

**GCSE (9–1) Biology A (Gateway Science) F**  
**J247/02 Paper 2 (Foundation Tier)**  
Sample Question Paper

**Date – Morning/Afternoon**

Version 2.1

Time allowed: 1 hour 45 minutes



**You may use:**

- a scientific or graphical calculator
- a ruler



First name

Last name

Centre  
number

Candidate  
number

**INSTRUCTIONS**

- Use black ink. You may use an HB pencil for graphs and diagrams.
- Complete the boxes above with your name, centre number and candidate number.
- Answer **all** the questions.
- Write your answer to each question in the space provided.
- Additional paper may be used if required but you must clearly show your candidate number, centre number and question number(s).
- Do **not** write in the bar codes.

**INFORMATION**

- The total mark for this paper is **90**.
- The marks for each question are shown in brackets [ ].
- Quality of extended response will be assessed in questions marked with an asterisk (\*).
- This document consists of **32** pages.

**SECTION A**

Answer **all** the questions.

You should spend a maximum of 30 minutes on this section.

- 1** Which statement is an example of sustainability?
- A** Harvesting selected trees from a forest and replanting.
  - B** Replacing forests with food crops.
  - C** Taking fish from the sea faster than they can reproduce.
  - D** Using crude oil to make plastics.

Your answer

**[1]**

- 2** Many habitats are being destroyed.  
It is important to stop habitat destruction to maintain:

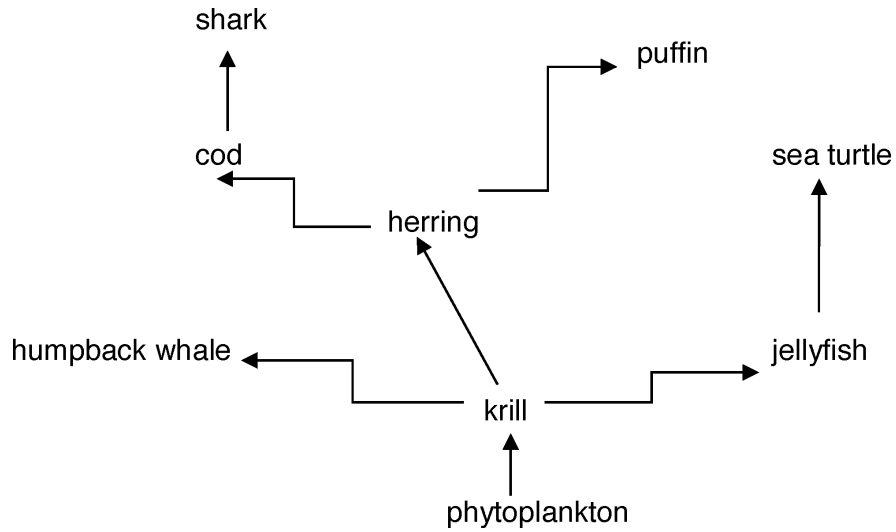
- A** Active transport
- B** Biodiversity
- C** Differentiation
- D** Homeostasis

Your answer

**[1]**



3 The diagram shows a food web.



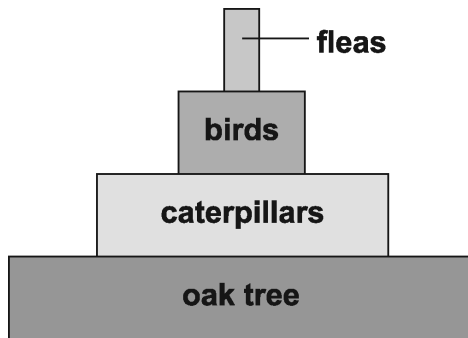
What is the most likely effect on the food web, if the number of cod decreases?

- A An increase in the number of herrings
- B An increase in the number of krill
- C An increase in the number of sharks
- D No effect on the population of puffins

Your answer

[1]

- 4 Look at the pyramid of biomass.



