1 (a) The bar chart shows the presence of organisms in six lakes.

Each lake has a different pH.

The bars show if a particular organism is present at a certain pH.

	pH of lake					
organism	6.5	6.0	5.5	5.0	4.5	4.0
trout						
bass						
perch						
frogs						
salamanders						
clams						
crayfish						
snails						
mayfly						

(i) Describe how pH affects the variety of organisms in these lakes.

(2)

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(ii) Acid rain can affect the pH of a lake.

Complete the sentence by putting a cross (☒) in the box next to your answer.

The main pollutant that causes acid rain is

(1)

☐ **A** carbon dioxide

☐ **B** carbon monoxide

☐ **C** oxygen

☐ **D** sulfur dioxide

(b) Water pollution can be caused by an increase in nitrates and phosphates.

Explain the problems associated with an increase of nitrates and phosphates levels in a lake.

(3)

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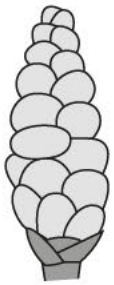
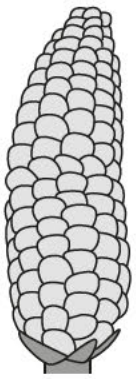
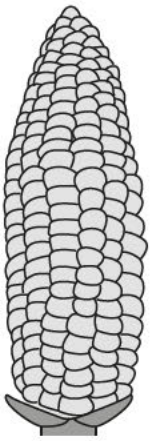
(c) Complete the table by writing the name of an indicator species for clean water and an indicator species for polluted water.

(2)

condition	indicator species
clean air	lichen
clean water	.....
polluted water	.....

(Total for Question 1 = 8 marks)

2 The diagram shows the development of maize cobs over the last 1000 years of cultivation.

maize cobs				
mean mass of cob /g	15	45	70	90
date	1000 years ago →			resent

(a) Describe how scientists can use plant breeding programmes to produce maize plants with larger cobs.

(3)

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(b) There has been an increase in the use of pesticides during the last 1000 years.

Explain how the use of pesticides may benefit maize production.

(2)

(c) Maize plants can be used in the production of biofuel.

Discuss the advantages and disadvantages of the use of biofuel.

(4)

(d) Plants grown for biofuel could be genetically modified.

Complete the sentence by putting a cross (☒) in the box next to your answer.

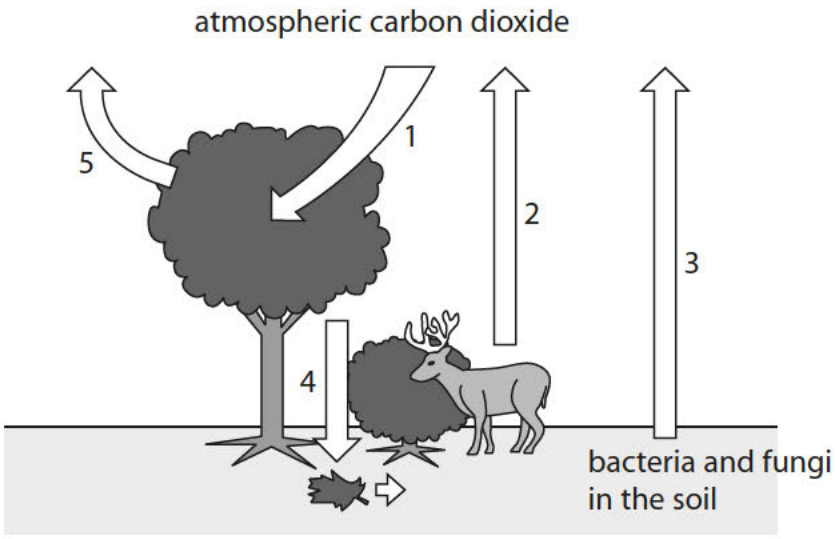
The microorganism used as a vector to produce transgenic plants is

(1)

- ☐ **A** *Agrobacterium tumefaciens*
- ☐ **B** *Bacillus thuringiensis*
- ☐ **C** *Fusarium venenatum*
- ☐ **D** *Saccharomyces cerevisiae*

(Total for Question 2 = 10 marks)

3 (a) The diagram shows the processes involved in the carbon cycle. Each process is numbered.



(i) What is the name of process 1?

Put a cross (☒) in the box next to your answer.

(1)

- ☐ **A** decomposition
- ☐ **B** denitrification
- ☐ **C** photosynthesis
- ☐ **D** respiration

(ii) Describe the numbered processes that return carbon dioxide back into the atmosphere.

(3)

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(b) The human population is increasing.

Explain how this could change the concentration of carbon dioxide in the atmosphere.

(2)

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(c) Air quality can be monitored using indicator species.

Name an indicator species used to monitor air quality.

(1)

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(d) The overuse of fertilisers can cause eutrophication.

Explain the effects of eutrophication that may lead to the death of aquatic animals.

