



UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS
International General Certificate of Secondary Education

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CANDIDATE
NAME

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NUMBER

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COMBINED SCIENCE

0653/31

Paper 3 (Extended)

October/November 2010

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	
3	
4	
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7	
8	
9	
Total	

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



- 1 Fig. 1.1 shows a rock that is falling from the top of a cliff into the river below.

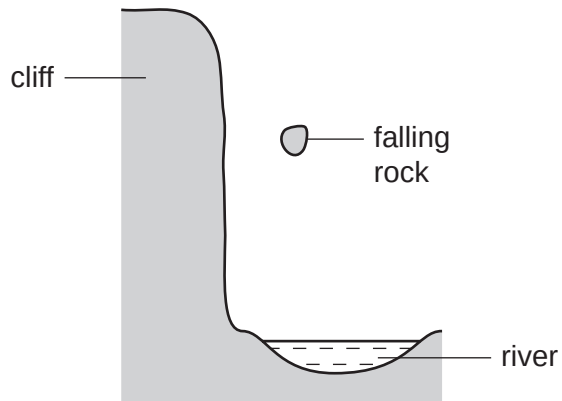


Fig. 1.1

- (a) The rock accelerates downwards at 10 m/s^2 . The mass of the rock is 4 kg .

Calculate the force pulling the rock downwards.

State the formula that you use and show your working.

formula used

working

..... [2]

- (b) Fig. 1.2 is speed-time graph for the motion of the rock. This graph ignores the effects of air resistance on the rock.

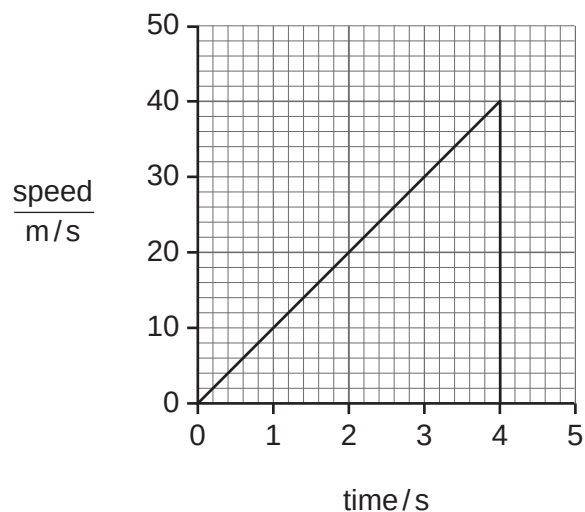


Fig. 1.2

Calculate the height of the cliff.

Show your working.

..... [2]

(c) The rock has an irregular shape.

Describe how you could find the density of an irregularly shaped object such as a rock. You should state the apparatus you would use and the measurements you would need to make.

.....

 [4]

(d) The rock contains radioactive substances emitting high levels of ionising radiation.

(i) State how the radioactivity could be detected.

..... [1]

(ii) Explain why it would be dangerous for a person to handle this rock without proper protection.

.....
 [1]

2 The gray wolf is a predator that lives in North America.

(a) In Wisconsin, Canada, the wolves' diet consists mainly of white-tailed deer, beaver and snowshoe hares. These all eat plants.

(i) Construct a food web including all the organisms mentioned above.

[3]

(ii) State what the arrows in your food web represent.

[1]

(iii) With reference to your answers to (i) and (ii), suggest why wolves are rarer than white-tailed deer.

[2]

- (b) People used to shoot gray wolves, because the wolves kill sheep on farms and that people like to hunt.

In 1978, a conservation programme for gray wolves began in Wisconsin and people were no longer allowed to shoot them.

Some people in Wisconsin are opposed to the wolf conservation programme.

Discuss the arguments for and against conserving the gray wolf.

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..... [3]

- 3 (a) Copper metal reacts with oxygen gas to form copper oxide. Table 3.1 information about two different types of copper oxide.

Table 3.1

name	colour	chemical formula
copper(II) oxide	black	CuO
copper(I) oxide	red	Cu ₂ O

- (i) Copper is a transition metal.

State **one** property, shown in Table 3.1, which is typical of transition metals.

..... [1]

- (ii) The formula of the oxide ion is O²⁻.

Use the formula of copper(I) oxide to deduce the charge on the copper ion in this compound.

Show your working.

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

(b) Fig. 3.1 shows apparatus used in the electrolysis of copper chloride solution.

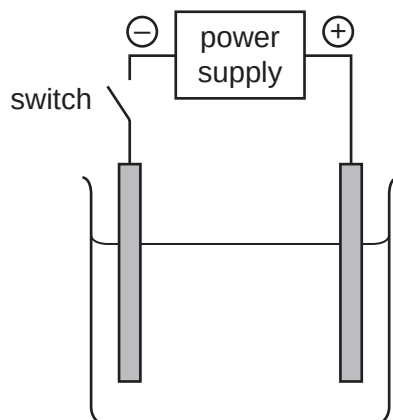


Fig. 3.1

(i) On the diagram, label clearly the **anode** and the **electrolyte**. [2]

(ii) Copper chloride solution contains copper ions and chloride ions.

When the switch in Fig. 3.1 is closed, bubbles of chlorine gas form at the anode and copper metal forms at the cathode.

Explain these observations in terms of ions, electrons and atoms.

.....

.....

.....

.....

.....

..... [4]

- 4 (a) Fig. 4.1 shows a ray of light hitting a mirror. The angle of incidence is 50° .

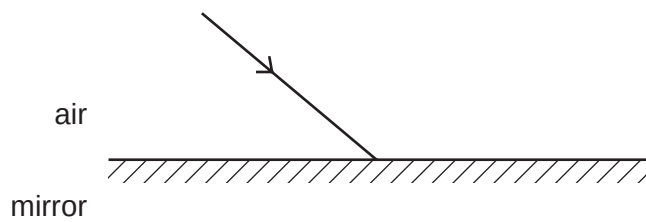
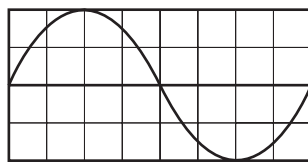


Fig. 4.1

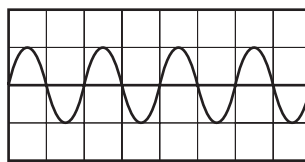
On Fig. 4.1

- (i) use a ruler to draw and label the reflected ray, [1]
- (ii) use a ruler to draw and label the normal, [1]
- (iii) label the angle of incidence. [1]

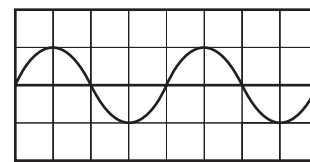
- (b) Fig. 4.2 shows the wave traces made by three sounds.



trace A



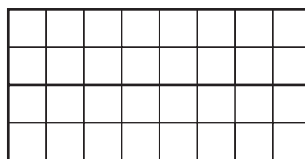
trace B



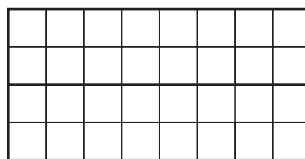
trace C

Fig. 4.2

- (i) On the grid below, draw the trace of a sound wave which has twice the frequency of trace A. [1]



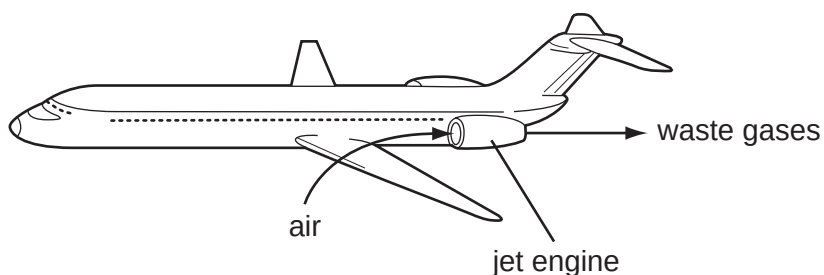
- (ii) On the grid below, draw the trace of a sound wave which has half the amplitude of trace A. [1]



- (iii) Which two traces in Fig. 4.2 show sounds with the same loudness? [1]

..... [1]

- 5 In jet engines, hydrocarbon molecules from the jet fuel mix with air and burn. This releases a large amount of energy and produces a mixture of waste gases. These waste gases pass out through the back of the jet engine into the atmosphere.



- (a) Fig. 5.1 shows a molecule of octane, which is a typical hydrocarbon molecule in jet fuel.

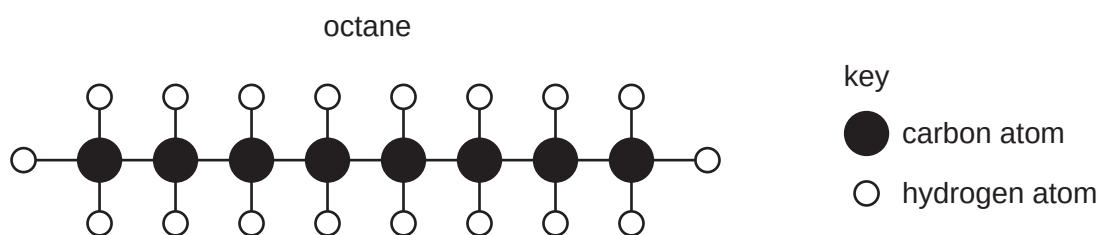
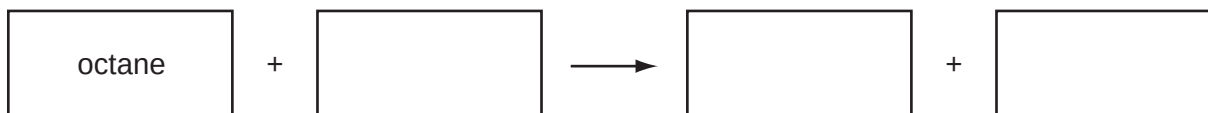


Fig. 5.1

- (i) State the chemical formula of octane.

..... [1]

- (ii) Complete the word equation below for the complete combustion of octane.



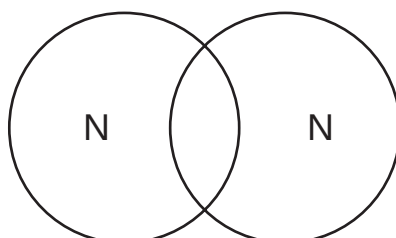
[2]

- (b) Air contains the element nitrogen, N_2 .

