds can be identified by their symbols.

Name a metallic element present in one of the compounds in Table 6.1 which is **not** present in Nordic gold.

..... [1]

- (iv) Suggest **two** properties of Nordic gold, other than its appearance, that make it a suitable material from which to make coins.

1

2 [2]

- (b) (i) Tin may be extracted from tin oxide by heating a mixture of tin oxide and carbon. The other product of this reaction is carbon monoxide.

Write a **word** chemical equation for this reaction.

..... [1]

- (ii) State and explain which substance is **oxidised** when tin is extracted from tin(IV) oxide.
substance which is oxidised
explanation
..... [2]

- (c) (i) Aluminium is extracted from the ionic compound aluminium oxide by electrolysis.
Explain the meanings of the following terms that are important in electrolysis.
cathode
electrolyte
..... [3]

- (ii) State how the position of aluminium in the Periodic Table shows that aluminium atoms have three electrons in their outer shell.
.....
..... [1]

- 7 (a) Fig. 7.1 shows a mother pushing her child in a baby buggy. She uses a force of 100 N.



Fig. 7.1

The baby buggy is pushed 2000 m.

Calculate how much work has been done.

State the formula that you use and show your working.

formula used

working

..... J [2]

- (b) A child is playing on a swing. This is shown in Fig. 7.2.

At the top of the oscillation, the child and swing are momentarily at rest.

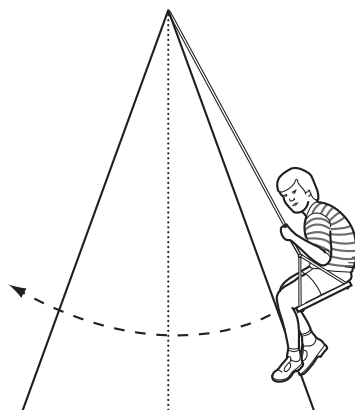


Fig. 7.2

- (i) Write the correct energy type in the space to complete the box.

gravitational potential energy at the top of the oscillation	=	gravitational potential energy at the bottom of the oscillation	+	 energy at the bottom of the oscillation	+	energy losses
---	---	--	---	--	---	---------------

[1]

- (ii) Suggest a form of energy which is lost from the system.

..... [1]

- (iii) Suggest where the lost energy goes.

..... [1]

- (c) The child weighs 400 N.

The Earth's gravitational field strength is 10 N/kg.

- (i) State the mass of the child.

..... kg [2]

- (ii) The average density of the human body is 1020 kg/m^3 .

Calculate the volume of the child.

State the formula that you use and show your working.

formula used

working

..... m^3 [1]

- 8 Fig. 8.1 shows a tree frog that lives in a tropical rain forest.

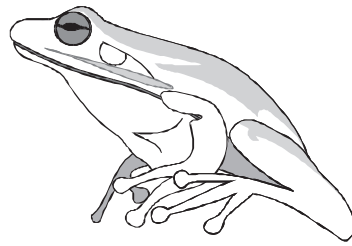


Fig. 8.1

- (a) Tree frogs feed on insects. Enzymes in their alimentary canal break down large molecules in the insects into small ones.

(i) State the correct biological term for this process. [1]

(ii) Explain why this process is necessary for the frog's survival.

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

(iii) Use words from the list to complete the sentences about enzymes.

carbohydrates

cells

denatured

dissolved

hydrogen

killed

oxygen

proteins

Enzymes are that catalyse chemical reactions
in living organisms. One example of an enzyme is catalase, which breaks down
hydrogen peroxide to water and Enzymes
are by high temperatures. [3]

- (b) Tropical rain forests have a high species diversity.

(i) Explain what is meant by *species diversity*.

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

- (ii) Many species of tree frog have become extinct in the last ten years.

Suggest how the loss of tree frogs from the rain forest could damage the ecosystem.

.....

.....

.....

