

Surname		Other Names	
Centre Number		Candidate Number	
Candidate Signature			

Leave blank

General Certificate of Secondary Education
June 2006

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

3860/2H

H



Friday 16 June 2006 9.00 am to 10.30 am

<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 marked.

Information

- The maximum mark for this paper is 90.
- The marks for questions are shown in brackets.

For Examiner's Use			
Number	Mark	Number	Mark
1		5	
2		6	
3			
4			
Total (Column 1) →			
Total (Column 2) →			
TOTAL			
Examiner's Initials			

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

1 Chemical products are used on a farm to help produce a better crop.

(a) Complete the table below by writing the name of a chemical product next to its use.

One has been done for you.

Name of chemical product	Use
	Kills insects that might eat the crop
	Kills weeds that are growing with the crop
	Protects the crop from diseases
Artificial fertiliser	Supplies minerals to increase the growth of the crop

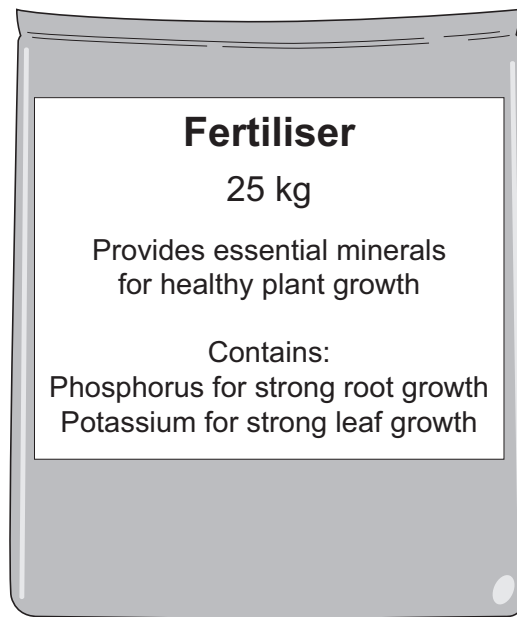
(3 marks)

(b) Why does killing the weeds help to increase the yield of a crop?

.....
.....

(1 mark)

- (c) The diagram shows a bag of artificial fertiliser.



- (i) Give the chemical symbols for the **two** elements in the fertiliser.

.....

.....

(2 marks)

- (ii) Name **two** other elements needed for healthy plant growth.

1

2

(2 marks)

Question 1 continues on the next page

Turn over ►

(d) Organic farmers increase crop yields without using chemical products.

(i) How does an organic farmer supply essential minerals to the crop?

.....

.....

(1 mark)

(ii) How does an organic farmer get rid of weeds?

.....

.....

(1 mark)

(iii) How does an organic farmer get rid of insects that might eat the crop?

.....

.....

(1 mark)

(e) The following table compares the cost and the yield of wheat produced by intensive farming methods and by more traditional organic methods.

	Intensive farming	Traditional methods
Cost to produce in £ per acre	83	52
Yield in tonnes per acre	4.0	2.3
Cost per tonne	£20.75	

(i) Explain why traditional methods produce a lower yield per acre.

.....

.....

.....

.....

(2 marks)

(ii) Calculate the cost per tonne of wheat produced by traditional methods.

Show your working.

.....
.....

Cost £ per tonne
(2 marks)

(f) A farmer uses selective breeding to improve his wheat.

What **three** features of the wheat could he choose to improve?

1
2
3
(3 marks)

(g) The crops produced by organic farming methods are usually more expensive, but many farmers choose to farm in this way.

Give **three** arguments in favour of organic farming.

1
.....
2
.....
3
.....
(3 marks)

Turn over for the next question

Turn over ▶

2 Metals are useful materials.

An engineer will choose a metal for a particular use because it has the right properties.

- (a) Metals are strong, and they have other important properties.

Give **one** important property related to their use, apart from strength, for each of the metals listed in the table.

One has been done for you.

Metal	Use	Property
Copper	Making wires	
Lead	Weights for divers	
Silver	Making jewellery	
Zinc	Protecting iron from corrosion	Corrodes easily

(3 marks)

- (b) High tensile strength shows that there are strong forces of attraction between the atoms in a metal structure.

The forces of attraction between the atoms affect the melting point of the metal.

The tensile strength of some metals is given in the table below.

Metal	Tensile strength in MPa
Copper	230
Lead	15
Silver	190
Zinc	140

- (i) Which metal in the table would you expect to have the highest melting point?

Give a reason for your answer.

.....

.....

.....

.....

(2 marks)

- (ii) Describe the forces that hold the atoms together in a metal structure.

.....

.....

.....

.....

(2 marks)

Question 2 continues on the next page

Turn over ►

- (c) Brass is an alloy made by mixing copper and zinc together.

The table shows how the amount of zinc in the alloy affects its tensile strength.

Percentage zinc by mass in the alloy	Tensile strength in MPa
0	230
10	260
20	300
30	330

- (i) Describe how the amount of zinc affects the tensile strength of the alloy.

.....

.....

.....

.....