- (i) State the number of outer electrons in a single nitrogen atom.

..... [1]

- (ii) Complete the bonding diagram below to show how the outer electrons are arranged around the atoms in a nitrogen molecule.



[2]

(c) Table 5.1 shows information about some metallic materials.

Table 5.1

material	strength	density
mild steel	very high	very high
aluminium	low	low
duralumin (an aluminium alloy)	very high	low

Duralumin is used in the manufacture of aircraft.

Explain why the properties of this material make it suitable for this purpose.

.....

.....

.....

.....

.....

[2]

6 Fig. 6.1 shows a generalised reflex arc.

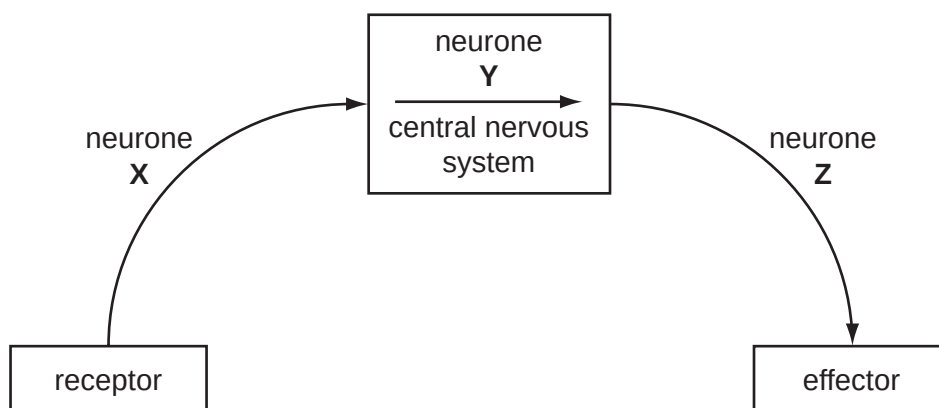


Fig. 6.1

(a) Name the neurones labelled **X**, **Y** and **Z**.

X

Y

Z [3]

(b) A student hears a sudden, loud bang. Receptors in his ear respond to the sound by generating electrical impulses in neurone **X**. These impulses travel along the reflex arc, eventually reaching an effector.

Suggest what the effector could be in this reflex, and how it would respond.

effector

response [2]

(c) Another reflex action involves the secretion of saliva into the mouth, in response to the smell of food. Saliva contains the enzyme amylase.

(i) Describe the role of amylase in the digestion of food.

.....

.....

..... [2]

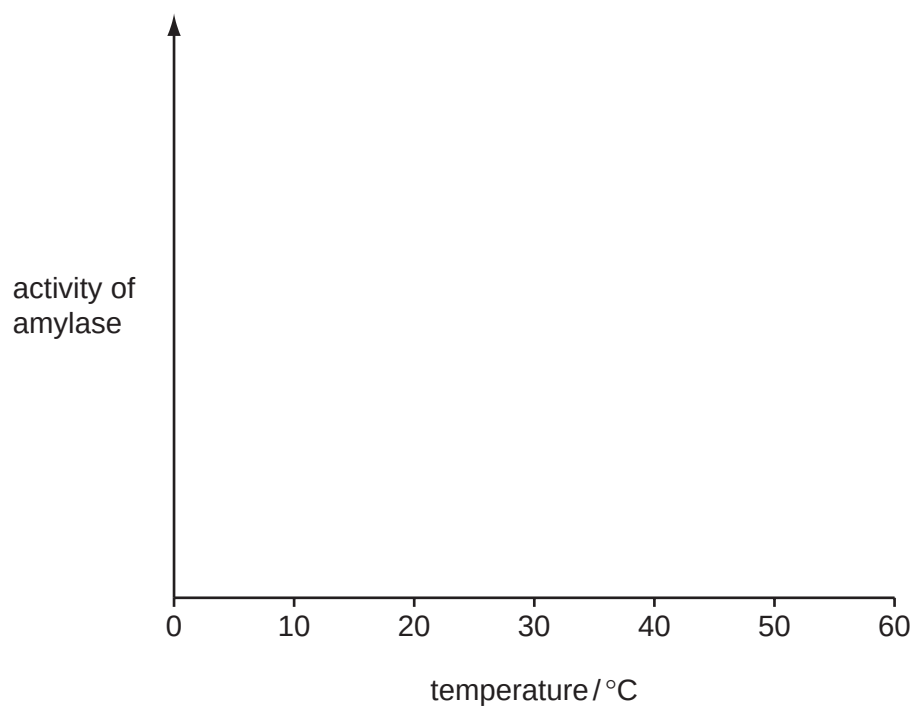
(ii) Explain why it is necessary for most types of food that we eat to be digested.

.....

.....

..... [2]

- (iii) On the axes below, sketch a curve to show how the activity of amylase in human saliva would vary with temperature.



[2]

- 7 (a) A student set up the electric circuit in Fig. 7.1.

It contains three lamps **L1**, **L2** and **L3**.

It contains three switches **S1**, **S2** and **S3**.

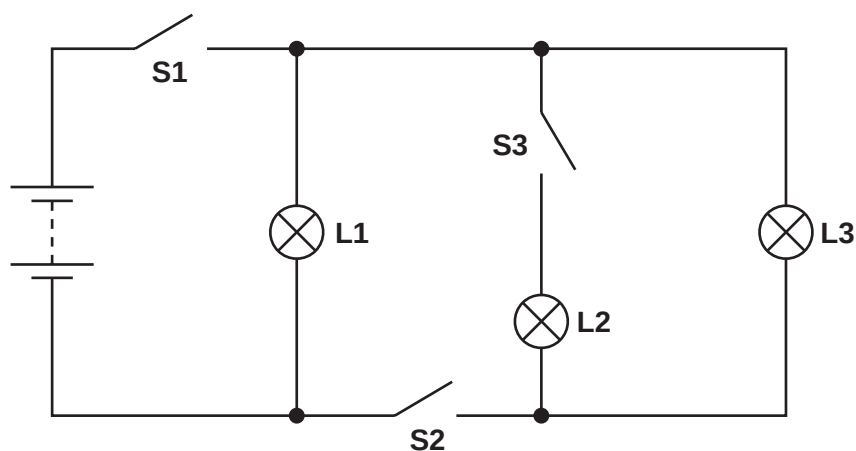


Fig. 7.1

In Table 7.1 write the words '**on**' or '**off**' to show when each lamp is lit or not lit for each set of switch positions.

Table 7.1

switch position			lamp 'on' or 'off'		
S1	S2	S3	L1	L2	L3
closed	closed	closed			
closed	closed	open			
closed	open	open			

[3]

(b) Fig. 7.2 shows an electrical device.

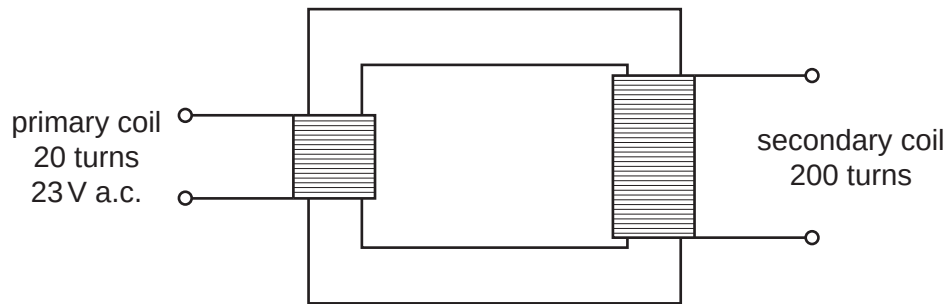


Fig. 7.2

(i) Name the device.

..... [1]

(ii) Calculate the output voltage.

State the formula that you use and show your working.

formula used

working

..... [2]

(c) Fig. 7.3 shows a simple a.c. generator.

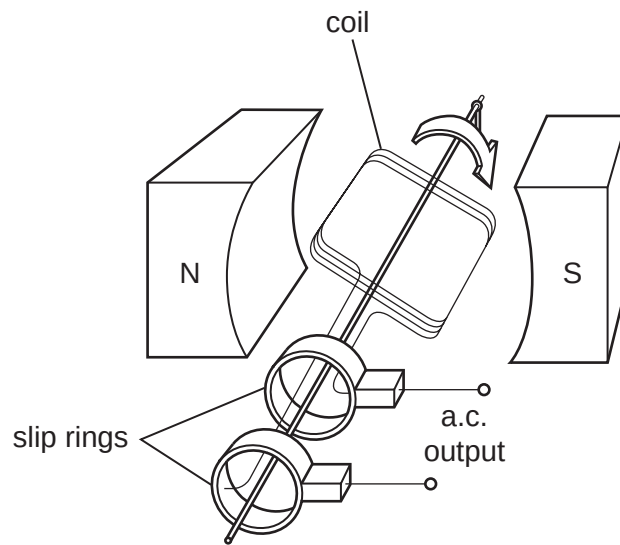


Fig. 7.3

Describe and explain how the generator works. Your answer should refer to

- how a voltage is generated,
- why an alternating voltage is generated,
- why slip rings are used.

.....

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.....

[4]

- 8 (a) Explain why plants need light for photosynthesis.

.....

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..... [2]

- (b) A student fixed a piece of black paper over a leaf, which was still attached to the plant. He left the plant in the sun for two days.

He then removed the leaf from the plant and tested it for starch, after removing the black paper.

Fig. 8.1 shows the leaf before and after he did the starch test.

