

Surname		Other Names	
Centre Number		Candidate Number	
Candidate Signature			

For Examiner's Use

General Certificate of Secondary Education
January 2008

APPLIED SCIENCE (DOUBLE AWARD)
Unit 2 Science for the Needs of Society
Foundation Tier

APSC/2F

F



Friday 18 January 2008 1.30 pm to 3.00 pm

<p>For this paper you must have:</p> <ul style="list-style-type: none"> • a ruler. <p>You may use a calculator.</p>

Time allowed: 1 hour 30 minutes

Instructions

- Use blue or black ink or ball-point pen.
- Fill in the boxes at the top of this page.
- Answer **all** questions.
- Answer the questions in the spaces provided.
- Do all rough work in this book. Cross through any work you do not want to be marked.

Information

- The maximum mark for this paper is 90.
- The marks for questions are shown in brackets.
- You are reminded of the need for good English and clear presentation in your answers.

Advice

- In all calculations, show clearly how you work out your answer.

For Examiner's Use			
Question	Mark	Question	Mark
1		7	
2		8	
3		9	
4			
5			
6			
Total (Column 1)		→	
Total (Column 2)		→	
TOTAL			
Examiner's Initials			



J A N O 8 A P S C 2 F O 1

Answer **all** questions in the spaces provided.

1 A fitness instructor gives advice to his clients about diet and exercise.

(a) A good diet is an important part of a healthy lifestyle.

The fitness instructor advises a client who is overweight to eat more healthy food and less unhealthy food.

Use words from the box to answer the questions.

Fat	Fruit	Sugar	Vegetables
------------	--------------	--------------	-------------------

(i) Give **one** example of a healthy food for an overweight client.

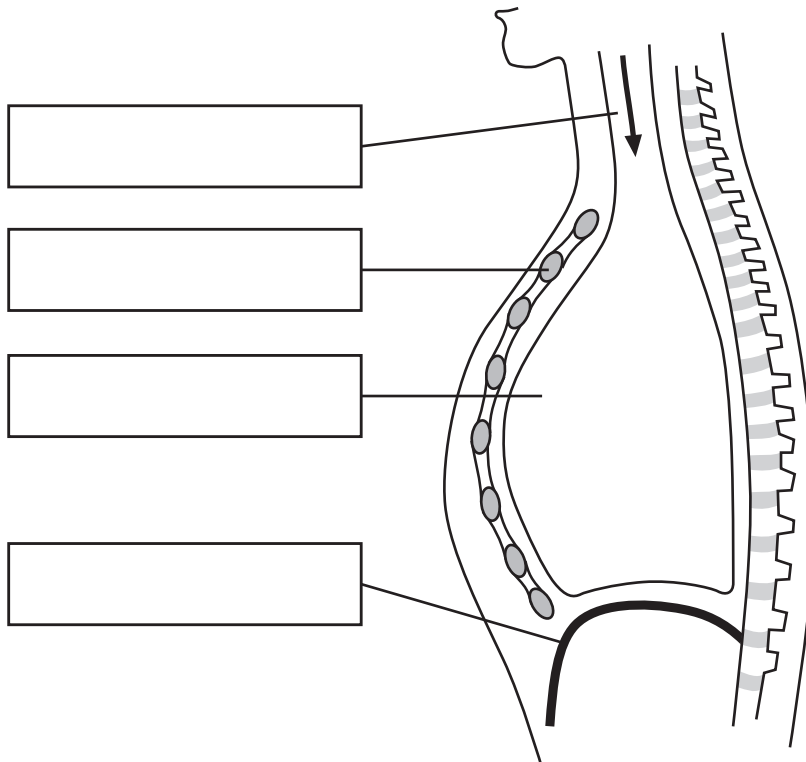
.....
(1 mark)

(ii) Give **one** example of an unhealthy food for an overweight client.

.....
(1 mark)

(b) Exercise will result in deeper breathing and more breaths per minute.

The diagram shows the parts of the human body that are involved in breathing.



- (i) Complete the labels on the diagram using the words from the box.

Diaphragm	Lung	Rib	Trachea
------------------	-------------	------------	----------------

(3 marks)

- (ii) The fitness instructor explains how the lungs are filled with air.