(2 marks)

- (ii) Explain why adding atoms of a different metal makes an alloy harder and less malleable than the original metal.

.....

.....

.....

.....

(2 marks)

- (d) Brass is used to make taps and ornaments.

Give **two** reasons why brass is a better choice for making taps and ornaments than zinc.

Use the information that was given in parts (a), (b) and (c) to help you.

1

2

(2 marks)

(e) Describe an experiment to test the strength of copper, zinc and brass.

You may use a labelled diagram to help you describe the apparatus.

.....

.....

.....

.....

.....

.....

(3 marks)

16

Turn over for the next question

Turn over ►

3 The skin is an important organ that protects us from infection and helps us to control our body temperature.

(a) Control of body temperature involves the sweat glands and changes to the diameter of blood capillaries in the skin.

(i) Explain how sweat glands help to control body temperature.

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

(2 marks)

(ii) Explain how changes to the diameter of blood capillaries help to control body temperature.

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

(2 marks)

- (b) Some people are born without any colouring in their skin.

This is an inherited condition known as albinism.

To have a child with albinism, both parents must carry the affected gene.

- (i) Although both parents carry the gene for albinism, they do not have the condition.

What is the correct word used to describe the gene for albinism?

.....
(1 mark)

- (ii) Using the symbols

A for the unaffected gene

a for the affected gene

draw and label a diagram to show how albinism can be inherited from two unaffected parents who both carry the affected gene.

(4 marks)

- (iii) What is the chance of the parents having a child with albinism?

.....
(1 mark)

Question 3 continues on the next page

Turn over ►

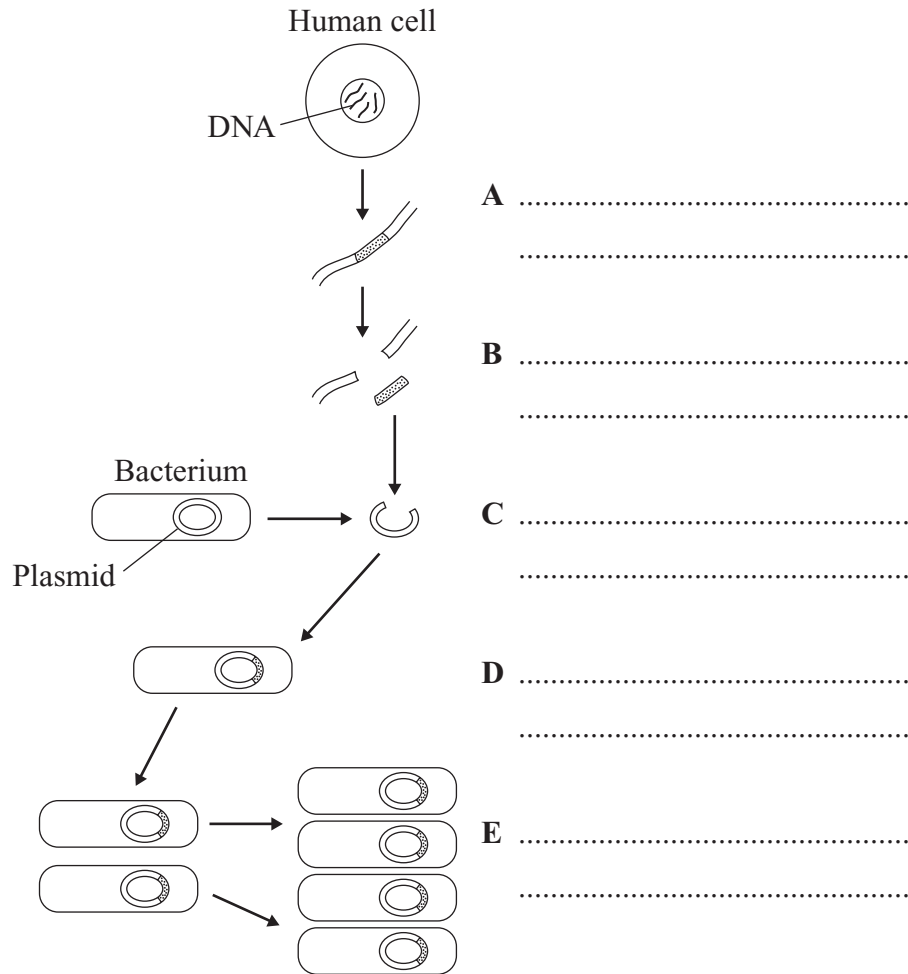
(c) Name the structure in the nucleus where DNA is found.

.....
(1 mark)

(d) Genetic engineering is used to transfer genes from one cell to another.

The following diagram shows how insulin is produced using genetic engineering.

Explain what is happening at each stage in the process.



A
.....
B
.....
C
.....
D
.....
E
.....

(5 marks)

(e) What is the name of the type of cell division that occurs at **E**?

.....
(1 mark)

(f) Give **two** other ways in which scientists have made use of genetic engineering.

1

.....

2

.....