(3)

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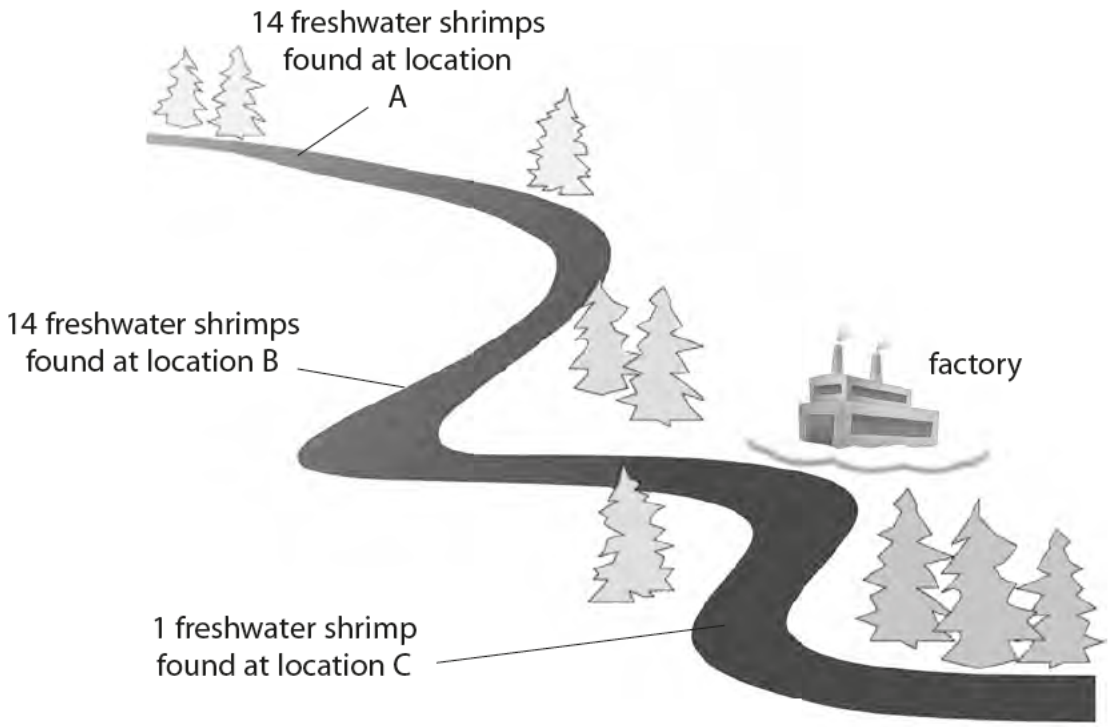
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(Total for Question 3 = 10 marks)

4 Catherine is an environmentalist studying water pollution in the stream shown in the diagram.

She took samples of water from locations A, B and C and recorded the number of freshwater shrimps at each location on the diagram.



(a) Explain which location in the stream is most polluted.

(2)

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(b) Complete the sentence by putting a cross (☒) in the box next to your answer.

Location A had other organisms present.

These organisms are likely to be

(1)

- ☐ **A** blackspot fungus
- ☐ **B** bloodworm
- ☐ **C** sludgeworm
- ☐ **D** stonefly

(c) Complete the sentence by putting a cross (☒) in the box next to your answer.

The factory shown in the diagram produces nitrate fertilisers.

Some nitrate fertilisers leaked into the stream and caused

(1)

- ☐ **A** combustion
- ☐ **B** decomposition
- ☐ **C** eutrophication
- ☐ **D** nitrification

(d) Describe what will happen to the organisms in the stream when nitrates leak from the factory.

(4)

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(Total for Question 4 = 8 marks)

5 (a) Figure 13 shows a food chain for organisms in a stream.

algae → stonefly larvae → water beetles → birds

Figure 13

(i) In the food chain there is 2.1×10^4 J of energy in the biomass of stonefly larvae. 90% of the energy is lost between each trophic level of the food chain.

Calculate the energy value that enters the birds.

(2)

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(ii) State the impact of this energy loss on the length of the food chain.

(1)

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(b) A group of students investigated the level of pollution in two different streams, A and B.

Figure 14 shows the student's results.

indicator species	total number in	
	stream A	stream B
Mayfly nymph	4	0
Caddis fly larva	29	0
Stonefly larvae	74	1
Water louse	34	4
Bloodworm	10	45
Sludge worm	2	100

Figure 14

Mayfly nymphs, caddis fly lavae and stonefly larvae are indicators of clean water.

(i) Calculate the percentage of organisms in stream A that are clean water indicators.

Give your answer to two significant figures.

(2)

(ii) Use the results to explain which stream is more polluted.

(2)

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The student investigated a third stream, which is very slow flowing and runs through an area where intensive farming methods are used.

Figure 15 shows the thick layer of algae formed on top of this stream.



Figure 15

(c) Explain the effect of this algal growth on the organisms in the stream.

(4)

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(Total for Question 5 = 11 marks)