..... [2]

9 Hydrocarbons are compounds which contain only the elements hydrogen and carbon.

(a) The simplest hydrocarbon is methane, which is an important fuel.

(i) State **one** natural source of methane.

..... [1]

(ii) Complete the displayed (graphical) formula of a methane molecule.



[2]

(iii) Carbon dioxide and carbon monoxide are compounds released into the atmosphere when methane burns.

Describe **one** environmental disadvantage of each compound.

carbon dioxide

.....

carbon monoxide

.....

[3]

- (b) Table 9.1 shows the molecular formulae and boiling points of four hydrocarbons.

Table 9.1

molecular formula	boiling point/°C
C_6H_{14}	69
$C_{10}H_{22}$	174
$C_{12}H_{26}$	216
C_5H_{12}	36

- (i) Name a process which could be used to separate a mixture of the compounds in Table 9.1.

..... [1]

- (ii) Use the information in Table 9.1 to describe how the boiling point of a hydrocarbon is affected by the mass of its molecules.

.....

 [2]

Group

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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NUMBER

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COMBINED SCIENCE

0653/23

Paper 2 (Core)

October/November 2011

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 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 **21** printed pages and **3** blank pages.



- 1 Coral reefs are found in shallow seawater. Limestone is a common type of rock found in Earth's crust. Both coral reefs and limestone are made mainly of the ionic compound calcium carbonate.

(a) A student used the apparatus shown in Fig. 1.1 to test a rock sample to discover whether or not it is limestone.

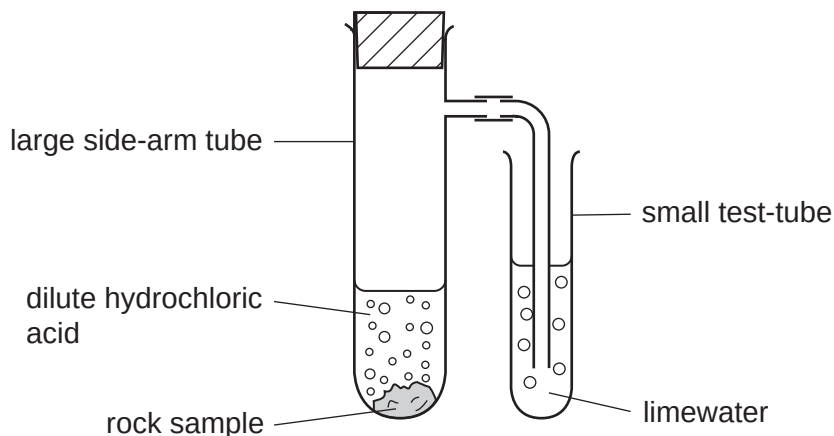


Fig. 1.1

The student observed that a gas was given off and that the limewater in the small test-tube became cloudy.

(i) Name the gas that was given off. [1]

(ii) State the chemical formula of hydrochloric acid.
..... [1]

(iii) After some time, the student observed that the gas stopped forming, but a small piece of the rock sample remained in the large side-arm tube.

Explain why gas stopped forming.

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

(iv) The student carried out a flame test on the solution that remained in the large side-arm tube. This test produced an orange-red colour.

Name the element that this observation suggests is contained in the rock sample.

..... [1]

- (b) In recent years, the amount of carbon dioxide dissolving in seawater has increased.

During this period, many coral reefs have become weakened and damaged.

- (i) State and explain briefly how an increase in carbon dioxide concentration will affect the pH of seawater.

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

- (ii) Suggest a reason why an increase in carbon dioxide concentration might be responsible for damage to coral reefs.

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

- 2 (a) Fig. 2.1 shows the horizontal forces acting on an aircraft moving along the runway. These forces are balanced.