What can you tell from this pyramid of biomass?

- A All four trophic levels contain consumers.
- B Fleas are producers.
- C The trophic level with oak trees has the lowest biomass.
- D There are fewer birds than caterpillars.

Your answer

[1]

- 5 Organisms in an ecosystem are affected by **biotic** factors.

Which term is a biotic factor?

- A Disease
- B Light intensity
- C Rainfall
- D Wind speed

Your answer

[1]



6 What are the names of the two scientists who first suggested the theory of natural selection?

- A Darwin and Mendel
- B Mendel and Wallace
- C Wallace and Darwin
- D Watson and Crick

Your answer

[1]

7 A sperm cell of a mouse has 20 chromosomes.

Which row in the table shows the correct number of chromosomes in each cell?

	Number of chromosomes in	
	a mouse egg cell	a mouse eye cell
<b>A</b>	20	20
<b>B</b>	20	40
<b>C</b>	40	20
<b>D</b>	40	40

Your answer

[1]

8 The DNA of an unborn baby can be found in the blood sample of the mother.

This DNA is tested to see which chromosomes are present.

Which conclusion is correct for the unborn baby?

- A It must be a boy if an X chromosome is present.
- B It must be a boy if a Y chromosome is present.
- C It must be a girl if an X chromosome is present.
- D It must be a girl if a Y chromosome is present.

Your answer

[1]

9 Different diseases are caused by different pathogens.

Which type of pathogen causes tobacco mosaic disease?

- A A bacterium
- B A fungus
- C A protist
- D A virus

Your answer

[1]

10 What may a vaccine contain?

- A Antibiotics specific to the microbe
- B Dead microbes
- C Memory cells
- D Small numbers of live harmful microbes

Your answer

[1]

11 Scientists want to make human stem cells from body cells rather than getting stem cells from embryos.

Why is this?

- A Human embryos are single-celled.
- B Some people object to destroying human embryos.
- C Stem cells cannot be found in human embryos.
- D The cells in human embryos are all differentiated.

Your answer

[1]



12 New drugs are tested on humans, animals and tissues.

Which order is used when tested?

- A Animals – tissues – humans
- B Humans – animals – tissues
- C Tissues – animals – humans
- D Tissues – humans – animals

Your answer

[1]

13 Why is it difficult to kill cancer cells in the body?

- A They are body cells and so the body's defence system does not attack them.
- B They are foreign cells that are not destroyed by antibiotics.
- C They divide very slowly.
- D They hide inside other body cells, away from the body's defence system.

Your answer

[1]

14 Heart disease affects a large number of people.

Which factor contributes to heart disease?

- A Being a non-smoker
- B Lack of exercise
- C Low fat diet
- D Not drinking alcohol

Your answer

[1]

15 Look at the table.

It shows the death rates from coronary heart disease (CHD) in the UK in 2008.

Death rates from CHD per 100,000 population			
Age 55–64		Age 65–74	
Men	Women	Men	Women
175	47	443	179

In 2008 the total number of deaths per 100,000 in both age ranges was 844.

What percentage of these deaths were women?

- A 5.6%
- B 21.2%
- C 22.6%
- D 26.8%

Your answer

[1]

**9**  
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**TURN OVER FOR THE NEXT QUESTION**

**SECTION B**

Answer **all** the questions.

**16** Different parts of the body have natural defence mechanisms to stop pathogens infecting the body.

These defences include:

- skin
- tears
- secretions from the stomach.

**(a)** Describe how each defence stops pathogens infecting the body.

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.....  
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.....  
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**[4]**

**(b)** Sometimes the defence mechanisms do **not** work and pathogens enter the body. The pathogens may then be treated with antibiotics.

What is an antibiotic?

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.....  
.....

