

**GENERAL CERTIFICATE OF SECONDARY EDUCATION**  
**GATEWAY SCIENCE**  
**BIOLOGY B**

Unit 2 Modules B4 B5 B6 (Higher Tier)

**TUESDAY 17 JUNE 2008**

Morning  
Time: 1 hour

Candidates answer on the question paper.

**Additional materials (enclosed):**  
None

Calculators may be used.

**Additional materials:** Pencil  
Ruler (cm/mm)



Candidate Forename

Candidate Surname

Centre Number

Candidate Number

**INSTRUCTIONS TO CANDIDATES**

- Write your name in capital letters, your Centre Number and Candidate Number in the boxes above.
- Use blue or black ink. Pencil may be used for graphs and diagrams only.
- Read each question carefully and make sure that you know what you have to do before starting your answer.
- Answer **all** the questions.
- Do **not** write in the bar codes.
- Write your answer to each question in the space provided.

**INFORMATION FOR CANDIDATES**

- The number of marks for each question is given in brackets [ ] at the end of each question or part question.
- The total number of marks for this paper is **60**.

FOR EXAMINER'S USE		
Section	Max.	Mark
A	20	
B	20	
C	20	
<b>TOTAL</b>	<b>60</b>	

This document consists of **24** printed pages.

Answer **all** the questions.

**Section A – Module B4**

1 Matt has a compost heap in his garden.

He fills it with dead leaves and grass cuttings which decay to form compost.



(a) (i) Matt adds earthworms to the compost to increase the rate of decay.

Explain why adding earthworms increases the rate of decay.

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

(ii) What word describes earthworms?

Put a **ring** around the correct answer.

**decomposers**

**detritivores**

**producers**

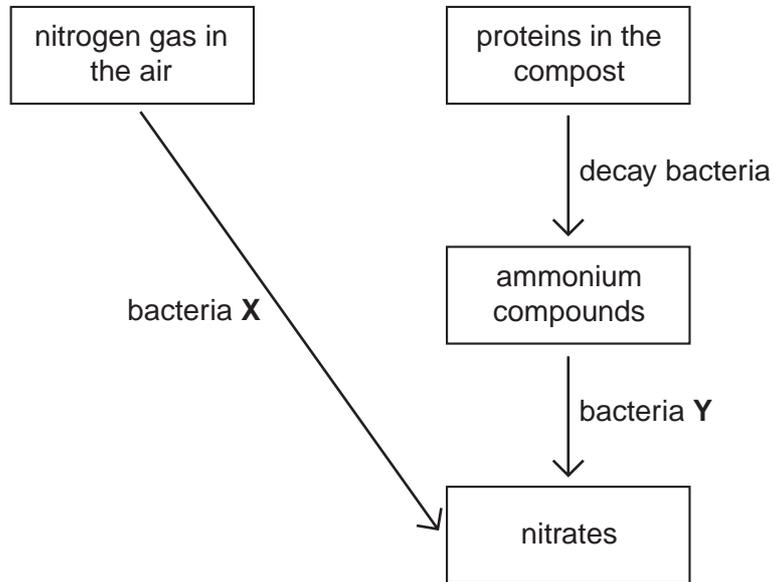
**saprophytes**

[1]

(b) Matt uses his compost to fertilise the soil in his garden.

The compost continues to break down as part of the nitrogen cycle.

Look at the diagram of part of the nitrogen cycle.



(i) What type of bacteria are bacteria X?

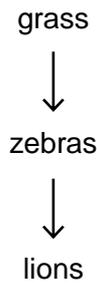
..... [1]

(ii) What type of bacteria are bacteria Y?