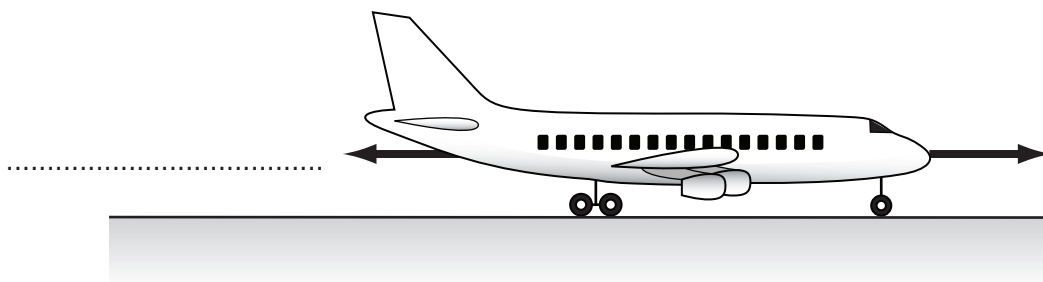


Fig. 2.1

- (i) The arrow to the right represents the driving force produced by the engines.

On the diagram, name the other force.

[1]

- (ii) Explain what is meant by the phrase *forces are balanced*.

.....
 [1]

- (iii) Describe the movement of the aircraft when these forces are balanced.

.....
 [1]

- (b) In the air, the aircraft travels at 80 m/s for one hour.

Calculate the distance travelled.

State the formula that you use and show your working.

formula used

working

..... m [2]

- (c) People who fly frequently have greater exposure to ionising radiation than those who do not fly.

(i) Explain why exposure to ionising radiation may be harmful.

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

- (ii) This ionising radiation is cosmic radiation from outer space. This is one source of background radiation.

State **one** other natural source of background radiation.

..... [1]

- (d) The aircraft is able to navigate using radar. This involves using microwaves. These are part of the electromagnetic spectrum.

Name **one** other wave which is part of the electromagnetic spectrum and give a use for this radiation.

name

use [2]

- 3 (a) Complete the word equation for aerobic respiration.

oxygen + ... $\longrightarrow$ + ... [2]

- (b) Describe how oxygen is transported from the lungs to a cell in a human muscle.

.....

 [2]

- (c) An athlete ran on a treadmill at a slow speed for 5 minutes. She then ran on the same treadmill at a faster speed for 5 minutes.

Fig. 3.1 shows the volume of oxygen she used per minute during both runs.