**[2]**

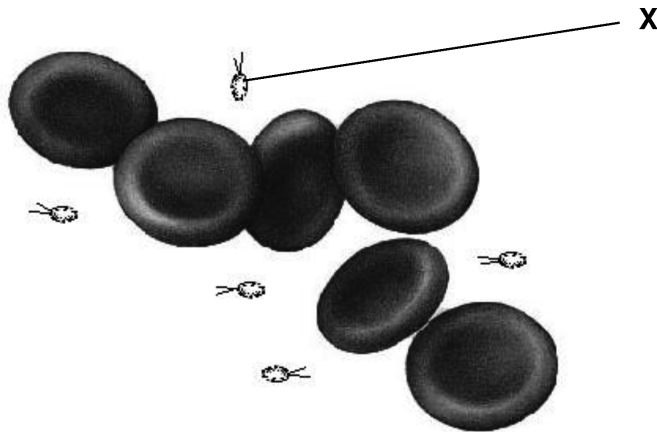
- (c) A student is ill and is having tests in hospital. His doctors monitor his body temperature frequently.

Explain why it is important to monitor his body temperature frequently.

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

- (d) The doctors took a sample of blood from the student. They looked at the specimen under a light microscope.

This is a picture of what they saw.



From this picture, the doctors decide that the student's illness is caused by bacteria (labelled X).

- (i) Why do the doctors **not** think that the structures labelled X are viruses?

..... [1]

- (ii) What equipment could the doctors use to get a clearer image to confirm their ideas?

..... [1]

- (e) The student's doctors want to check that the bacteria causing his illness are not resistant to the antibiotic erythromycin.

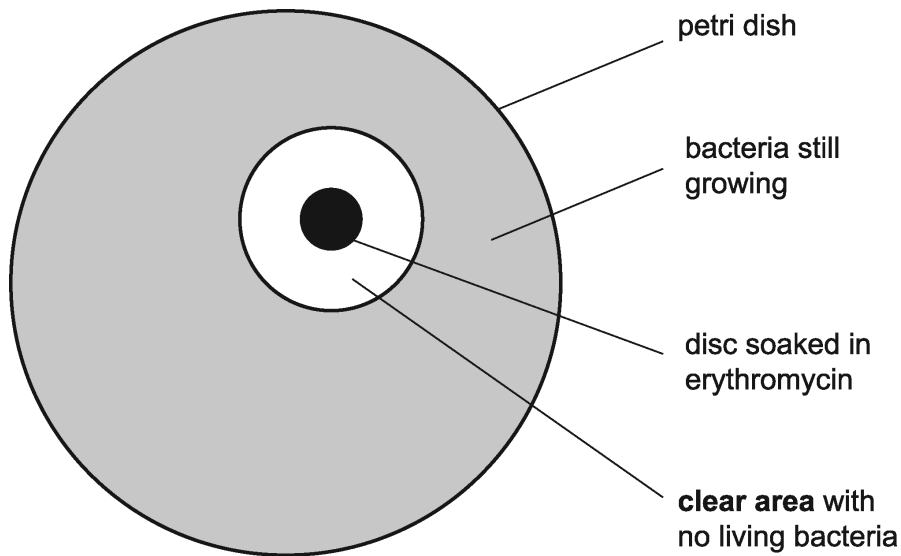
This is the method they use:

1. A petri dish is made that has the bacteria growing evenly over the surface of agar.
2. A disc of filter paper is soaked in erythromycin.
3. The disc is placed on the agar in the centre of the petri dish.
4. The lid of the dish is fixed on with a piece of tape.
5. The dish is then incubated.

- (i) Why did the doctors tape the lid on the petri dish?

..... [1]

- (ii) The diagram shows the doctor's results.



Use a ruler to measure the diameter of the **clear area** in mm.

Using this diameter, calculate the area of the circle where there are no living bacteria.

- The area of a circle =  $\pi r^2$  and  $\pi = 3.14$

Answer = ..... mm<sup>2</sup> [3]

(iii) This table is used to analyse the results of the experiment.