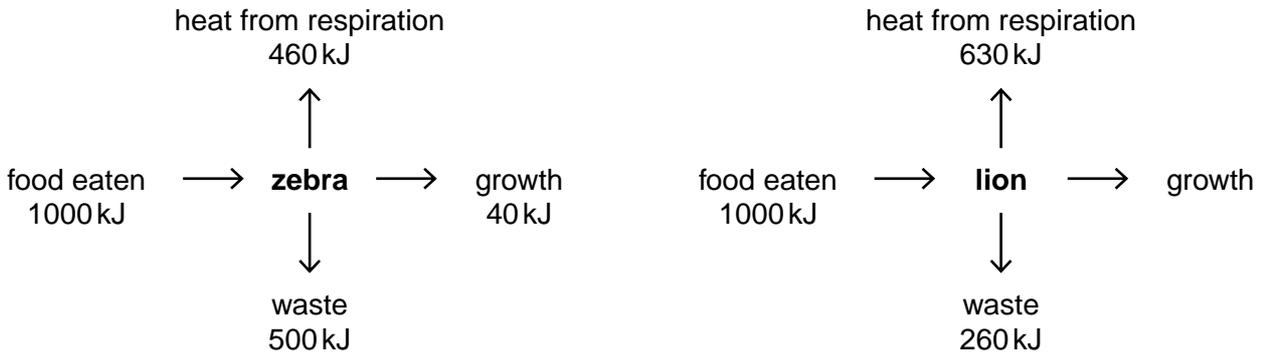
..... [1]

[Total: 5]

2 Look at the food chain found in Africa.



The diagrams below show how a zebra and a lion transfer energy.



(a) (i) For every 1000 kJ of food energy, how much energy does the **lion** use for growth?  
 ..... kJ [1]

(ii) For every 1000 kJ of food energy, the amounts of energy that a lion cub transfers as heat, growth and waste are different from an adult lion.

Suggest **one** way that the amounts of energy a lion cub transfers would be different from an adult lion.

.....

Explain your answer. ....

..... [1]

(b) The efficiency of energy transfer from food to growth in lions is 11%.

The efficiency of energy transfer from food to growth in zebras is less than this.

(i) Calculate the efficiency of energy transfer from food to growth in zebras.

Show your working.

..... % [2]

(ii) The efficiency of energy transfer from food to growth in zebras is less than in lions.

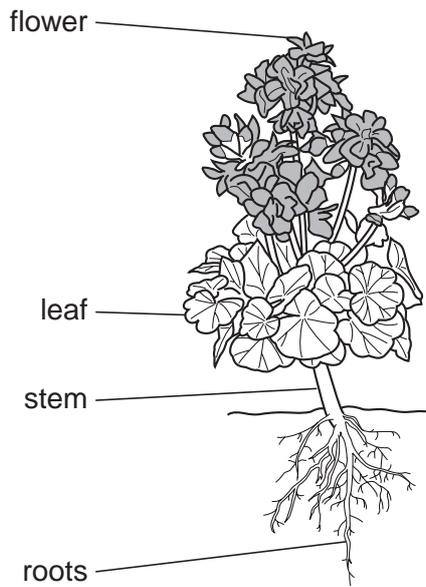
This is because they lose more energy in their waste.

Suggest why.

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

[Total: 5]

3 Kate is growing geraniums in her garden.



(a) Geranium leaves are adapted for efficient photosynthesis.

Describe **two** ways leaves are adapted for efficient photosynthesis.

1 .....

.....

2 .....

..... [2]

(b) Plants lose water from their leaves. This is called transpiration.

Describe how transpiration happens.

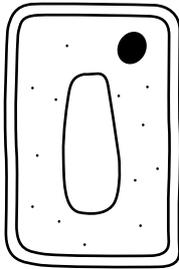
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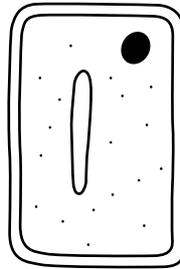
..... [2]

- (c) Kate wants to put one of her geraniums in a pot. She digs up one of them. Unfortunately many of the roots break off. She plants the geranium in a pot. However, even though she waters it regularly, the geranium wilts (droops).

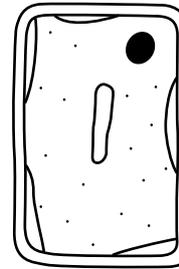
Look at the diagrams of different plant cells.



A



B



C

- (i) Which cell is **most** likely to come from the leaves of the wilting geranium?

Choose from **A**, **B** or **C**.

.....

[1]

- (ii) What word describes cell **A**?

Put a **ring** around the best answer.