Complete the sentences using words from the box.

contract	decreases	flat	increases	relax	up
-----------------	------------------	-------------	------------------	--------------	-----------

The rib muscles and the diaphragm muscles

The ribcage is moved and out and the diaphragm is pulled

The space inside the chest so air flows into the lungs. (4 marks)

- (iii) The fitness instructor would like to measure the effect of exercise on a client.

He measures the change in the breathing rate of his client.

Describe an experiment to measure the effect of exercise on breaths per minute.

.....

.....

.....

.....

.....

.....

.....

(3 marks)

12

Turn over for the next question

Turn over ►



2 The properties of a material are controlled by its chemical structure.

Scientists and engineers use their knowledge of chemical structure to make the best use of a material.

The chemical building blocks of all materials are elements and their atoms.

(a) The elements can be divided into metals and non-metals.

A list of words used to describe the properties of materials is given below.

A ring has been drawn around a typical property of non-metals.

Draw rings around **three other** typical properties of non-metals.

low melting point	dull	low density
malleable	shiny	high melting point
poor conductor of electricity	high density	brittle
good conductor of electricity		

(2 marks)

(b) The names and symbols of some elements are listed below.

Name	Symbol
Aluminium	Al
Carbon	C
Copper	Cu
Lead	Pb
Silicon	Si
Sulfur	S

Choose an element from the table to match each of the descriptions below.

(i) An element that can be used straight from the ground.

.....
(1 mark)



(ii) A reducing agent that is used to extract metals from metal ores.

.....
(1 mark)

(iii) An element that is often used to make a roof watertight.

.....
(1 mark)

(iv) A low-density metal that is used to make lightweight structures.

.....
(1 mark)

(c) The building blocks of elements are atoms.

Complete the sentences by drawing a ring around the correct word in each box.

(i) The atoms of any one element always have the same number

of

electrons
neutrons
protons

 in the nucleus.

(1 mark)

(ii) The positively charged particle in the nucleus of the atom is

the

electron
neutron
proton

 .

(1 mark)

(iii) When atoms lose electrons to become positively charged, they

form

ions
molecules
protons

 .

(1 mark)

9

Turn over ►



- 3 Road transport engineers need to consider the stopping distances of vehicles when they set the speed limit on roads.

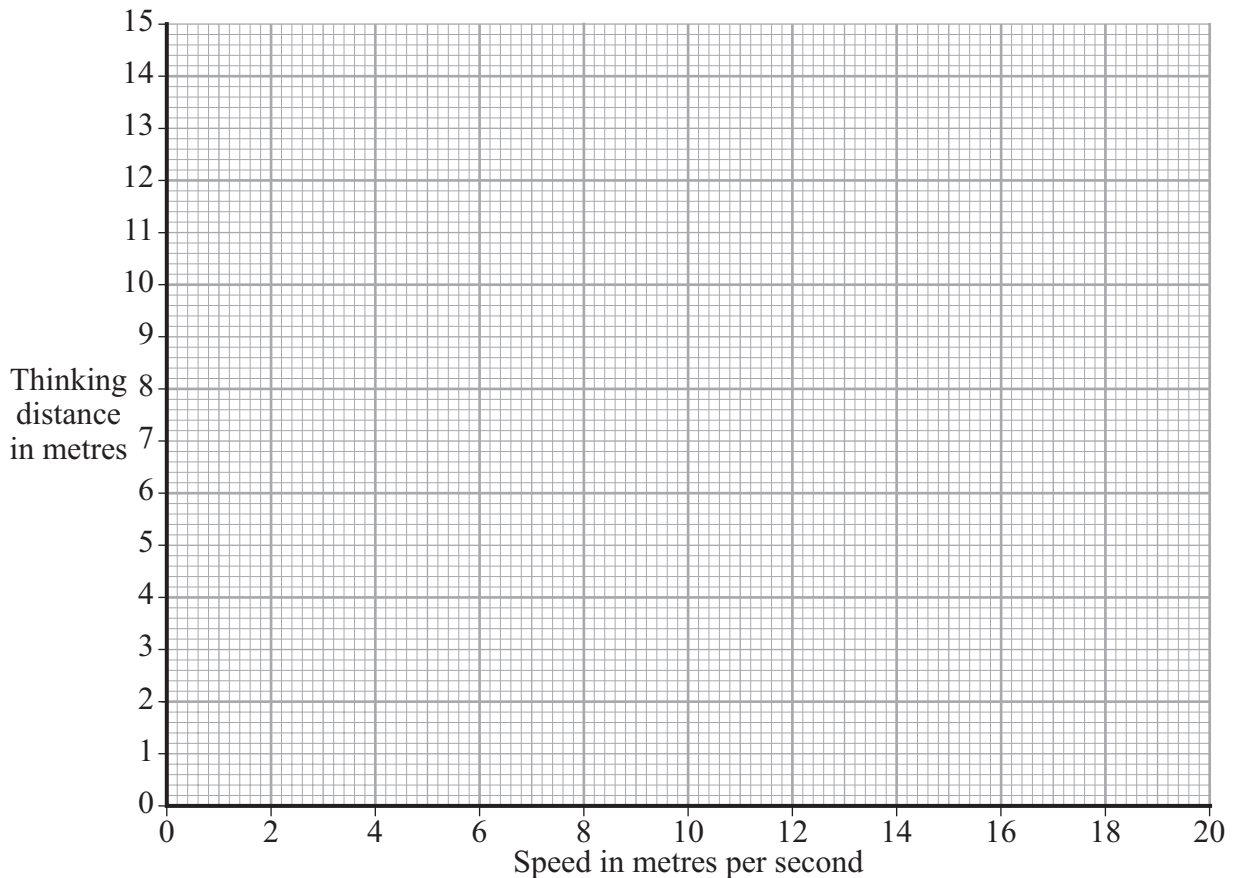
The overall stopping distance of a vehicle depends on:

- the distance travelled in the driver's reaction time – this is the *thinking distance*
- the distance travelled when the driver applies the brakes – this is the *braking distance*.

- (a) The table shows how the thinking distance depends on the speed of the vehicle.

Speed in metres per second	0	10	15	20
Thinking distance in metres	0	6.7	10.2	13.6

- (i) Draw a graph of thinking distance against speed.



(2 marks)

- (ii) Describe how the thinking distance depends on the speed of the vehicle.

.....

.....

(1 mark)



- (iii) Use your graph to work out the thinking distance when a car is travelling at 13.5 metres per second.

Thinking distance = metres
(1 mark)

- (iv) The overall stopping distance of a vehicle travelling at 20 metres per second is 46.0 metres.

Calculate the braking distance of the vehicle.

.....
.....

Braking distance = metres
(3 marks)

- (b) Give **two** factors that affect the braking distance of a vehicle.

1

2

(2 marks)

- (c) Explain why there are signs on motorways advising drivers to take a break.



.....
.....
.....
.....

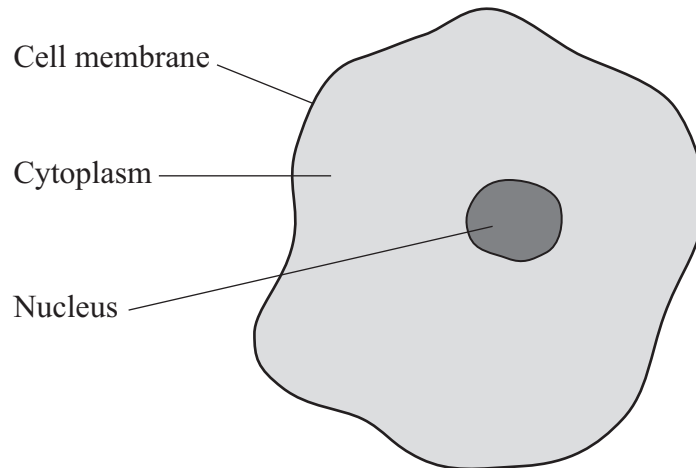
(2 marks)



- 4 Medical scientists have discovered how genetic information is stored in our bodies and how this information is passed on to our children.

This knowledge can be used to develop treatments for inherited diseases such as cystic fibrosis.

The diagram shows the structure of a typical animal cell.



- (a) The information in the boxes describes the structures that store genetic information in the body.

Match each structure to the correct description by drawing a line between the boxes.

One line has been drawn for you.

Structure	Description
Nucleus	Part of a chromosome containing the information that controls a particular characteristic, eg eye colour.
Allele	The smallest part of the body that can function on its own.
Gene	The most dense part of the cell. It contains the chromosomes.
Cell	Strands of DNA that carry the genes.
Chromosome	A different version of the same gene. It can be dominant or recessive.