<b>Area clear of bacteria including the area of the disc (mm<sup>2</sup>)</b>	<b>Level of resistance</b>
less than 133	resistant
133 to 416	intermediate resistance
more than 416	not resistant

Use your result from part (ii) to judge the level of resistance in the microbe.

..... [1]

17 Rheumatic fever is a rare disease in the UK.

Look at this information.

**Rheumatic fever information leaflet**

Bacteria can enter the mouth and cause a sore throat.

This may develop into rheumatic fever.

Rheumatic fever is much more likely if a person does not get enough food or lives in overcrowded conditions.

White blood cells in the body make protein molecules to kill the bacteria causing rheumatic fever.

However, sometimes these molecules attack heart valves, making them leaky.

(a) (i) Put ticks (✓) in the **two** boxes that best describe rheumatic fever.

a communicable disease	
a disease that is affected by lifestyle	
a disease that is caused by defective alleles	
a non-communicable disease	

[1]

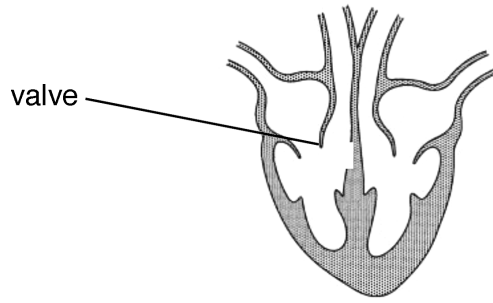
(ii) White blood cells make protein molecules that can kill the bacteria.

What is the name of these protein molecules?

..... [1]



(iii) The diagram shows one of the valves that can be made leaky.



People who have this leaky valve often have these symptoms:

- they get out of breath easily
- they do not seem to have much energy and feel tired.

Write about the job of this valve and how damage to the valve may cause these symptoms.

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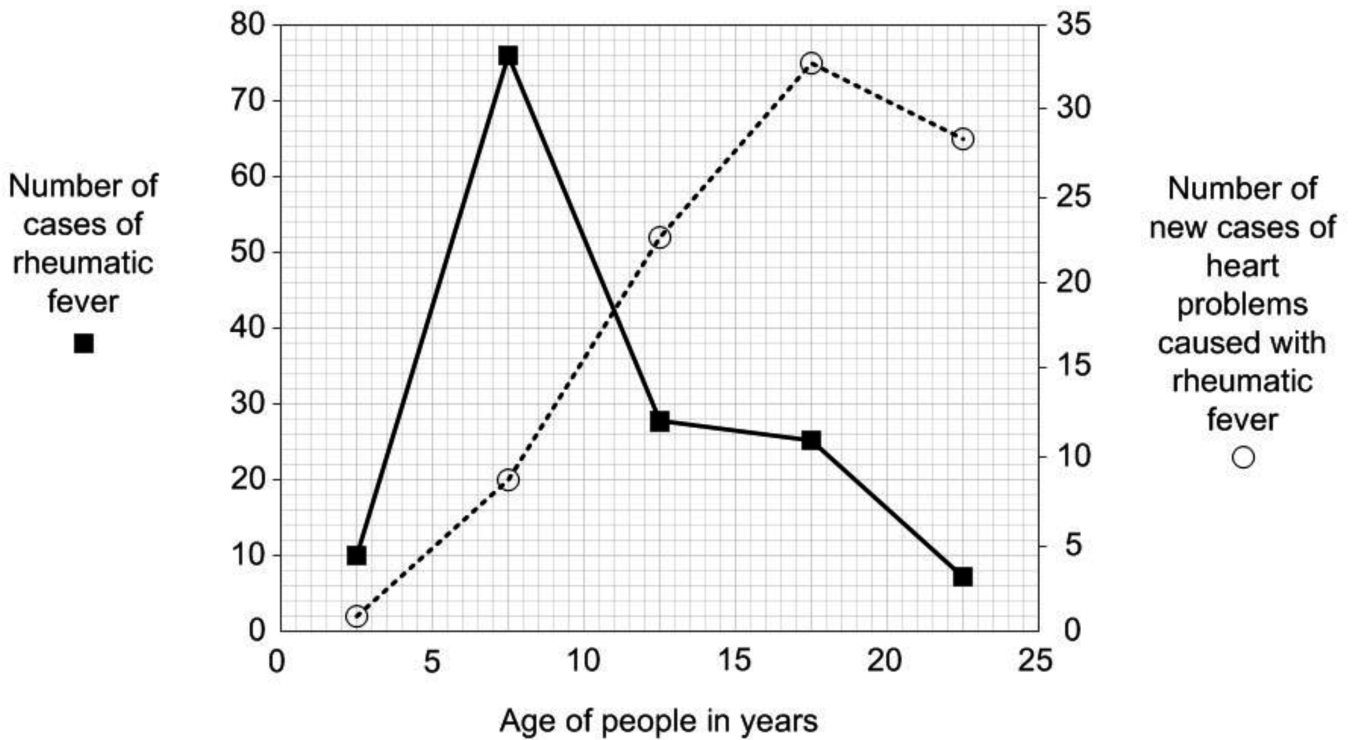
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[4]