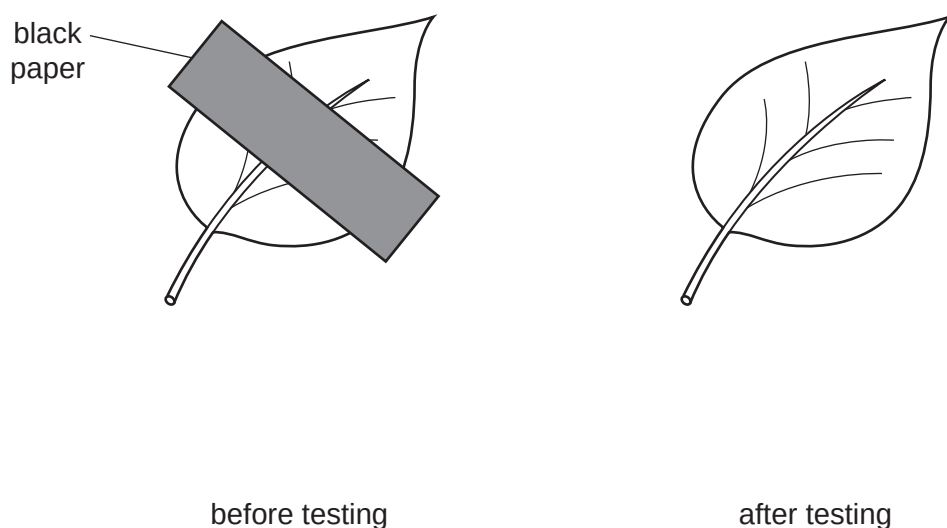


Fig. 8.1

Complete the diagram of the leaf after testing in Fig. 8.1, using labels to show the colours of each part. Do **not** colour the diagram. [2]

- (c) In daylight, plant leaves take in carbon dioxide and give out oxygen. In darkness, they take in oxygen and give out carbon dioxide.

Explain why this happens.

.....

.....

.....

..... [3]

- 9 Fig. 9.1 shows the apparatus a student used to measure the rate of reaction between powdered metal and dilute hydrochloric acid.

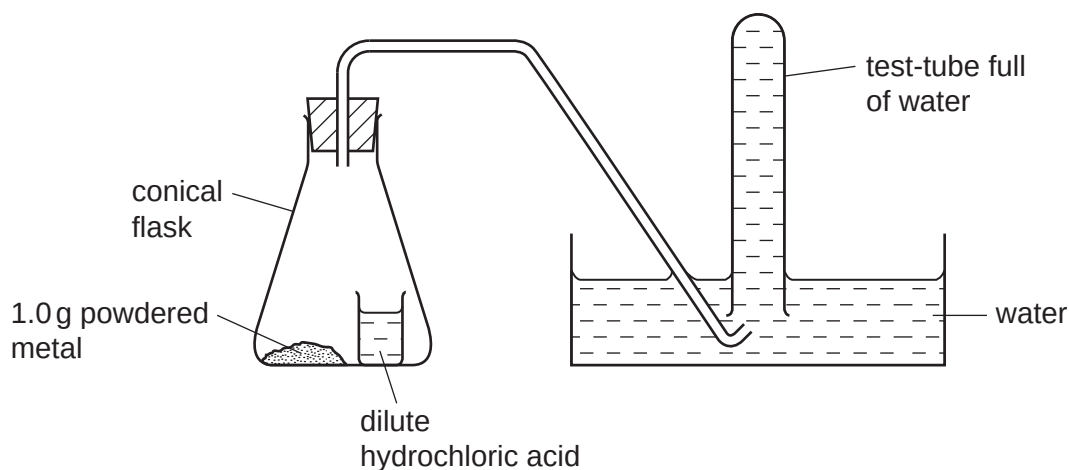


Fig. 9.1

When the student tilted the conical flask, the acid mixed with the powdered metal. Any gas which was produced collected in the test-tube, pushing the water out. The student used a stopwatch to measure the time taken for the test-tube to fill with gas.

- (a) (i) Name the gas produced when metals react with dilute acid.

..... [1]

- (ii) State the formula of the *ion* that is present in **all** dilute acid solutions.

..... [1]

- (b) The student used apparatus like that in Fig. 9.1 to compare the rates of reaction between dilute hydrochloric acid and three powdered metals, **X**, **Y** and **Z**.

The results the student obtained are shown in Table 9.1.

Table 9.1

metal	mass of metal / g	time for gas to fill the test-tube / seconds
X	1.0	154
Y	1.0	28
Z	1.0	76

- (i) The student was careful to ensure that the only variable (factor) which differed between the experiments was the type of metal.

State **two** variables, other than the mass and surface area of the metals, that the student must keep the same in each experiment.

1

2 [2]

- (ii) Explain how the results show that the rate of reaction was the lowest when metal **X** was used.

.....

..... [1]

- (iii) The student repeated the experiment with metal **Y** but this time he used a single piece of metal which had a mass of 1.0 g.

State how the rate of reaction would differ from the experiment in which 1.0 g of powdered metal was used. Explain your answer in terms of the collisions between the surface of the metal and ions in the solution.

.....

.....

.....

..... [3]

- (c) When magnesium reacts with dilute hydrochloric acid, HCl , one of the products is magnesium chloride, MgCl_2 .

Construct a balanced symbolic equation for this reaction.

..... [2]

DATA SHEET
The Periodic Table of the Elements

Group																			
I	II											III	IV	V	VI	VII	0		
												1 H Hydrogen 1							4 He Helium 2
7 Li Lithium 3	9 Be Beryllium 4											11 B Boron 5	12 C Carbon 6	14 N Nitrogen 7	16 O Oxygen 8	19 F Fluorine 9	20 Ne Neon 10		
23 Na Sodium 11	24 Mg Magnesium 12											27 Al Aluminium 13	28 Si Silicon 14	31 P Phosphorus 15	32 S Sulfur 16	35.5 Cl Chlorine 17	40 Ar Argon 18		
39 K Potassium 19	40 Ca Calcium 20	45 Sc Scandium 21	48 Ti Titanium 22	51 V Vanadium 23	52 Cr Chromium 24	55 Mn Manganese 25	56 Fe Iron 26	59 Co Cobalt 27	59 Ni Nickel 28	64 Cu Copper 29	65 Zn Zinc 30	70 Ga Gallium 31	73 Ge Germanium 32	75 As Arsenic 33	79 Se Selenium 34	80 Br Bromine 35	84 Kr Krypton 36		
85 Rb Rubidium 37	88 Sr Strontium 38	89 Y Yttrium 39	91 Zr Zirconium 40	93 Nb Niobium 41	96 Mo Molybdenum 42	101 Ru Ruthenium 44	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		
87 Fr Francium	88 Ra Radium	89 Ac Actinium																	
58-71 Lanthanoid series																			
90-103 Actinoid series																			
175 Lu Lutetium 71																			
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141 Pr Praseodymium 59																			
140 Ce Cerium 58																			
238 U Uranium 92																			
238 Pa Protactinium 91																			
232 Th Thorium 90																			
232 Bk Berkelium 97																			
232 Cm Curium 96																			
232 Am Americium 95																			
232 Pu Plutonium 94																			
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232 Eu Europium 63																			
232 Gd Gadolinium 64																			
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232 Dy Dysprosium 66																			
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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.).



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* 2 3 2 2 1 7 2 4 2 7 *

COMBINED SCIENCE

0653/32

Paper 3 (Extended)

October/November 2010

1 hour 15 minutes

Candidates answer on the Question Paper.

No Additional Materials are required.

READ THESE INSTRUCTIONS FIRST

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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	
3	
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5	
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7	
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9	
Total	

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



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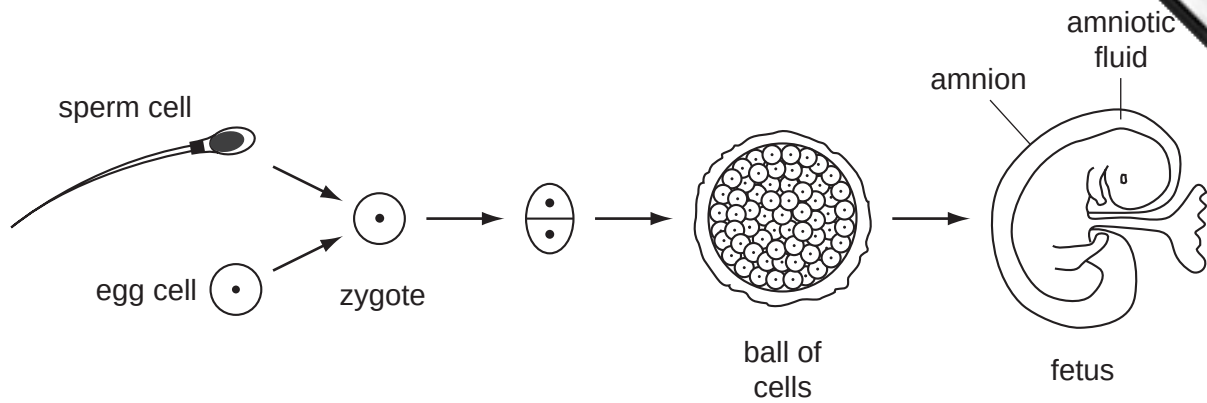


Fig. 1.1

- (a) Most human cells contain 46 chromosomes, but egg cells and sperm cells contain only 23 chromosomes each.

Suggest a reason for this.

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

- (b) Name the part of the reproductive system in which each of these events takes place.

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- (c) Describe the function of the amnion.

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

- (d) A disease called thalassaemia is caused by a person's genes.

The haemoglobin gene has two alleles, **T** and **t**. A person with the alleles **tt** has thalassaemia, but a person with alleles **Tt** does not.

- (i) State which allele, **T** or **t**, is dominant. Explain your answer.

allele

explanation

[1]

- (ii) Complete the genetic diagram to show how two parents who do not have thalassaemia could have a child with thalassaemia.

phenotypes of parents

man without
thalassaemia

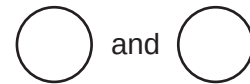
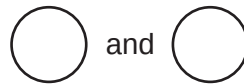
woman without
thalassaemia

genotypes of parents

Tt

.....

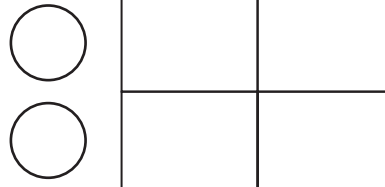
gametes



gametes from woman



gametes
from man



[4]

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Explain why someone with thalassaemia often does not have the energy to do vigorous exercise.

.....

.....