**flaccid**

**plasmolysed**

**turgid**

[1]

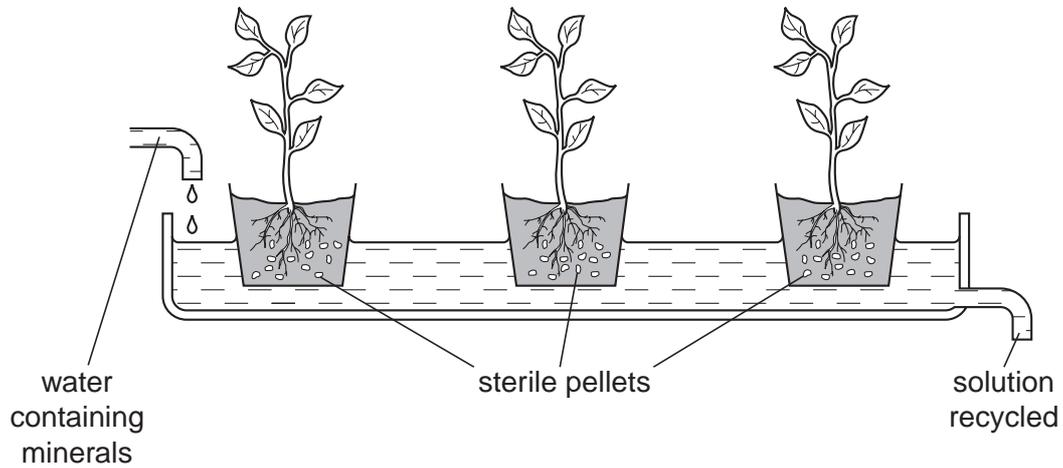
[Total: 6]

4 Chris grows tomato plants in a glass house.

He uses hydroponic farming techniques.

This means he does **not** grow his tomato plants in soil.

Instead he grows them with their roots in water.



(a) (i) Chris adds different minerals to the water the tomato plants grow in.

If he does **not** do this, the plants will **not** be healthy and will **not** grow properly.

Draw a straight line to match each **mineral deficiency** with the example of **poor growth** caused by it.

Draw **three** lines only.

**mineral deficiency**

nitrate

phosphate

potassium

**poor growth**

poor flower and fruit growth

poor root growth

yellow leaves

[2]

(ii) Minerals move through plants in vessels.

What is the name of the type of vessel that transports minerals?

..... [1]

(b) Suggest **one** advantage of using hydroponic farming techniques compared to growing plants in soil.

.....

..... [1]

[Total: 4]

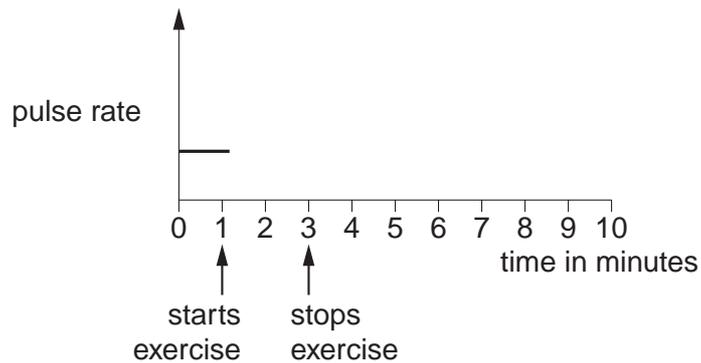
Section B – Module B5

5 This question is about the blood system.

- (a) Paul exercises for two minutes by running around the school field. He then sits down and measures his pulse rate every minute. After another five minutes his pulse rate returns to normal.

How would you expect Paul's pulse rate to change when he exercises and then sits down?

Show your answer by completing the line on the graph.



[2]

- (b) Your pulse is caused by your heart beating. Sometimes the heart does not work properly and has to be treated.

Draw a straight line to match each **heart condition** with its correct **treatment**. Draw **two** lines only.

**heart condition**

blocked coronary artery

damaged valves

**treatment**

artificial replacement

bypass surgery

pacemaker

[2]

(c) Heart beats are controlled by the pacemaker cells in the heart.

Explain how the different types of pacemaker cells control heart beats.

.....

.....

.....

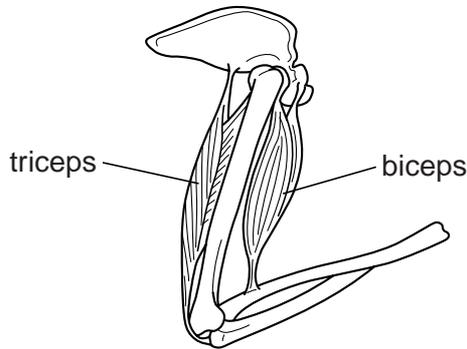
.....