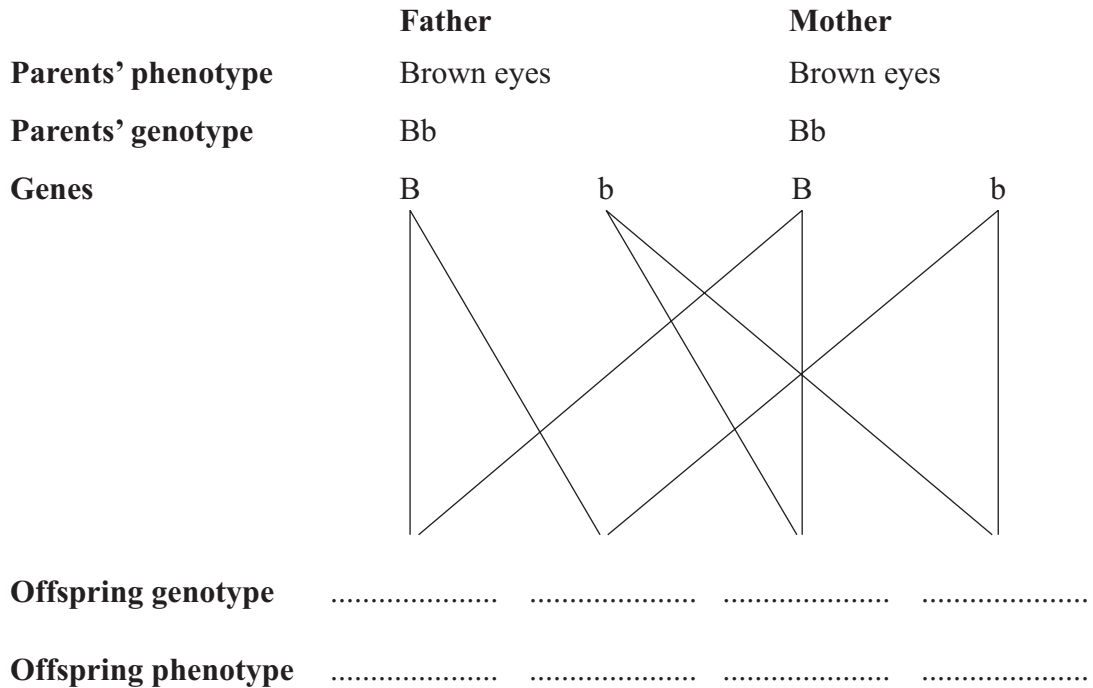
(3 marks)



- (b) The information below shows how two brown-eyed parents can produce children with either blue eyes or brown eyes.

Alleles

B = gene for brown eyes (dominant)
b = gene for blue eyes (recessive)



- (i) Complete the diagram to show the genotypes and the phenotypes of the offspring. *(4 marks)*
- (ii) What is the chance of these parents producing a child with blue eyes?
- Draw a ring around the correct answer.

$\frac{1}{4}$ $\frac{2}{4}$ $\frac{1}{2}$ $\frac{3}{4}$

(1 mark)

Question 4 continues on the next page

Turn over ►



(c) Cystic fibrosis is the UK's most common life-threatening inherited disease.

(i) What is the most likely cause of cystic fibrosis?

Put a tick (✓) in the box next to your answer.

Tick **one** box.

Poor diet	
Bacterial infection	
Viral infection	
Faulty gene	

(1 mark)

(ii) Name a life-threatening disease that is **not** inherited.

.....

(1 mark)

10



Turn over for the next question

Turn over ►



- 5 The products we buy from the supermarket contain mixtures of materials.

The materials may be solids, liquids or gases, and they can be mixed together in different ways.

- (a) Complete the table using words from the box.

Aerosol	Emulsion	Foam	Solution	Suspension
----------------	-----------------	-------------	-----------------	-------------------

One has been done for you.

Type of mixture	Composition
	Two liquids mixed together but not dissolved
	A liquid mixed with small lumps of solid that are not dissolved in the liquid
Solution	A solid, liquid or gas dissolved in a solvent
	A gas trapped inside bubbles of a liquid
	A fine spray of liquid particles in a gas

(3 marks)

- (b) Fizzy Cola is a solution containing a gas and some solid ingredients dissolved in water.

The label from a bottle of Fizzy Cola is shown below.

Fizzy Cola
Carbonated soft drink
BEST SERVED CHILLED
3 LITRES
Ingredients:
Water, carbon dioxide, colouring, phosphoric acid, sugar, preservative, flavouring



(i) Name the solvent used in Fizzy Cola.