..... [2]

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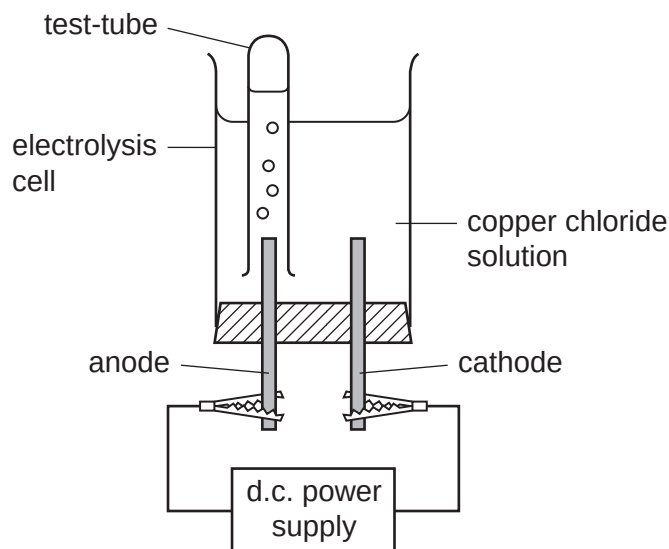


Fig. 2.1

- (i) Describe what is observed at the cathode.

..... [1]

- (ii) Chloride ions have a single negative electrical charge, Cl^- .

For every copper ion in the solution, two chloride ions are present.

Deduce the electrical charge of a copper ion.

Show how you obtained your answer.

..... [2]

- (iii) Fig. 2.2 shows diagrams of two particles, **L** and **M**. Each of these particles has 17 protons in their nucleus.

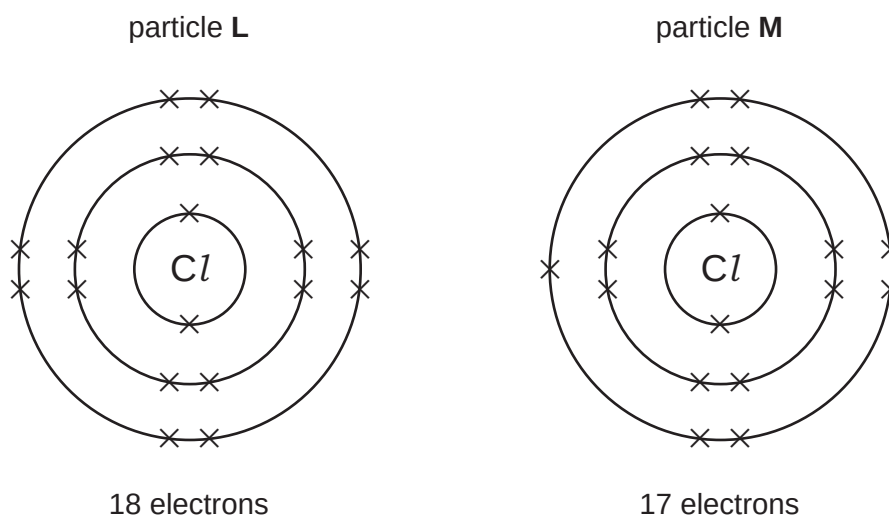


Fig. 2.2

State and explain which one of these particles, **L** or **M**, moves towards the anode during electrolysis.

particle

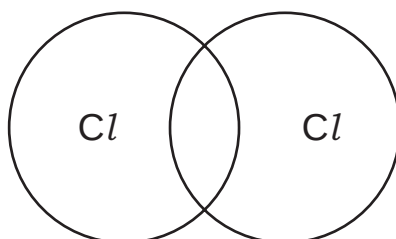
explanation

.....

..... [2]

- (iv) The bubbles of gas which rise from the anode contain diatomic molecules of chlorine.

Complete the bonding diagram below to show how the outer electrons are arranged in a chlorine molecule.



[2]

- (b) The apparatus shown in Fig. 2.3 can be used to react lead oxide, PbO , and carbon.

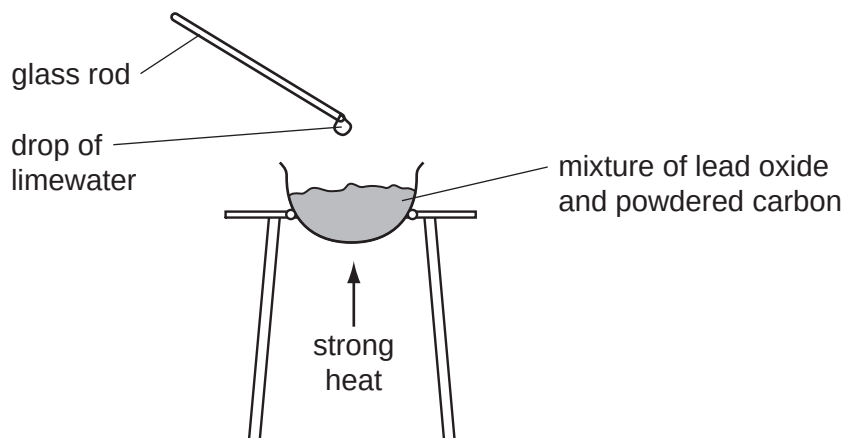


Fig. 2.3

When the mixture is heated, a redox reaction occurs in which lead oxide is reduced.

The drop of limewater suspended on the glass rod turns cloudy.

- (i) Name the gas which is produced in this redox reaction.

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- (ii) Suggest the balanced symbolic equation for the redox reaction between lead oxide and carbon.

..... [2]

- 3 (a) (i) Complete Table 3.1 to show the properties of alpha, beta and gamma radiation.

Table 3.1

	description	charge	range in air	ionising ability
alpha		positive	5 cm	very strong
beta	electron		50 cm	
gamma	electromagnetic wave		many kilometres	weak

[4]

- (ii) Many people have smoke detectors in their houses.

Smoke detectors contain a radioactive source which emits alpha radiation.

Explain why the alpha radiation from the smoke detector is not dangerous to people living in the house.

.....

.....

..... [1]

- (b) A scientist uses a Geiger counter to measure the radiation from a radioactive source. She records the results every hour.

Fig. 3.1 shows the graph of her results.

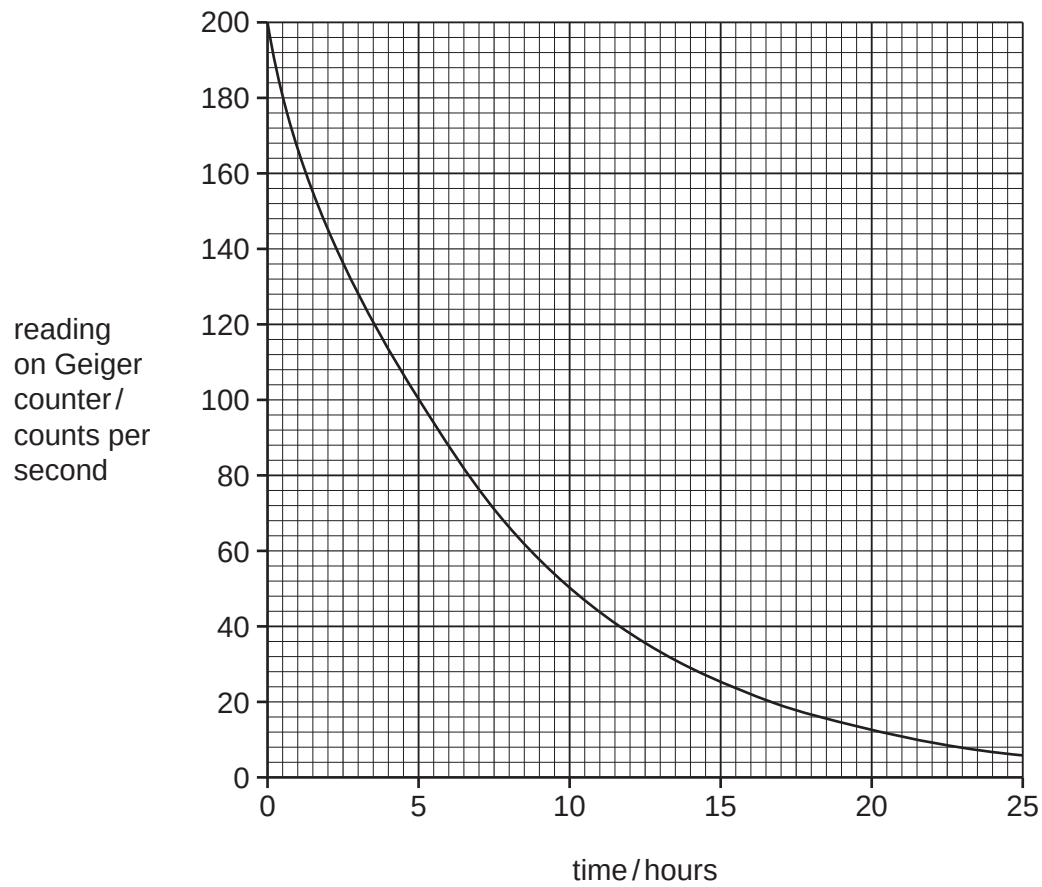


Fig. 3.1

Calculate the half-life of the radioactive source.

Show your working.

[2]

- 4 Soya beans are an important crop in many tropical and subtropical countries, because they contain a lot of protein.

(a) A farmer grows soya beans in a field on a steep slope.

Describe **two** things the farmer could do to reduce the risk of soil erosion.

- 1
- 2
- [2]

(b) Soya beans and other crops are often attacked by aphids and other insect pests.

Farmers may use pesticides or biological control to kill the pests.

- (i) Describe **one** advantage and **one** disadvantage of using pesticides, rather than biological control, to control pests of crops.

advantage

.....

disadvantage

..... [2]

- (ii) State what is meant by a *systemic pesticide* and explain **one** advantage of using a systemic pesticide rather than a contact pesticide.

meaning

.....

advantage

..... [2]

- 5 (a) Fig. 5.1 shows a circuit built by a student.

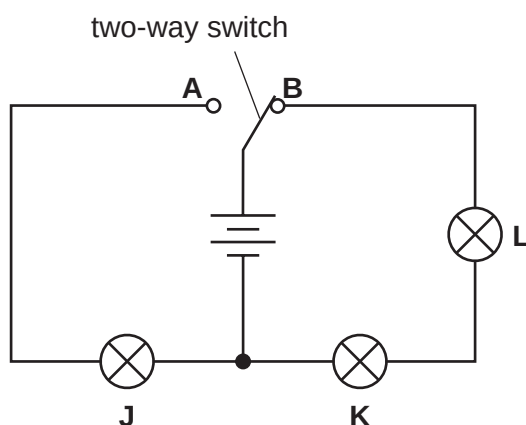


Fig. 5.1

- (i) The switch is at position **B**. Which lamps will be lit? [1]

- (ii) The switch is then moved to position **A**.