(b) Look at the graph.

- It gives data about people of different ages.
- It shows the number of cases of rheumatic fever.
- It also shows the number of new cases of heart problems caused by rheumatic fever.



(i) What is the age of people that most commonly have rheumatic fever?

Answer = ..... years [1]

(ii) How many years after getting rheumatic fever is it most common to get heart problems?

How can you tell this from the graph?

.....

.....

.....

..... [2]

- (c) One treatment for the heart valve problem is to lower the patient's blood pressure.

Blood pressure can be lowered by taking a drug to **increase** the amount of water excreted by the body.

Which organ would be targeted by the drug and what would be the effect on urine?

Organ targeted .....

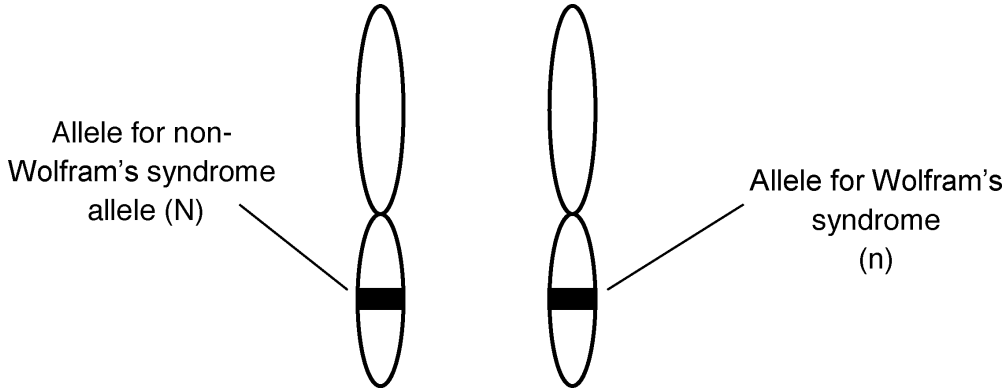
effect on urine .....

..... [2]

18 Wolfram's syndrome is a genetic disorder.

- It is caused by a recessive allele (n).
- In people with Wolfram's syndrome, a protein does not function correctly.

The diagram shows a pair of chromosomes from a person called Kai.



(a) Complete these sentences.

Kai does **not** have Wolfram's syndrome.

This is because his genotype is .....

This means that the probability of any one of his sperm having the Wolfram's allele is..... [2]

(b) (i) Layla is expecting a baby.

Kai is the father.

Complete this genetic diagram.

		Kai	
Layla	N		
	n		

[2]

(ii) Wolfram's syndrome can affect the production of hormones from the pancreas.

Layla and Kai's doctor tells them that there is a chance that their baby will have problems controlling its blood glucose level.