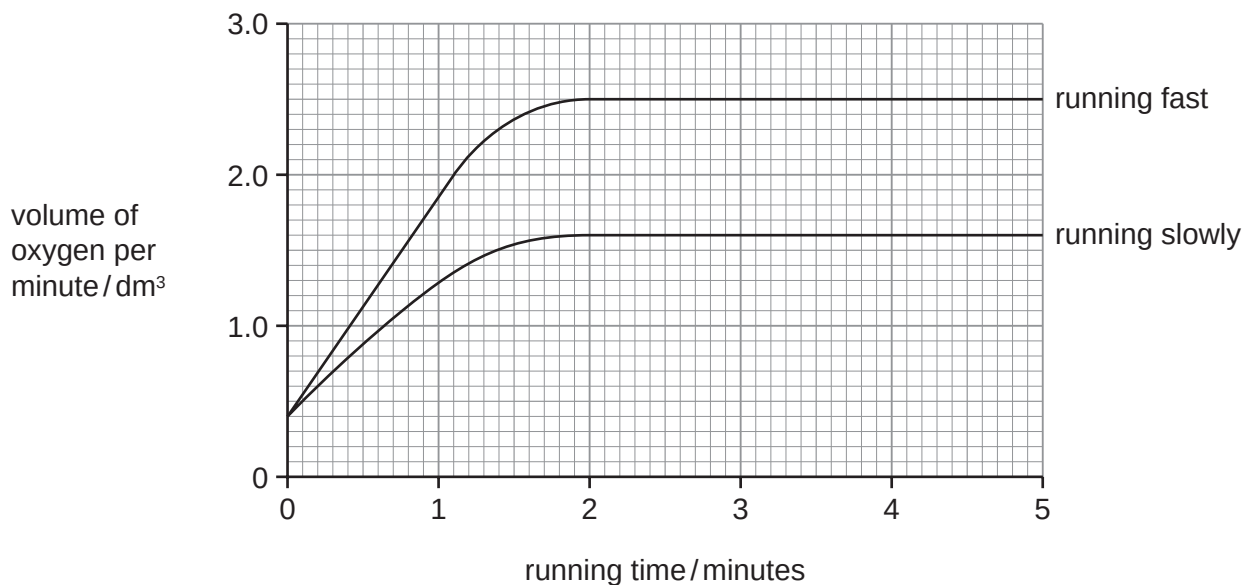


Fig. 3.1

- (i) State the volume of oxygen used per minute by the athlete before she began to run.

..... dm³ [1]

- (ii) Describe how the volume of oxygen used per minute during the fast run differs from the slow run.

.....

 [2]

- (iii) Suggest an explanation for the differences you have described in (ii).

.....

.....

..... [2]

- (d) Professional athletes do not smoke cigarettes because smoking can cause emphysema. This reduces the ability of oxygen to diffuse into the blood from the lungs.

Explain what is meant by *emphysema*.

.....

..... [1]

- 4 Fig. 4.1 shows an electric hairdryer.

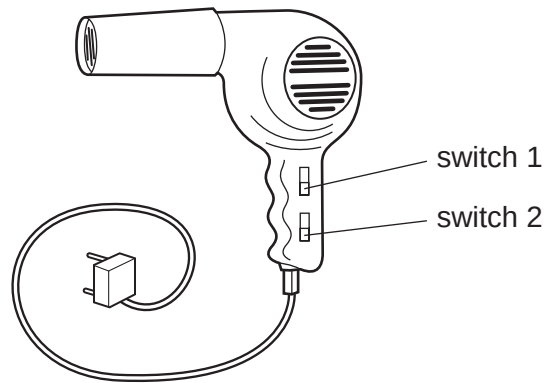


Fig. 4.1

- (a) Fig. 4.2 shows the circuit diagram for the hairdryer.

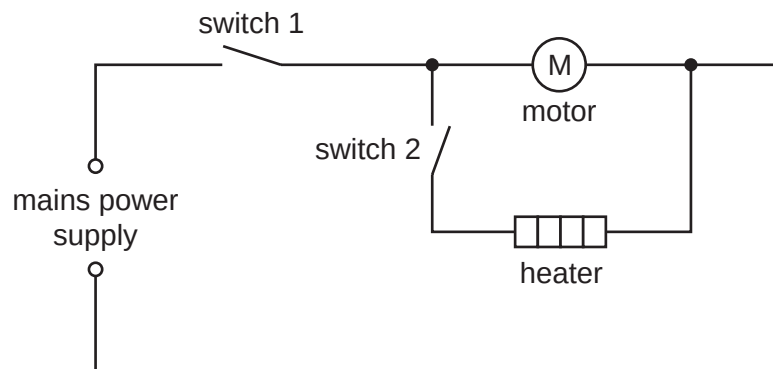


Fig. 4.2

- (i) State which of the switches must be closed (on) for the heater in the hairdryer to work.

..... [1]

- (ii) A student wanted to determine the resistance of the heater.

Fig. 4.3 shows the circuit he built to measure the current passing through the heater and the potential difference across the heater.

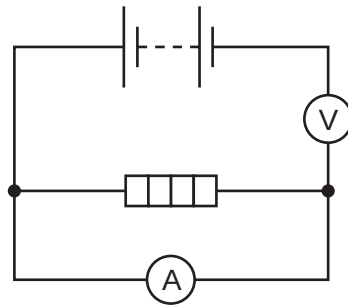


Fig. 4.3

His experiment did not work because his circuit was incorrect.

Draw the correct circuit in the space below.

[2]

- (b) The electricity used in the hairdryer was generated at a power station.