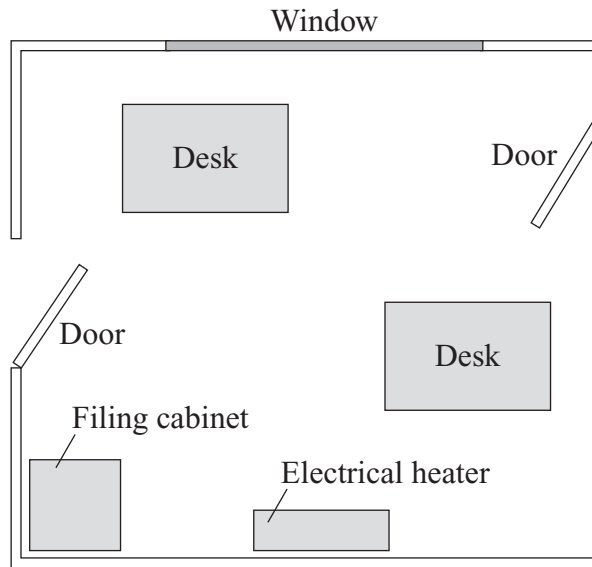
(2 marks)

19

Turn over for the next question

Turn over ►

4 An oil filled electrical heater is used to heat a small office.



The electrical heater has a power output of 3 kilowatts.

The electrical heater is switched on for 8 hours each day.

- (a) Use the equation below to calculate the electrical energy used by the heater when it is switched on for 8 hours.

$$\text{Energy used (kilowatt-hours)} = \text{power (kilowatts)} \times \text{time (hours)}$$

.....
.....

..... kilowatt-hours
(2 marks)

- (b) One kilowatt-hour of electricity costs 7p.

Calculate the cost of using the electrical heater for one day.

.....
.....

Cost = p
(2 marks)

- (c) Use the equation below to calculate the current used by the heater when it is operated with a potential difference (voltage) of 240 volts.

$$\text{power (watts)} = \text{current (amps)} \times \text{voltage (volts)}$$

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

(4 marks)

- (d) Give **two** ways in which heat is transferred from the electrical heater to the room.

1

2

(2 marks)

- (e) Give **two** ways to stop heat escaping from the room.

1

2

(2 marks)

- (f) Suggest **one** reason why it is better to have the radiator filled with oil and not water.

.....
.....

(1 mark)

Turn over for the next question

5 Methane is a fossil fuel used for heating homes.

Methane is classified as an organic compound.

(a) Give **two** reasons why methane is a suitable fuel for heating homes.

1

2

(2 marks)

(b) Explain why methane is classified as an organic compound.

.....

.....

(1 mark)

(c) The chemical equation for the burning of methane is given below.

The equation is not balanced.



Energy change when bonds are broken = 2640 kilojoules.

Energy change when bonds are formed = 3338 kilojoules.

(i) Name the elements in methane.

.....

(1 mark)

(ii) Balance the equation by writing a number in the space provided. (1 mark)

(iii) Name the products formed when methane burns.

.....

.....

(2 marks)

(iv) Draw a ring around the **two** words that correctly describe this reaction.

combustion **endothermic** **exothermic** **neutralisation** (2 marks)

(v) Calculate the overall energy change for the burning of methane.

.....
.....

..... kilojoules
(2 marks)

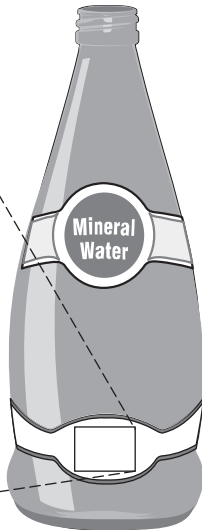
11

Turn over for the next question

Turn over ►

6 The diagram shows a label from a bottle of mineral water.

Natural Mineral Water			
500 ml			
Typical analysis (mg/litre)			
Calcium (Ca^{2+})	11.5	Sulphates (SO_4^{2-})	8.1
Potassium (K^+)	6.2	Chlorides (Cl^-)	13.5
Magnesium (Mg^{2+})	8.0	Nitrates (NO_3^-)	6.3
Sodium (Na^+)	11.6	Bicarbonates (HCO_3^-)	71.0
Dry residue = 130 mg/litre			



(a) A technician working at the bottling plant was asked to check the amount of solid dissolved in the water.

(i) Describe how the technician could measure the amount of solid dissolved in 500 ml of the water.

.....

.....

.....

.....

.....

.....

(3 marks)

(ii) Calculate the expected result of the experiment.

.....

.....

(2 marks)

- (b) The dry residue contains a mixture of ionic compounds.

Sodium chloride (NaCl) is likely to be present in the dry residue.

- (i) Describe the chemical bonding in sodium chloride.

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

(2 marks)

- (ii) Explain why sodium chloride has a high melting point.

.....
.....

(1 mark)

- (iii) Name and write the formula for one other ionic compound that may be present in the dry residue.

Name

Formula

(2 marks)

10

END OF QUESTIONS

There are no questions printed on this page