Explain why the doctor thinks this.

Use information from part (b)(i) and your biological knowledge.

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..... [4]

19 In many countries, people rely on bananas for food.

Black sigatoka is a disease of banana plants.

The disease is caused by a fungus.

(a) Banana plants grown by farmers are usually produced asexually.

This process uses mitosis.

This means that, if one banana plant dies of black sigatoka, all the bananas can die.

Explain why.

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

(b) The food security of bananas could be improved using different methods.

Draw a straight line to join each **method** to a step that it **involves**.

method	involves
biological control	putting a gene for resistance into banana plants
	growing bananas in a greenhouse
genetic engineering	choosing resistant banana plants to use for reproduction
	using hydroponics
selective breeding	introducing a virus that kills black sigatoka fungus

[3]

- (c) A type of pesticide called a fungicide can be used to kill the fungus.

Scientists are investigating how well a fungicide works. They also want to see if the fungicide works better if they add a chemical called a sticking agent. This helps the fungicide stick to the banana leaves.

The scientists grow banana plants in four blocks.

The table shows the treatments each block is given.

Block	Treatment	
	Fungicide	Sticking agent
A	✓	✓
B	✓	X
C	X	✓
D	X	X

- (i) Why did the scientists include the treatments given to block C and block D?

Block C .....

.....

Block D .....

..... [2]

- (ii) After a few months the scientists gave the plants in each area a disease rating.

The higher the disease rating the more disease present.

Block	Disease rating
A	20
B	35
C	45
D	60

What conclusions could the scientists make from this study?

.....

.....

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..... [3]

20 The rock pocket mouse is a small grey coloured mouse that lives in Mexico.



- These mice are the main food for owls.
- Rattlesnakes also feed on these mice.
- The mice get most of their food from grass plants.

(a) Complete the sentences about this food web.

The grass plants are producers in the food web.

Mice are primary ..... in this food web.

The group of mice living in this habitat is called a population.

All the organisms living in this habitat is called the ..... [2]

(b) Scientists want to construct a pyramid of biomass for this food web.

They first need to estimate how many organisms there are in the area.  
They decide to do this using sampling.

(i) Describe how the scientists would sample an area and ensure that the sample was **not** biased.

.....

.....

..... [2]





(c) In most areas of Mexico the ground is covered in grey rocks.

In one area the ground is covered with black rocks.

The black rocks were formed about 1000 years ago when a volcano erupted.

The scientists make two observations:

1. Very occasionally a black mouse is born to grey parents due to a mutation.
2. Black mice are well camouflaged.

Using these two observations, explain why most of the mice in this area are black and **not** the usual grey.

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**[4]**

**25**  
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**TURN OVER FOR THE NEXT QUESTION**

21

Some students are investigating lichens.  
Lichens are often studied because they are sensitive to pollution.

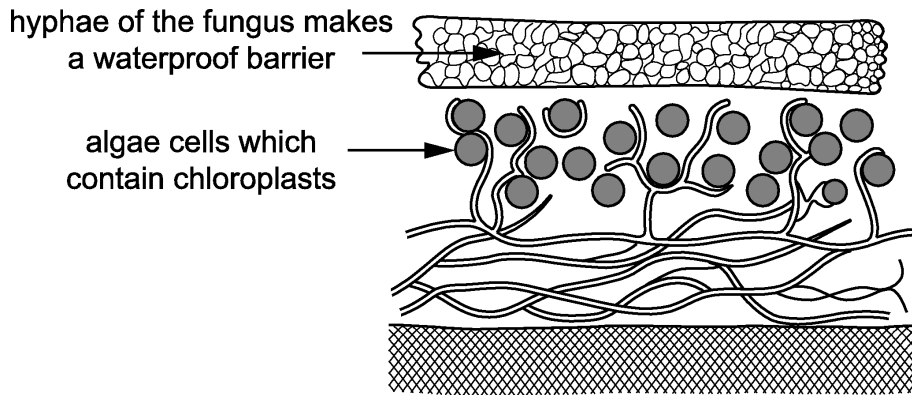
(a) Lichens are made up of two different organisms: fungus and algae.