What happens to lamps **J**, **K** and **L**?

lamp **J**

lamp **K**

lamp **L** [2]

- (b) The student has six resistors as shown in Fig. 5.2.

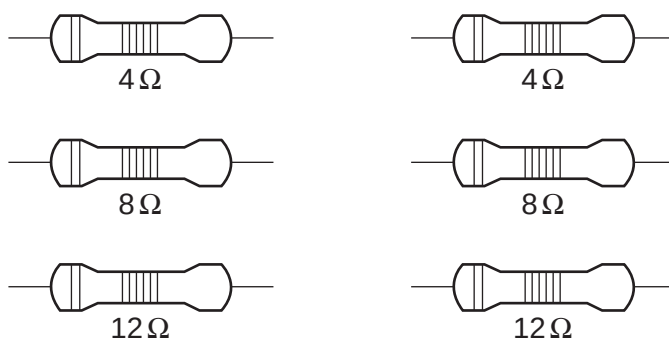


Fig. 5.2

Explain how he can combine **two** of these resistors to get a total resistance of 6 ohms.

.....

.....

.....

..... [3]

(c) Fig. 5.3 shows a simple electrical generator.

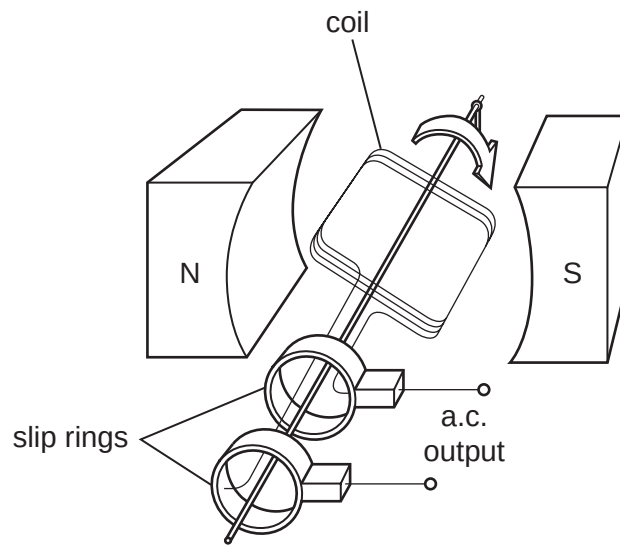


Fig. 5.3

(i) Explain why a voltage is induced in the coil when the coil is turned.

.....
 [1]

(ii) Explain why this generator produces an alternating current.

.....
 [1]

- 6 A solution of sodium chloride is produced when sodium hydroxide solution, an alkali, is neutralised by dilute hydrochloric acid. Fig. 6.1 shows apparatus which can be used to carry out this neutralisation.

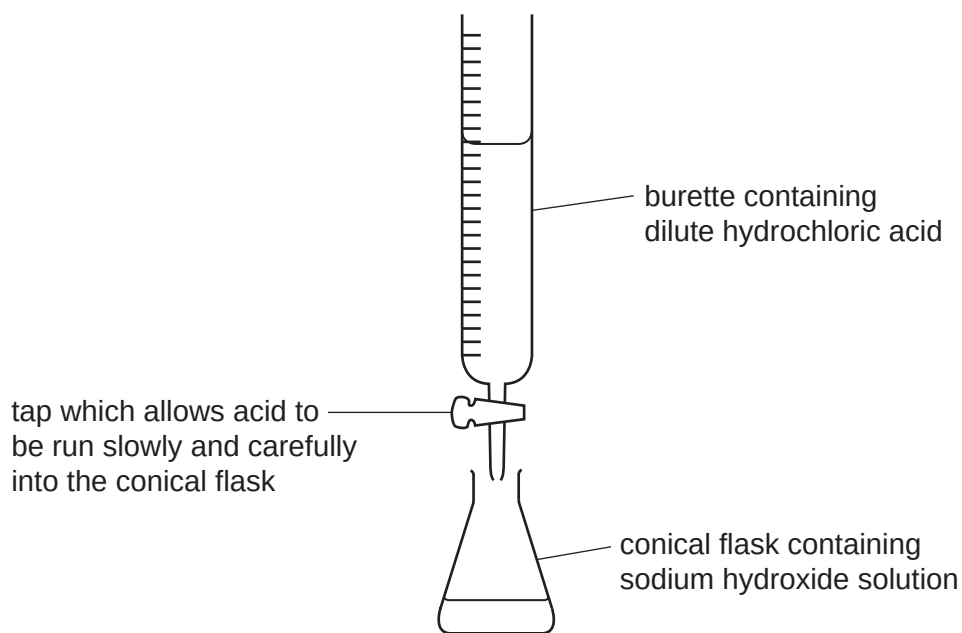


Fig. 6.1

- (a) Complete the balanced symbolic equation, involving ions and molecules, for the neutralisation reaction between an aqueous acid and an aqueous alkali.



- (b) A student adds a few drops of litmus solution, an indicator, to the sodium hydroxide solution.

Suggest what the student should then do in order to produce a **neutral** solution of sodium chloride, using only the apparatus shown in Fig. 6.1.

.....

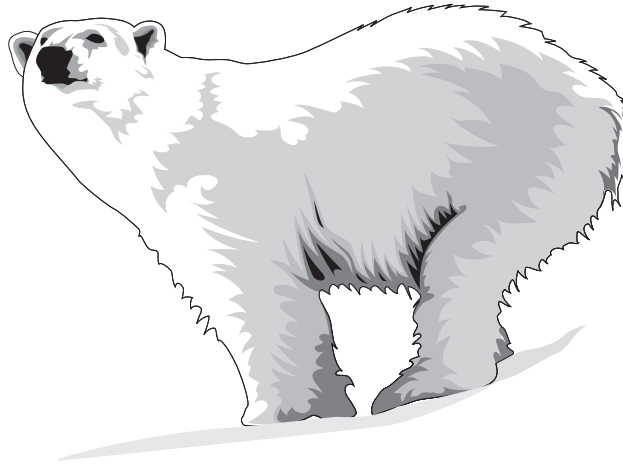
 [2]

- (c) Suggest how the student could use information gained from the experiment in (b) to obtain a sample of dry, **colourless** sodium chloride crystals which do not contain any litmus.

.....

 [3]

- 7 (a) Polar bears live in the cold, arctic region. They have thick, white fur.



- (i) Describe how fur keeps a polar bear warm.

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

- (ii) Explain why white fur will keep a polar bear warmer than black fur.

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

- (b) An elephant can communicate with other elephants using infra-sound. This is low frequency vibration, which is usually impossible for a human to hear.

- (i) Suggest a possible frequency for this vibration and explain how you chose your answer.

frequency Hz

explanation

..... [1]

- (ii) State the meaning of the term *frequency*.

.....

..... [1]

- (iii) Fig. 7.1 shows an oscilloscope trace for a low frequency sound which the human ear can just hear.

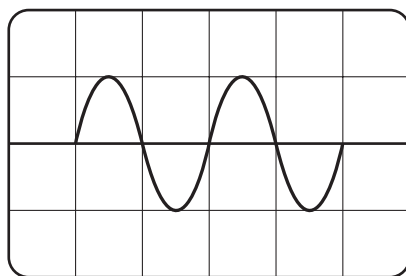


Fig. 7.1

On Fig.7.2 draw the trace of an infra-sound wave of the same amplitude.

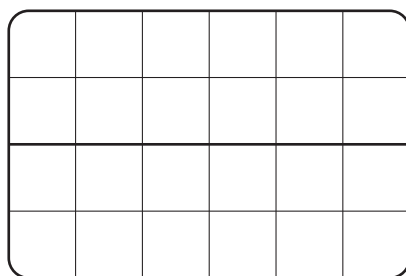


Fig. 7.2

[2]

(c) Fig. 7.3 shows a magnifying glass being used to look at a caterpillar.

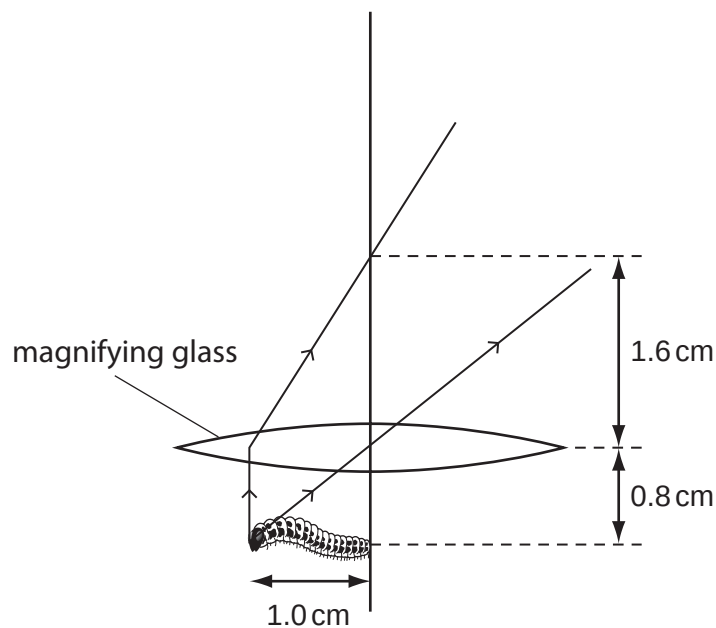


Fig. 7.3

- (i) State the focal length of the lens. [1]
- (ii) Complete the ray diagram to show how the eye sees an enlarged image of the caterpillar. [2]
- (iii) This image is called a virtual image.

Explain the meaning of the term *virtual image*.

.....

..... [1]

- 8 Carbon and hydrogen combine to form hydrocarbons.

Ethene, C_2H_4 , is a gaseous, unsaturated hydrocarbon, which is of industrial importance.

- (a) Complete the displayed formula of the ethene molecule which has been started below.



[2]

- (b) Unsaturated hydrocarbons are made in industry from fractions obtained by the fractional distillation of oil (petroleum).