.....
(1 mark)

(ii) Which ingredient is added to make the cola fizzy?

.....
(1 mark)

(iii) Which ingredient could be changed to make a 'diet' cola drink?

.....
(1 mark)

(c) Fizzy Cola is sold in plastic bottles.

(i) Explain why the use of plastic bottles may cause environmental pollution.

.....
.....
(1 mark)

(ii) Give **one** method of reducing this kind of pollution.

.....
.....
(1 mark)

(iii) Fizzy Cola is also sold in metal cans.

Name a material that would be suitable for making the cans, and give **one** reason why you would choose this material.

Name

Reason

.....
(2 marks)

10

Turn over for the next question

Turn over ►



6 Fuel scientists are trying to develop better fuels for motor vehicles.

A good fuel produces a large amount of energy when it burns.

A good fuel produces the minimum amount of pollution.

(a) Pentane, C_5H_{12} , is a compound that is found in petrol but not in diesel.

Petrol and diesel are both separated from a fossil fuel.

(i) Why is pentane described as a hydrocarbon?

.....

 (2 marks)

(ii) Name the fossil fuel that is separated to produce petrol and diesel.

.....
 (1 mark)

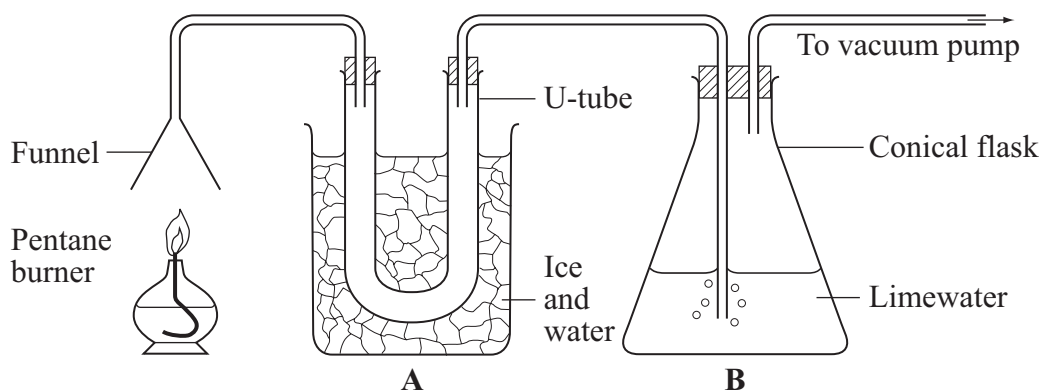
(iii) Name the method used to separate petrol and diesel from the fossil fuel.

.....
 (1 mark)

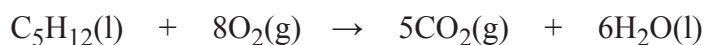
(iv) Give **one** difference between petrol and diesel.

.....
 (1 mark)

(b) A fuel scientist carried out an experiment to identify the products formed when pentane burns.



The equation shows the complete combustion of pentane.



- (i) Name the liquid that collects in the tube at **A**.

.....
(1 mark)

- (ii) A gas produced by the combustion of pentane bubbles into the flask at **B**.

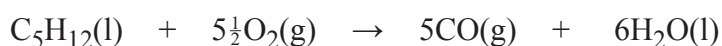
Name the gas.

.....
(1 mark)

- (c) Incomplete combustion occurs when pentane burns in a car engine.

Incomplete combustion produces toxic products.

The equations show the incomplete combustion of pentane.



- (i) Name the toxic products produced during the incomplete combustion of pentane.

.....
.....
(2 marks)

- (ii) Give **one** other disadvantage of using fossil fuels such as pentane.

.....
.....
(1 mark)

- (d) Fuel scientists are developing alternative fuels for motor vehicles that will replace fossil fuels in the future.

Give **one** example of an alternative fuel.

.....
(1 mark)



- 7 An agricultural scientist uses his knowledge of plant nutrients to help a farmer improve the yield of his crop.

The scientist sets up an experiment to test the effect of adding minerals, in the form of artificial fertiliser, to the soil.

Read the method for the experiment and answer the questions that follow.