..... [3]

[Total: 7]

6 This question is about skeletons and bones.

- (a) Skeletons contain joints.  
Look at the diagram of the elbow joint.



The biceps and triceps muscles work together to move the arm.

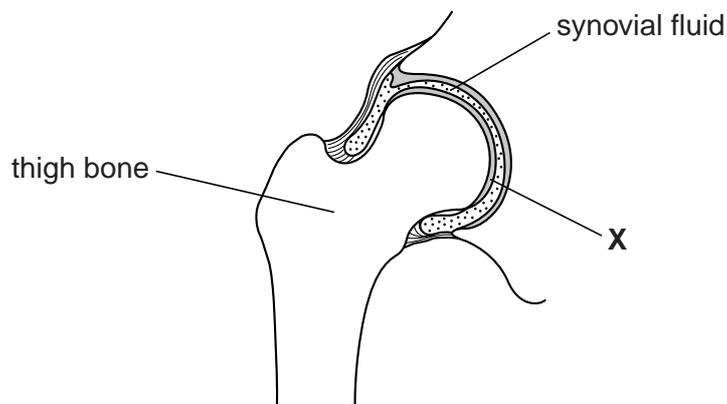
How do they work together to **straighten** the arm?

Put a tick (✓) in the correct box.

biceps	triceps	
contracts	contracts	
contracts	relaxes	
relaxes	contracts	
relaxes	relaxes	

[1]

- (b) Look at the diagram of a hip joint.



- (i) Substance X covers the end of the thigh bone.

Write down the name of substance X.

..... [1]

(ii) The joint contains synovial fluid.

If a joint does **not** contain enough synovial fluid it will **not** move properly.

Explain why.

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

(c) Lynne is ill.

She needs a bone marrow transplant from a donor.

Write down **two** things that would make someone a suitable donor.

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

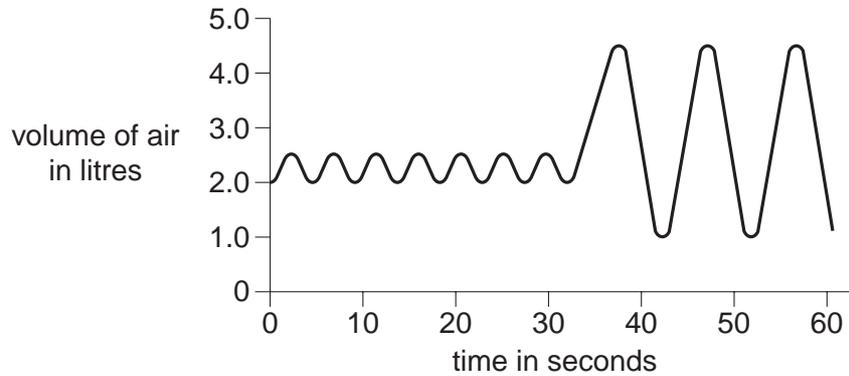
[Total: 5]

7 Kate uses a spirometer to investigate her lung capacity.

She breathes normally for 30 seconds.

She then breathes in and out as deeply as she can.

The graph shows her results.



(a) What is Kate's vital capacity? ..... litres [1]

(b) Kate's residual air volume is 1.0 litre.

What is **residual air**?

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

(c) When Kate breathes in and out the volume and pressure inside her lungs change.

How do they change when she starts to breathe **in**?

Put a tick (✓) in the correct box.

volume	pressure	
increases	increases	
increases	decreases	
decreases	increases	
decreases	decreases	

[1]

(d) If she wants to, Kate can control her breathing rate.

However, usually it is controlled automatically.

For example, if she exercises, her breathing rate automatically increases.

What causes this automatic increase?