Name the process which is used to make unsaturated hydrocarbons, and describe briefly how it is done.

name of process

description

.....

.....

..... [3]

- (c) Describe, in terms of changes to chemical bonds, what happens when ethene molecules react to form molecules of poly(ethene).

.....

.....

..... [2]

(d) Calculate the relative formula mass of ethene.

Show your working.

..... [2]

- 9 A healthy plant growing in a pot was watered and placed in a sunny window. A transparent plastic bag was placed over the plant, as shown in Fig. 9.1.

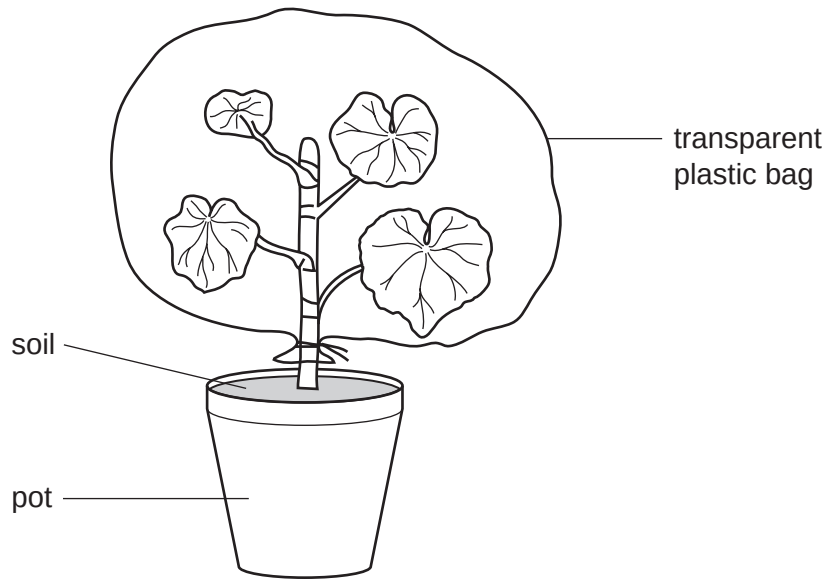


Fig. 9.1

- (a) The temperature near the window fell overnight. The next morning, small droplets of water were visible on the inside of the plastic bag.

Explain why the droplets of water appeared on the inside of the plastic bag.

.....

.....

.....

.....

..... [4]

- (b) The plastic bag was then removed from the plant. The next day was warm and and by the end of the day the plant had lost so much water that it wilted.

Fig. 9.2 shows a cell from a leaf before and after the plant wilted.

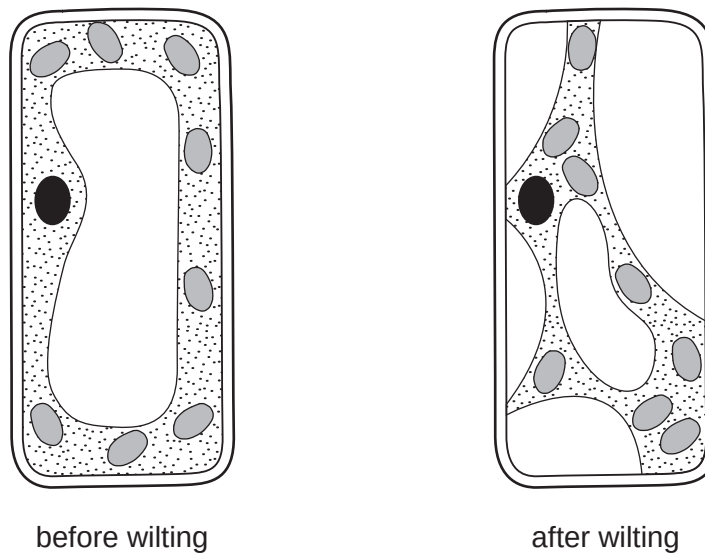


Fig. 9.2

- (i) On the diagram of the cell before wilting in Fig. 9.2, label and name **two** structures that would **not** be present in an animal cell. [2]
- (ii) Using your knowledge of osmosis, explain what happened to the plant cell to cause its appearance after the plant wilted.

.....

.....

.....

.....

..... [3]

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	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	131 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 Francium 87	226 Ra Radium 88	227 Ac Actinium 89																				
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a

X

b

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a	X	b
Key		
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*58-71 Lanthanoid series
†90-103 Actinoid series

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COMBINED SCIENCE

0653/33

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October/November 2010

1 hour 15 minutes

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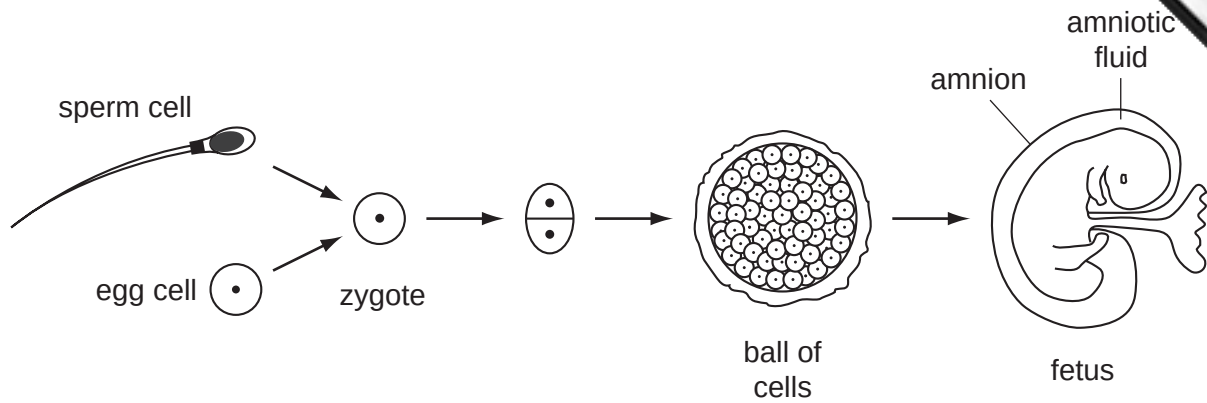


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allele

explanation

[1]

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phenotypes of parents

man without
thalassaemia

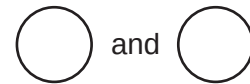
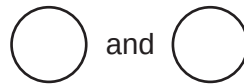
woman without
thalassaemia

genotypes of parents

Tt

.....

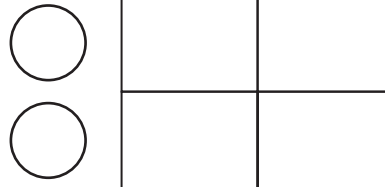
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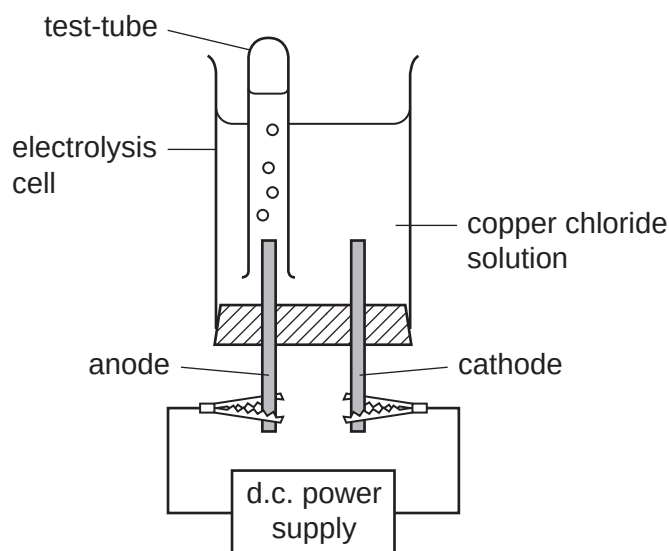


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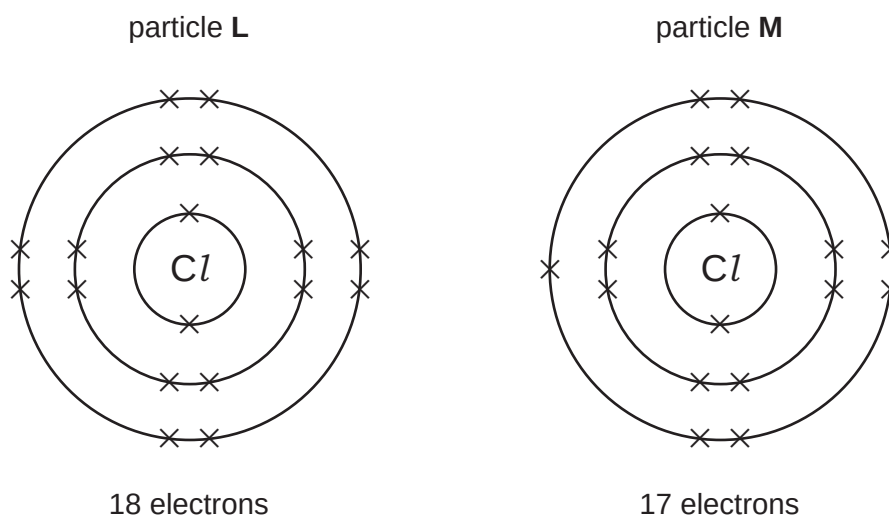


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particle

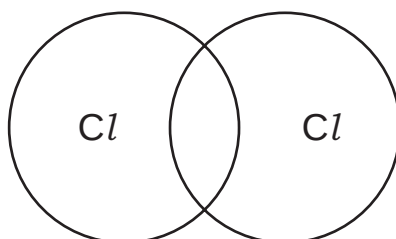
explanation

.....