Fungi and algae gain from living together.

What biological name is given to a relationship where both organisms gain?

..... [1]

(b) The students find a diagram of a lichen.



Using the diagram, suggest what the algae and fungus each gain from their relationship.

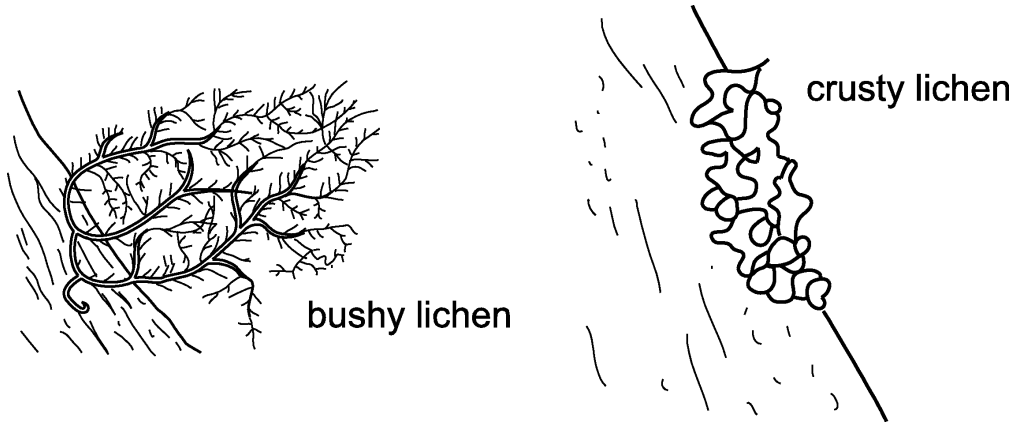
Algae .....

.....

Fungus .....

..... [2]

- (c) Lichens are sensitive to pollution because they take up chemicals from the air. The diagram shows a 'bushy' species of lichen and a 'crusty' species of lichen.



Bushy lichens are usually more sensitive to pollution than crusty lichens.

Use the diagrams to suggest why.

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

- (d) The students decide to use lichens to try and work out how polluted their school grounds are.

They read about a scale called the Lichen Diversity Value (LDV).

LDV is worked out in this way.

- Step 1** Choose four trees in the area.
- Step 2** Hold a quadrat on the north side of the trunk of one tree.
- Step 3** Count the total number of all the lichens in the quadrat.
- Step 4** Repeat **steps 1–3** on the east, south and west side of the tree.
- Step 5** repeat **steps 1–4** for each tree.

- (i) Suggest how the students could choose the four trees in **step 1**.

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

(ii) The students record their results in a table.

	Total number of lichens found in each quadrat			
Tree number	North	East	South	West
1	3	11	18	7
2	4	12	17	8
3	5	10	15	12
4	4	15	12	9
mean	4.0	12.0	15.5	.....

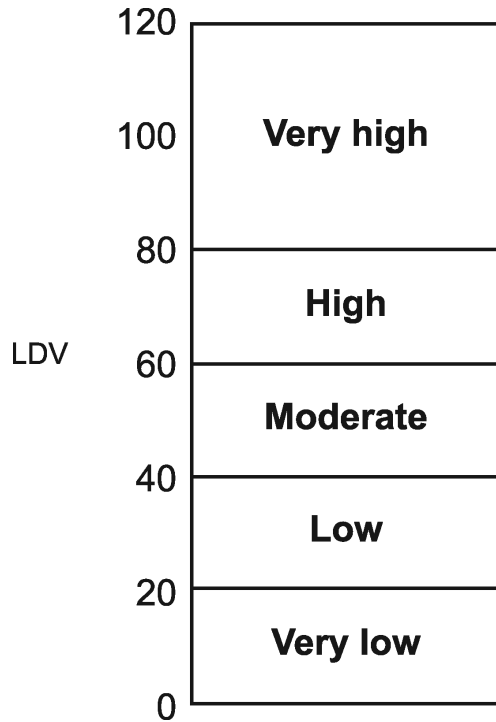
The LDV is found by adding together the four mean values.