- (i) Name a fossil fuel that can be used in power stations.

..... [1]

- (ii) Power is transmitted from the power station over large distances.

A high voltage is always used. Explain why.

.....

..... [1]

The high voltage is produced by a transformer.

Fig. 4.4 shows a simple transformer.

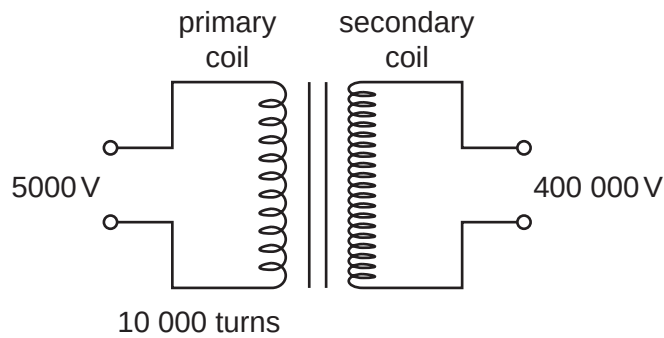


Fig. 4.4

- (iii) Use the equation

$$V_p/V_s = N_p/N_s$$

to calculate the number of turns in the secondary coil.

Show your working.

number of turns = ... [1]

- (iv) Transformers are also used between power lines and people's houses.

Explain why.

.....

 [2]

5 Fig. 5.1 shows a section through a flower.

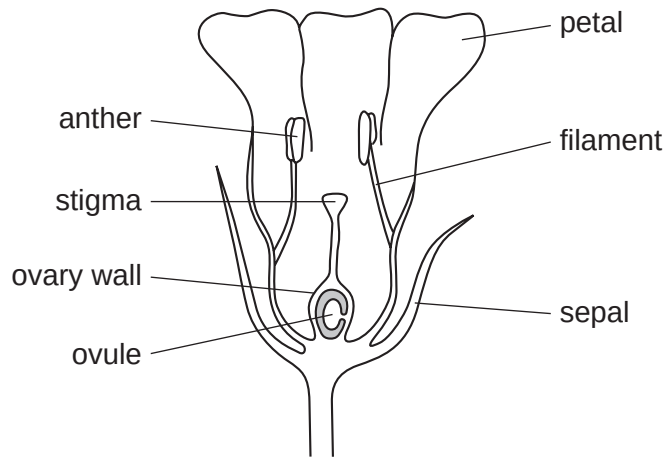


Fig. 5.1

(a) (i) State the function of each of the following parts of the flower.

petal
anther [2]

(ii) Name the part of the flower that

develops into a seed, ...
develops into a fruit. [2]

(b) Flowers are involved in sexual reproduction.

Complete the table to show whether each statement is true for asexual reproduction, sexual reproduction, both or neither.

Use a tick (✓) for a correct statement and a cross (✗) for an incorrect statement. You must write either a tick or cross in each space in the table.

The first statement has been completed for you.

statement	asexual reproduction	sexual reproduction
gametes are involved	✗	✓
new individuals are produced		
a zygote is produced		
offspring are always genetically identical		

- 6 Nordic gold is an alloy of four metals used to make coins.



Table 6.1 shows information about the metals contained in Nordic gold.

Table 6.1

metal	% by mass in Nordic gold	compound from which the metal is extracted
aluminium	5	Al_2O_3
copper		CuFeS_2
tin	1	SnO_2
zinc	5	ZnS

- (a) (i) Complete Table 6.1 by stating the percentage of copper in Nordic gold. [1]

- (ii) Suggest how Nordic gold could be made.

..... [1]

- (iii) In the right hand column, the elements present in compounds can be identified by their symbols.

Name a metallic element present in one of the compounds in Table 6.1 which is **not** present in Nordic gold.

..... [1]

- (iv) Suggest **two** properties of Nordic gold, other than its appearance, that make it a suitable material from which to make coins.