Put a tick (✓) in the correct box.

increased CO<sub>2</sub> concentration in the blood

increased CO<sub>2</sub> concentration in the lungs

decreased O<sub>2</sub> concentration in the blood

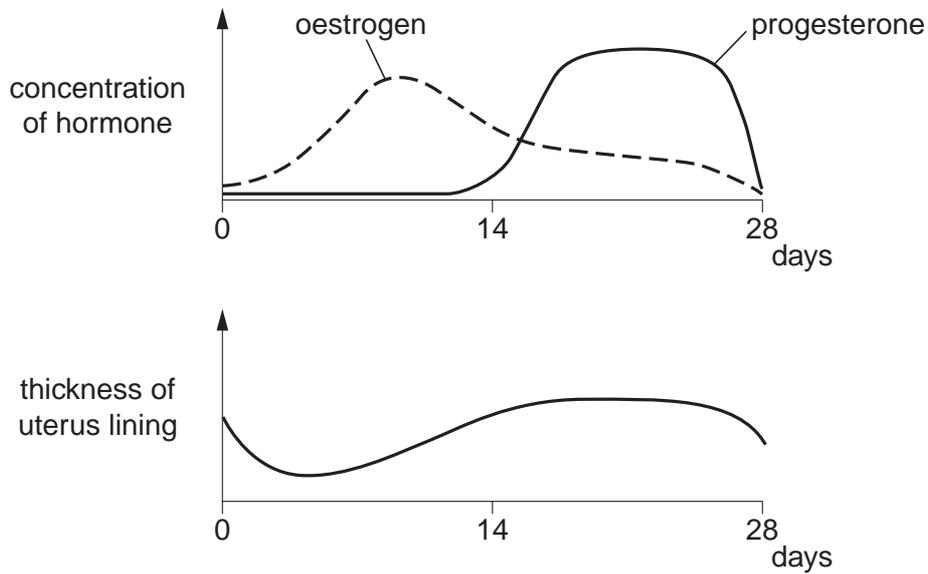
decreased O<sub>2</sub> concentration in the lungs

[1]

[Total: 4]

8 Look at the graphs.

They show changes in the levels of oestrogen and progesterone and the thickness of the uterus lining during the menstrual cycle.



(a) Why is it important that the uterus lining becomes thicker during the menstrual cycle?

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

(b) How does oestrogen affect the thickness of the uterus lining?

..... [1]

(c) At the end of the menstrual cycle, the level of progesterone decreases.

However, during pregnancy, the level of progesterone stays high.

Suggest why the level of progesterone needs to stay high.

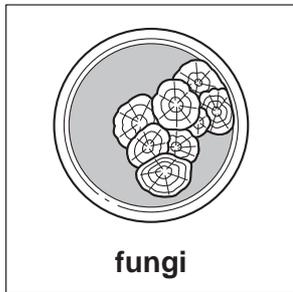
.....  
 .....  
 ..... [2]

[Total: 4]

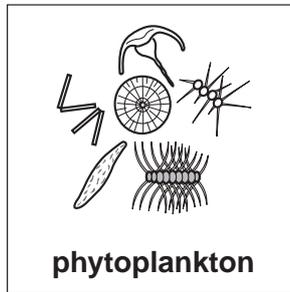
Section C – Module B6

9 The diagrams show different types of organisms.

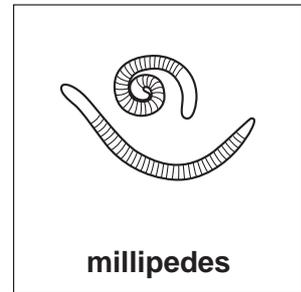
They are not drawn to the same scale.



fungi



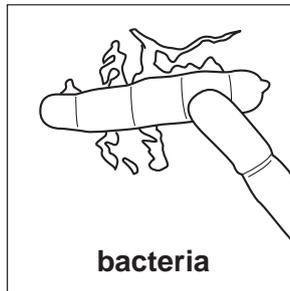
phytoplankton



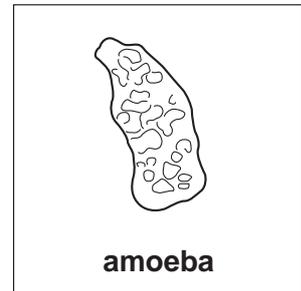
millipedes



zooplankton



bacteria



amoeba

(a) Answer the questions by choosing from the organisms in the diagrams.

(i) Write down the name of the organism which is a detritivore in soil.

..... [1]

(ii) Write down the name of the organism which does **not** have 'true' nuclei.