..... [2]

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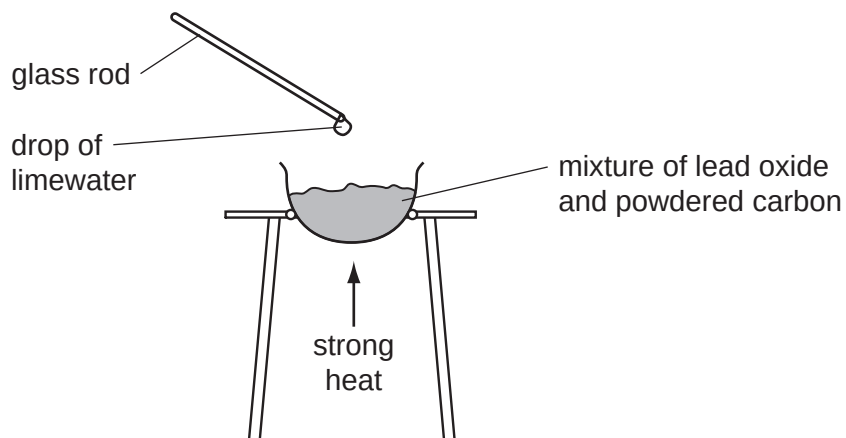


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alpha		positive	5 cm	very strong
beta	electron		50 cm	
gamma	electromagnetic wave		many kilometres	weak

[4]

- (ii) Many people have smoke detectors in their houses.

Smoke detectors contain a radioactive source which emits alpha radiation.

Explain why the alpha radiation from the smoke detector is not dangerous to people living in the house.

.....

 [1]

- (b) A scientist uses a Geiger counter to measure the radiation from a radioactive source. She records the results every hour.

Fig. 3.1 shows the graph of her results.

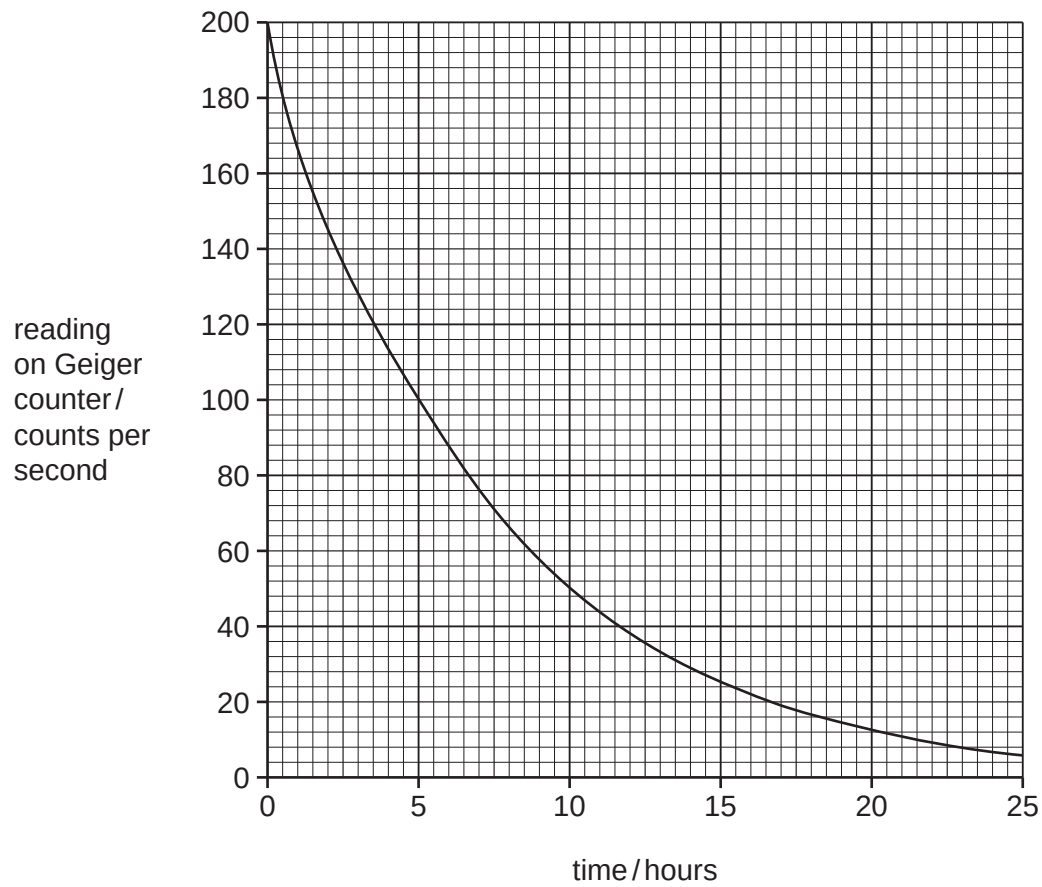


Fig. 3.1

Calculate the half-life of the radioactive source.

Show your working.

[2]

- 4 Soya beans are an important crop in many tropical and subtropical countries, because they contain a lot of protein.

(a) A farmer grows soya beans in a field on a steep slope.

Describe **two** things the farmer could do to reduce the risk of soil erosion.

- 1
- 2
- [2]

(b) Soya beans and other crops are often attacked by aphids and other insect pests.

Farmers may use pesticides or biological control to kill the pests.

- (i) Describe **one** advantage and **one** disadvantage of using pesticides, rather than biological control, to control pests of crops.

advantage

.....

disadvantage

..... [2]

- (ii) State what is meant by a *systemic pesticide* and explain **one** advantage of using a systemic pesticide rather than a contact pesticide.

meaning

.....

advantage

..... [2]

- 5 (a) Fig. 5.1 shows a circuit built by a student.

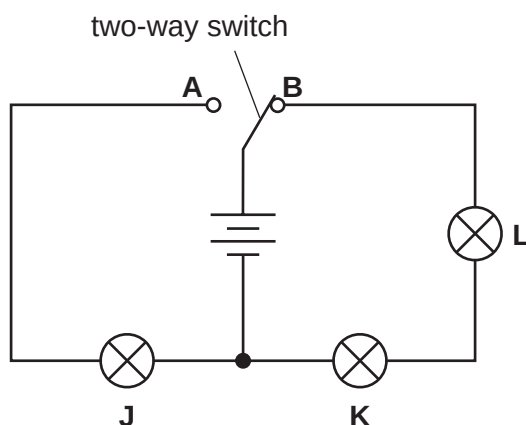


Fig. 5.1

- (i) The switch is at position **B**. Which lamps will be lit? [1]

- (ii) The switch is then moved to position **A**.

What happens to lamps **J**, **K** and **L**?

lamp **J**

lamp **K**

lamp **L** [2]

- (b) The student has six resistors as shown in Fig. 5.2.

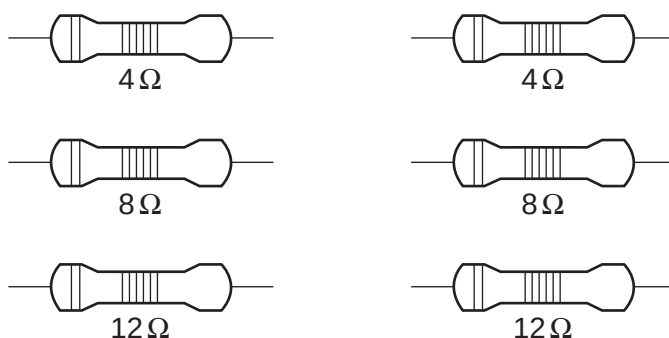


Fig. 5.2

Explain how he can combine **two** of these resistors to get a total resistance of 6 ohms.

.....

 [3]

(c) Fig. 5.3 shows a simple electrical generator.

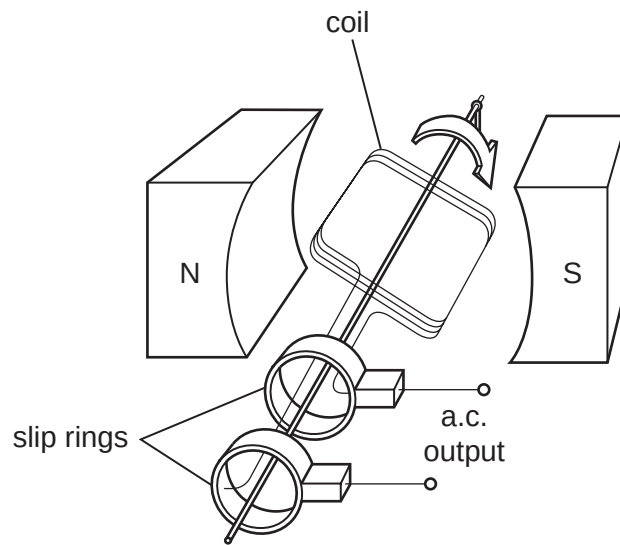


Fig. 5.3

(i) Explain why a voltage is induced in the coil when the coil is turned.

.....
 [1]

(ii) Explain why this generator produces an alternating current.

.....
 [1]

- 6 A solution of sodium chloride is produced when sodium hydroxide solution, an alkali, is neutralised by dilute hydrochloric acid. Fig. 6.1 shows apparatus which can be used to carry out this neutralisation.

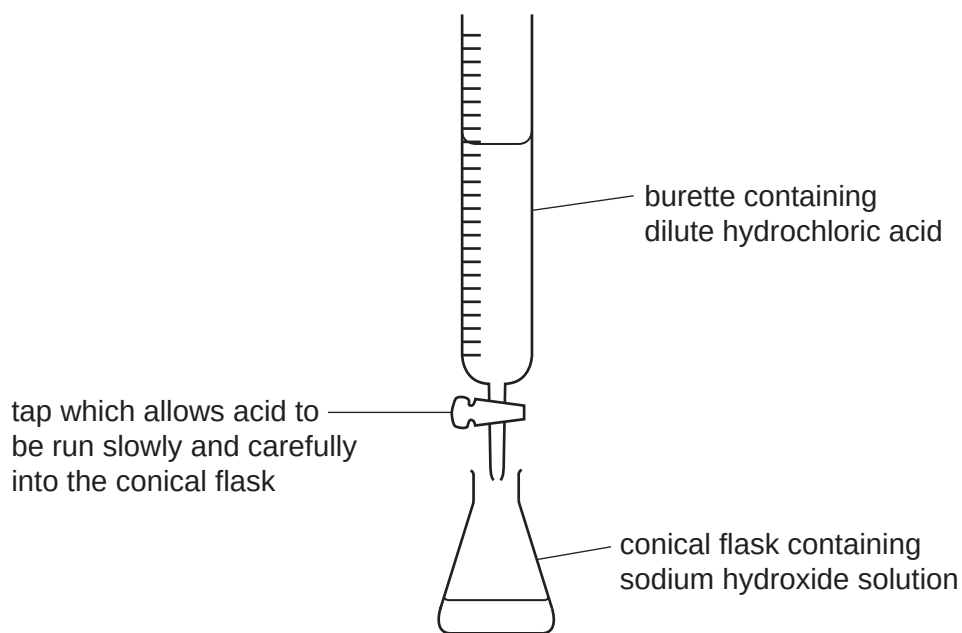


Fig. 6.1

- (a) Complete the balanced symbolic equation, involving ions and molecules, for the neutralisation reaction between an aqueous acid and an aqueous alkali.