The students calculate the mean number of lichens on the north, east and south sides of the trees.

- Calculate the mean value for the west side and add it to the table.
- Calculate the LDV.

LDV = ..... [2]

(iii) This scale shows the type of diversity shown by the LDV.



What does the LDV show about the amount of diversity in the school grounds?

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

(iv) LDV is calculated by counting all the lichens present.

The students want to make a better assessment of pollution.

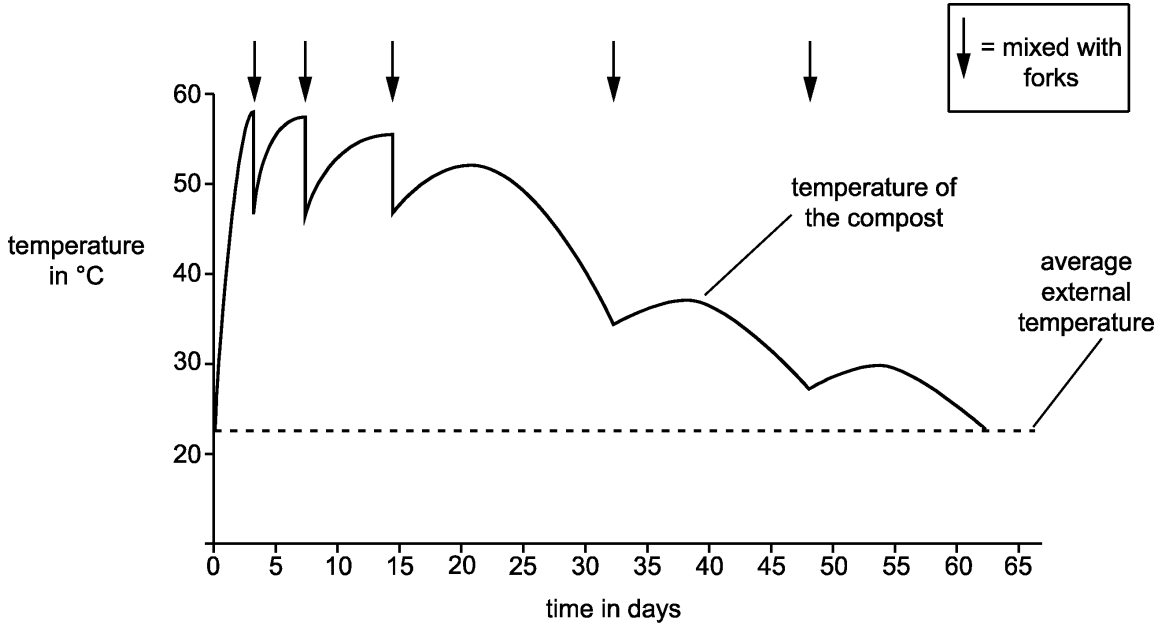
What else about the lichens could the students look for?

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.....  
..... [3]

22 Some students measure the temperature inside a compost heap. They also measure the external temperature.

On five occasions they mixed up the compost heap with garden forks.

The graph shows their results.



(a) (i) The compost took 63 days to completely decompose.

Explain how the students could tell this from their graph.

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

(ii) The rate of temperature increase is greatest before the compost is mixed for the first time.

Explain how the rate of temperature change can be calculated.

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



(b) Compost decomposes more slowly below 30°C or above 60°C.

Use ideas about enzymes and decomposition to explain why.

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

(c) Use the graph to describe how mixing with a fork helps to provide the best temperature for decomposition.

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

**END OF QUESTION PAPER**

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