..... [1]

(b) Sir Alexander Fleming made an important discovery involving two of these types of organisms.

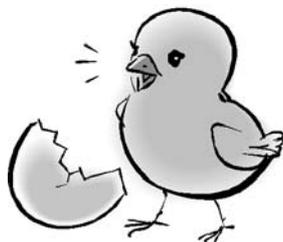
Describe Alexander Fleming's discovery.

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

[Total: 4]

10 Read the article that appeared in a recent newspaper.

### Chickens with valuable eggs



A group of scientists have produced chickens that lay eggs containing an anti-cancer protein. This was done using genetic engineering.

The scientists looked at the human genetic code and found a human gene that makes an anti-cancer protein.

They 'cut' this gene out of a human chromosome and put it into a male chick.

The chick grew up, mated and produced many chickens. Some of these laid eggs containing the anti-cancer protein.

- (a) The chickens had their genes altered to make the anti-cancer protein.

What is the name given to an organism that has had a new gene put into it?

..... [1]

- (b) The gene coding for the human protein was 'cut' out of a chromosome using an enzyme.

Write down the name of the type of enzyme which is used.

..... [1]

- (c) Some of the chickens produced eggs containing the anti-cancer protein.

Some of the chickens produced eggs that did **not** contain the anti-cancer protein.

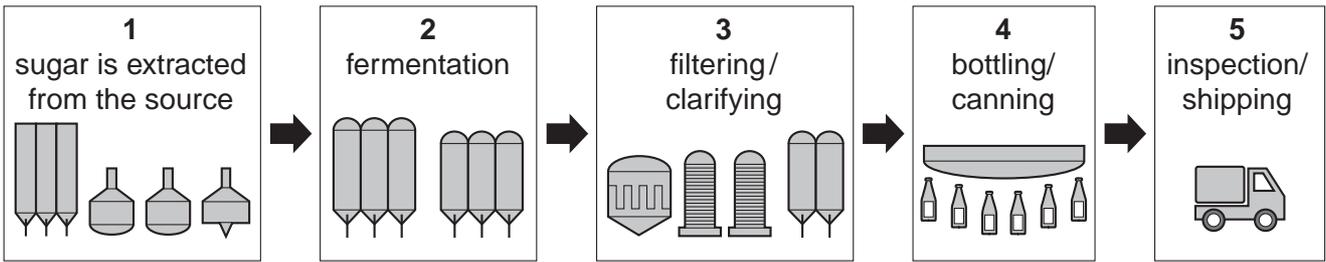
Suggest why.

.....

..... [1]

[Total: 3]

11 The diagram shows some steps in beer making.



(a) In which step, 1, 2, 3, 4 or 5, is the yeast removed from the beer?

..... [1]

(b) In which step, 1, 2, 3, 4 or 5, is the beer pasteurised?

..... [1]

(c) Beer usually contains about 5% alcohol.

Describe how beer could be treated to increase the concentration of alcohol and produce a spirit.

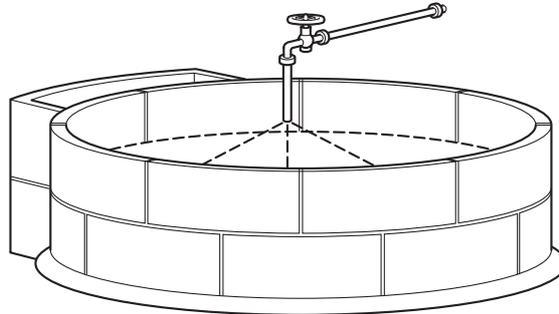
.....  
 .....  
 ..... [2]

[Total: 4]

12 Biogas is a mixture of gases that can be used as a fuel.

It is often used in remote parts of the world.

The diagram shows a digester that is used to make biogas.



(a) Biogas contains a mixture of gases.

Write down the name of the main gas in biogas.

..... [1]

(b) It is important to control the temperature in a digester.

Why is this?

Put a tick (✓) in the box next to the correct reason.

If the temperature is too high the organic material will produce biogas too quickly.