1

2 [2]

- (b) (i) Tin may be extracted from tin oxide by heating a mixture of tin oxide and carbon. The other product of this reaction is carbon monoxide.

Write a **word** chemical equation for this reaction.

..... [1]

- (ii) State and explain which substance is **oxidised** when tin is extracted from tin(IV) oxide.
substance which is oxidised
explanation [2]

- (c) (i) Aluminium is extracted from the ionic compound aluminium oxide by electrolysis.
Explain the meanings of the following terms that are important in electrolysis.
cathode
electrolyte [3]

- (ii) State how the position of aluminium in the Periodic Table shows that aluminium atoms have three electrons in their outer shell.
.....
..... [1]

- 7 (a) Fig. 7.1 shows a mother pushing her child in a baby buggy. She uses a force of 100 N.



Fig. 7.1

The baby buggy is pushed 2000 m.

Calculate how much work has been done.

State the formula that you use and show your working.

formula used

working

..... J [2]

- (b) A child is playing on a swing. This is shown in Fig. 7.2.

At the top of the oscillation, the child and swing are momentarily at rest.

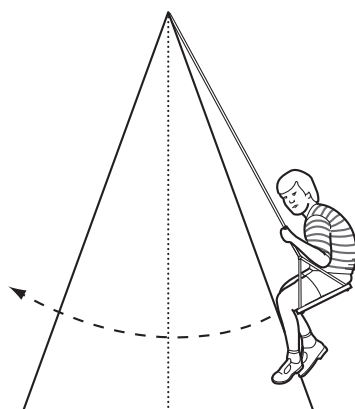


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---	---	--	---	--	---	---------------

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The Earth's gravitational field strength is 10 N/kg.

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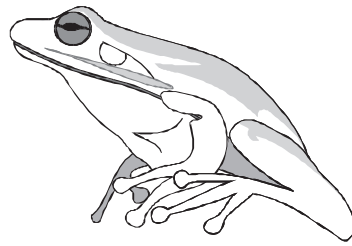


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dissolved

hydrogen

killed

oxygen

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.....

.....

.....

..... [2]

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[2]

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.....

.....

carbon monoxide

.....

.....

[3]

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..... [1]

- (ii) Use the information in Table 9.1 to describe how the boiling point of a hydrocarbon is affected by the mass of its molecules.

.....

 [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																	4 He Helium 2					
23 Na Sodium 11	24 Mg Magnesium 12																	19 F Fluorine 9					
																		20 Ne Neon 10					
																		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	101 Ru Ruthenium 44	101 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	127 Te Tellurium 52	128 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		At Astatine 85	Rn Radon 86						
Fr Francium 87	226 Ra Radium 88	227 Ac Actinium 89																					
58-71 Lanthanoid series																							
90-103 Actinoid series																							
158-171 Lanthanoid series																							
172-103 Actinoid series																							
175 Lu Lutetium 71																							
173 Yb Ytterbium 70																							
169 Tm Thulium 69																							
167 Er Erbium 68																							
165 Ho Holmium 67																							
162 Dy Dysprosium 66																							
159 Tb Terbium 65																							
157 Gd Gadolinium 64																							
152 Eu Europium 63																							
150 Sm Samarium 62																							
144 Nd Neodymium 60																							
141 Pr Praseodymium 59																							
140 Ce Cerium 58																							
238 U Uranium 92																							
238 Pa Protactinium 91																							
232 Th Thorium 90																							
232 Np Neptunium 93																							
238 Pu Plutonium 94																							
238 Am Americium 95																							
238 Cm Curium 96																							
238 Bk Berkelium 97																							
238 Cf Californium 98																							
238 Es Einsteinium 99																							
238 Fm Fermium 100																							
238 Md Mendelevium 101																							
238 No Nobelium 102																							
238 Lr Lawrencium 103																							

a

X

a = relative atomic mass

X = atomic symbol

b = proton (atomic) number

Key

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

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