Method

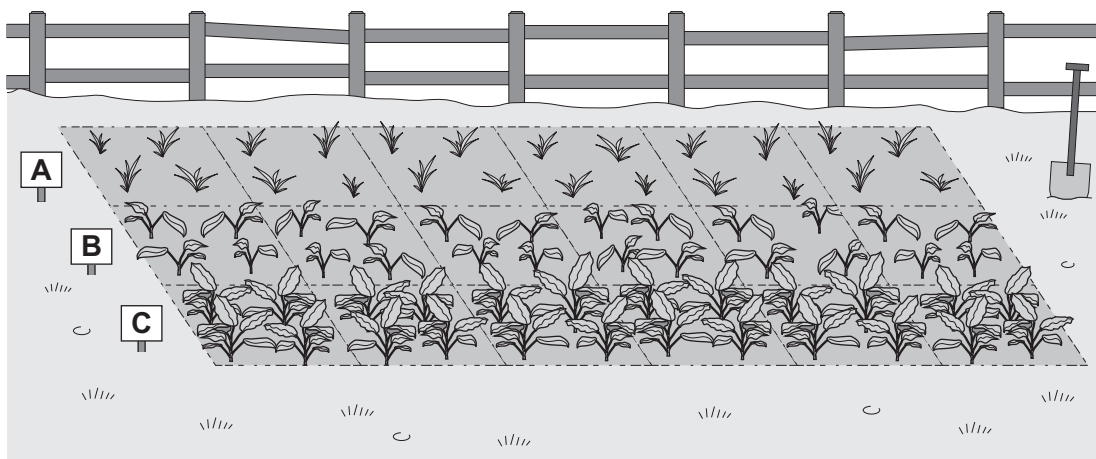
1. Divide a field into eighteen 1 m² plots.
2. Plant the same number of plants in each plot.
3. Give each plant the same amount of water.
4. Apply artificial fertiliser as follows.

EXPERIMENT A Six plots are given water only.

EXPERIMENT B Six plots are given general fertiliser solution containing equal amounts of nitrate, phosphorus and potassium.

EXPERIMENT C Six plots are given nitrogen-rich fertiliser containing nitrate, phosphorus and potassium in the ratio of 5:1:1.

5. Cut the fully grown plants in each plot and place them in plastic bags before weighing them.



- (a) (i) How did the plants growing in **Experiment A** get the minerals they need for healthy growth?

.....
(1 mark)



- (ii) The plants in **Experiment B** and **Experiment C** were given artificial fertiliser containing nitrate, phosphorus and potassium.

Name **one** other mineral needed for healthy plant growth.

.....
(1 mark)

- (iii) Suggest why the plants were placed in plastic bags before they were weighed.

.....
.....
(1 mark)

- (b) Use the results in the table to help you to answer the questions that follow.

Plot number	EXPERIMENT A Yield in grams	EXPERIMENT B Yield in grams	EXPERIMENT C Yield in grams
1	1306	1395	1530
2	1298	1406	1525
3	1284	1382	1512
4	1329	1379	1532
5	1315	1410	1508
6	1310	1390	1519
Average yield		1394	1521

- (i) Calculate the average yield for **Experiment A**.

.....
Average yield = g
(1 mark)

- (ii) Describe the results of the experiment.

.....
.....
.....
.....
(2 marks)

Turn over ►



(iii) Why does the addition of extra nitrate in **Experiment C** affect the yield in this way?

.....
.....

(1 mark)

(c) The use of large amounts of nitrate in artificial fertiliser causes problems. Rain washes nitrate into rivers, where it causes excessive plant growth and the death of fish. High concentrations of nitrate in drinking water have been linked with health problems in babies.

Explain how the farmer could improve the yield of his crops and at the same time reduce the environmental and health problems described above.

.....
.....
.....
.....

(2 marks)

9

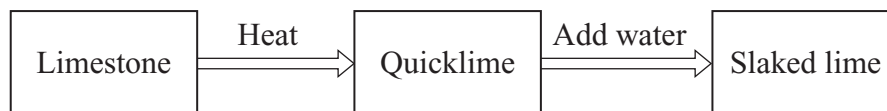


8 Limestone rock is almost pure calcium carbonate.

It is one of the few examples of a compound that can be quarried directly from the earth.

Limestone has a wide variety of uses in the building industry.

Quicklime and slaked lime are important compounds that can be manufactured from limestone.



(a) Give **one** use for limestone in the building industry.

.....
(1 mark)

(b) Complete the table with the chemical names for quicklime and slaked lime.