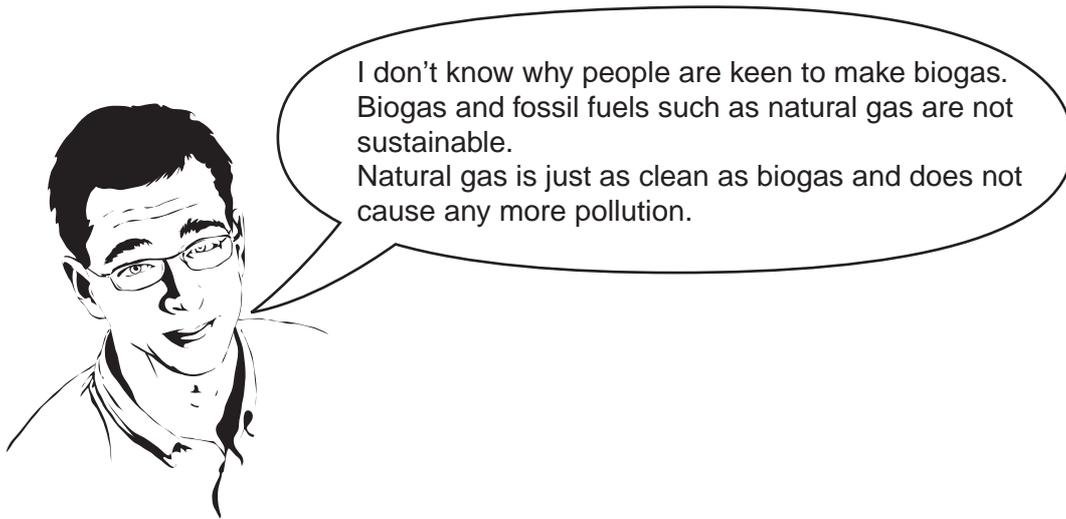
Enzymes in the bacteria work best at a particular temperature.

At very high temperatures the enzymes in the bacteria will produce other products.

At an optimum temperature the organic matter will produce biogas without any bacteria.

[1]

(c) Tim has some views on using biogas.



Complete these explanations to show why Tim's ideas are **incorrect**.

Biogas is a sustainable fuel because .....

.....  
.....

Natural gas causes more pollution than biogas because .....

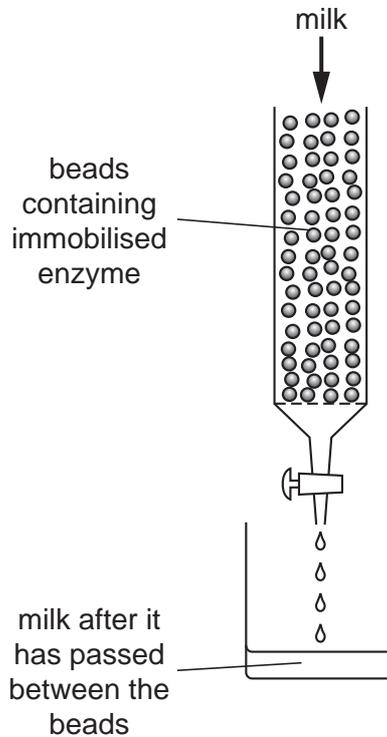
.....  
..... [2]

[Total: 4]

13 Enzymes have many uses.

Some enzymes can be immobilised (trapped) in beads.

One type of immobilised enzyme is used to break down the sugar in milk.



(a) Look at the list.

- |         |         |           |         |
|---------|---------|-----------|---------|
| amylase | glucose | galactose | lactose |
|         | lactase | sucrase   | sucrose |

Use words from the list to complete these sentences.

The enzyme in the beads is .....

The sugar in milk is converted to ..... and ..... [2]

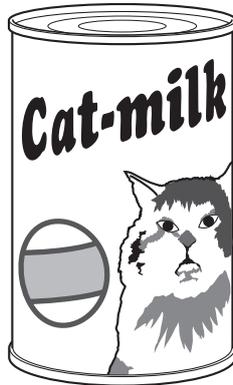
(b) The sugar in milk could be broken down by adding the enzyme to a beaker of milk.

Write down **one** reason why it might be better to use the immobilised enzyme.

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

(c) The picture shows milk that has been prepared using the immobilised enzyme.

This milk has been treated so that it can be given to cats.



Why is it best to treat milk in this way before giving it to cats?

.....

.....

..... [2]

[Total: 5]

**END OF QUESTION PAPER**

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