- (b) A student adds a few drops of litmus solution, an indicator, to the sodium hydroxide solution.

Suggest what the student should then do in order to produce a **neutral** solution of sodium chloride, using only the apparatus shown in Fig. 6.1.

.....

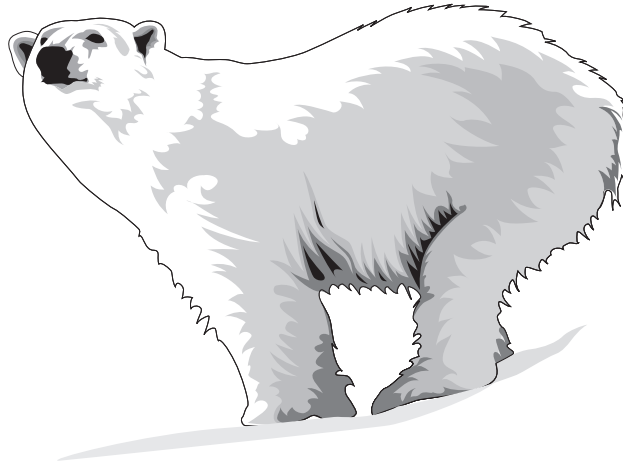
 [2]

- (c) Suggest how the student could use information gained from the experiment in (b) to obtain a sample of dry, **colourless** sodium chloride crystals which do not contain any litmus.

.....

 [3]

- 7 (a) Polar bears live in the cold, arctic region. They have thick, white fur.



- (i) Describe how fur keeps a polar bear warm.

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

- (ii) Explain why white fur will keep a polar bear warmer than black fur.

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

(b) An elephant can communicate with other elephants using infra-sound. This is low frequency vibration, which is usually impossible for a human to hear.

- (i) Suggest a possible frequency for this vibration and explain how you chose your answer.

frequency Hz

explanation

..... [1]

- (ii) State the meaning of the term *frequency*.

.....

..... [1]

- (iii) Fig. 7.1 shows an oscilloscope trace for a low frequency sound which the human ear can just hear.

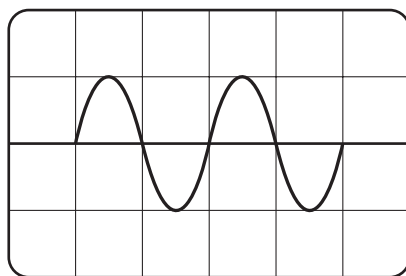


Fig. 7.1

On Fig. 7.2 draw the trace of an infra-sound wave of the same amplitude.

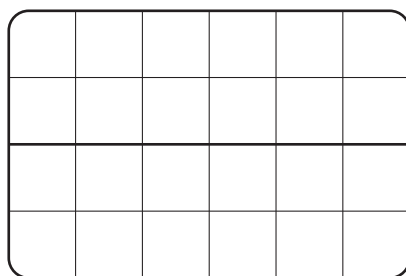


Fig. 7.2

[2]

(c) Fig. 7.3 shows a magnifying glass being used to look at a caterpillar.

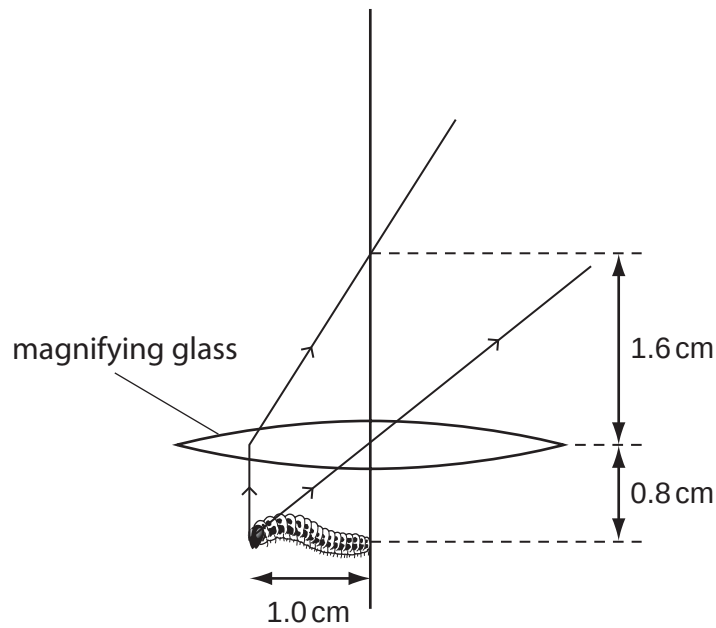


Fig. 7.3

- (i) State the focal length of the lens. [1]
- (ii) Complete the ray diagram to show how the eye sees an enlarged image of the caterpillar. [2]
- (iii) This image is called a virtual image.

Explain the meaning of the term *virtual image*.

..... [1]

.....

- 8 Carbon and hydrogen combine to form hydrocarbons.

Ethene, C_2H_4 , is a gaseous, unsaturated hydrocarbon, which is of industrial importance.

- (a) Complete the displayed formula of the ethene molecule which has been started below.



[2]

- (b) Unsaturated hydrocarbons are made in industry from fractions obtained by the fractional distillation of oil (petroleum).

Name the process which is used to make unsaturated hydrocarbons, and describe briefly how it is done.

name of process

description

.....

.....

..... [3]

- (c) Describe, in terms of changes to chemical bonds, what happens when ethene molecules react to form molecules of poly(ethene).

.....

.....

..... [2]

(d) Calculate the relative formula mass of ethene.

Show your working.

..... [2]

- 9 A healthy plant growing in a pot was watered and placed in a sunny window. A transparent plastic bag was placed over the plant, as shown in Fig. 9.1.

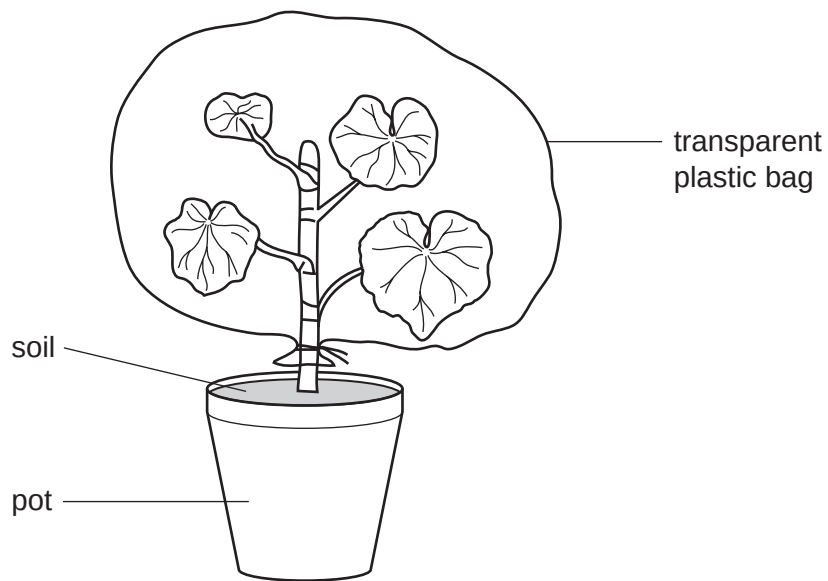


Fig. 9.1

- (a) The temperature near the window fell overnight. The next morning, small droplets of water were visible on the inside of the plastic bag.

Explain why the droplets of water appeared on the inside of the plastic bag.

.....

.....

.....

.....

..... [4]

- (b) The plastic bag was then removed from the plant. The next day was warm and and by the end of the day the plant had lost so much water that it wilted.

Fig. 9.2 shows a cell from a leaf before and after the plant wilted.

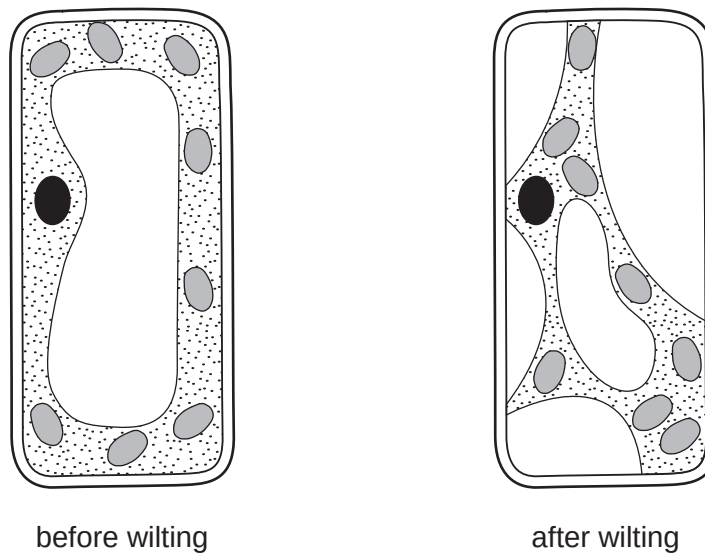


Fig. 9.2

- (i) On the diagram of the cell before wilting in Fig. 9.2, label and name **two** structures that would **not** be present in an animal cell. [2]
- (ii) Using your knowledge of osmosis, explain what happened to the plant cell to cause its appearance after the plant wilted.

.....

.....

.....

.....

..... [3]

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	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	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		Po Polonium 84	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																																											
140 Ce Cerium 58																		141 Pr Praseodymium 59	144 Nd Neodymium 60	150 Sm Samarium 62	152 Eu Europium 63	157 Gd Gadolinium 64	159 Tb Terbium 65	162 Dy Dysprosium 66	165 Ho Holmium 67	167 Er Erbium 68	169 Tm Thulium 69	173 Yb Ytterbium 70	175 Lu Lutetium 71														
232 Th Thorium 90																		238 Pa Protactinium 91		238 U Uranium 92		238 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	
Key	X	a	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.).