Common name	Chemical name	Chemical formula
Limestone	Calcium carbonate	CaCO_3
Quicklime		CaO
Slaked lime		Ca(OH)_2

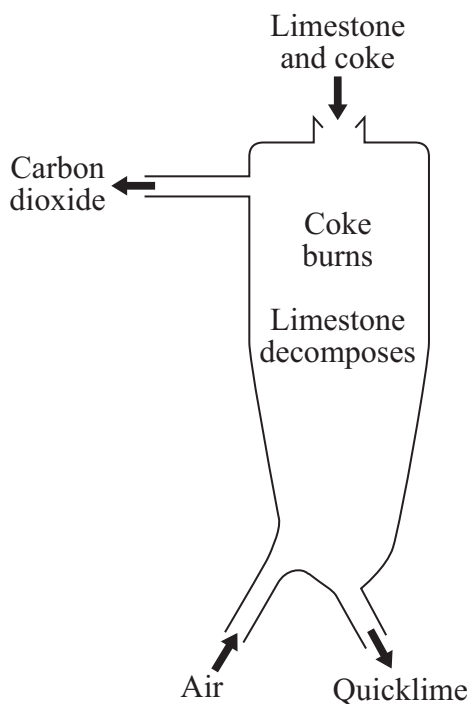
(2 marks)

Question 8 continues on the next page

Turn over ►



(c) Quicklime is manufactured from limestone in a coke-fired kiln.



(i) Coke (carbon) burns in the kiln in an exothermic reaction:



Write the symbol equation for the combustion of coke.

..... + → (2 marks)

(ii) Limestone decomposes in the kiln in an endothermic reaction:



Explain why the limestone does not decompose unless coke is burned in the kiln.

.....

(2 marks)



- (d) A mining company has applied to extend a limestone quarry in an area of natural beauty.

Read the article below and answer the question that follows.

**Protesters say NO!
to quarry extension**

A protest group will march through the village tomorrow to try to prevent the extension of the limestone quarry. Managers from the mining company have agreed to meet the environmental protesters and representatives of local residents so they can present their side of the argument. The mining company has agreed to carry out the blasting and the movement of heavy lorries only at certain times during weekdays. They are keen to stress that the quarry will bring much-needed employment to the area. The company has promised to restore the area when quarrying has finished. They will pay to set up a Ranger service and a local wildlife centre.

Give **two** reasons why you think that the protesters want to prevent the extension of the limestone quarry.

1

.....

2

.....

(2 marks)

9

Turn over for the next question

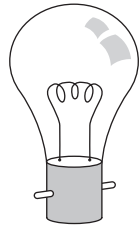
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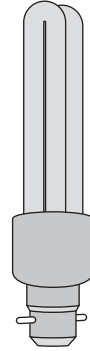
- 9 Electricity supplied to homes for heating and lighting is expensive.

Efficient electrical devices save money because they use less electrical energy.

The diagram shows two bulbs that give the same amount of light.



60 watt ordinary
light bulb



11 watt low-energy
light bulb

Low-energy light bulbs operate at a much lower temperature than ordinary light bulbs and use less than a quarter of the electricity.

An electrical engineer compared the two types of bulb to encourage customers to buy low-energy bulbs.

	Ordinary light bulb	Low-energy light bulb
Power	60 watts	11 watts
Cost	£0.22	£1.95
Average lifetime	0.5 years	6 years
Cost of electricity used in one year	£14.02	£2.57

- (a) The low-energy light bulb costs less to use per year because it is more efficient.

Percentage efficiency can be calculated using the formula:

$$\% \text{ efficiency} = \frac{\text{useful power transferred by the bulb}}{\text{total power supplied to the bulb}} \times 100$$

- (i) Why are ordinary light bulbs described as being less efficient?

.....

.....

(1 mark)



- (ii) Calculate the percentage efficiency of a 60 watt light bulb if 42 watts of power is lost from the bulb as heat.

.....

.....

% efficiency =
(2 marks)

- (b) Most customers decide not to buy low-energy light bulbs even though they are more efficient.

- (i) Why do most customers decide not to buy low-energy light bulbs?

.....

.....

(1 mark)

- (ii) Use calculations, and data from the table, to help you to explain why customers should buy low-energy light bulbs.

.....

.....

.....

.....

.....

.....

(3 marks)

- (c) Describe **two** other ways in which customers can reduce the amount of electrical energy used in their homes.

1

.....

2

.....

(2 marks)

END OF QUESTIONS



There are no questions printed on this page

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