1 Nitrogen is an essential element for plant growth. Most plants can only use nitrogen in the form of nitrate ions. Only legumes that have bacteria living in their root nodules can use nitrogen from the air.

(a) (i) Explain how nitrate ions help plants to grow.

(1)

.....

.....

(ii) Name the type of bacteria that live in the root nodules of legumes.

(1)

.....

(b) Many animals excrete urine that contains urea. Some soil microorganisms use the enzyme urease to change urea to ammonium ions and carbon dioxide.

Describe how ammonium ions can be converted to nitrate ions in the soil.

(2)

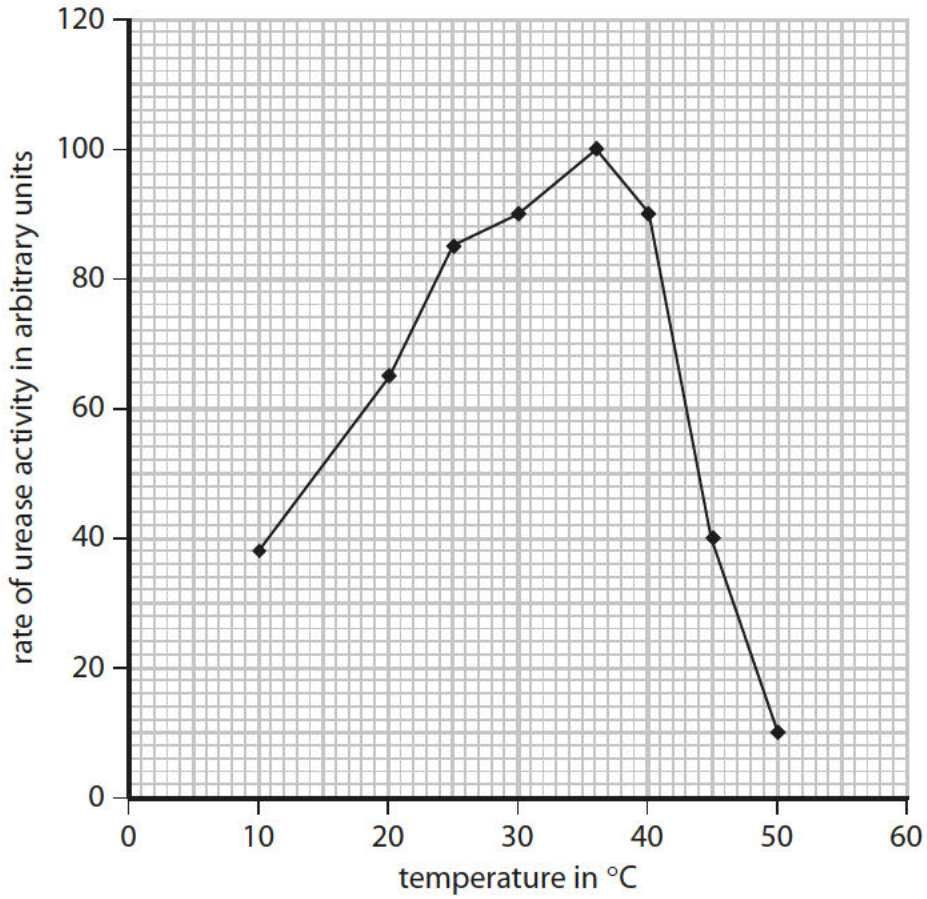
.....

.....

.....

.....

(c) The graph shows the effect of different temperatures on the rate of urease activity.



(i) Explain the change in rate of urease activity from 10 °C to 36 °C.

(2)

.....

.....

.....

.....

(ii) Explain the change in rate of urease activity from 36 °C to 50 °C.

(3)

.....

.....

.....

.....

.....

.....

(Total for Question = 9 marks)

2 (a) The diagram shows the cell wall of a bacterium.

Complete the diagram by drawing and labelling the parts found inside the cell wall.

(3)



(b) Decomposition by bacteria helps to release mineral ions, such as nitrates, into the soil.

(i) Explain why the rate of decomposition is affected by the pH of the soil.

(2)

(ii) Explain how nitrate ions help plants to grow.

(2)

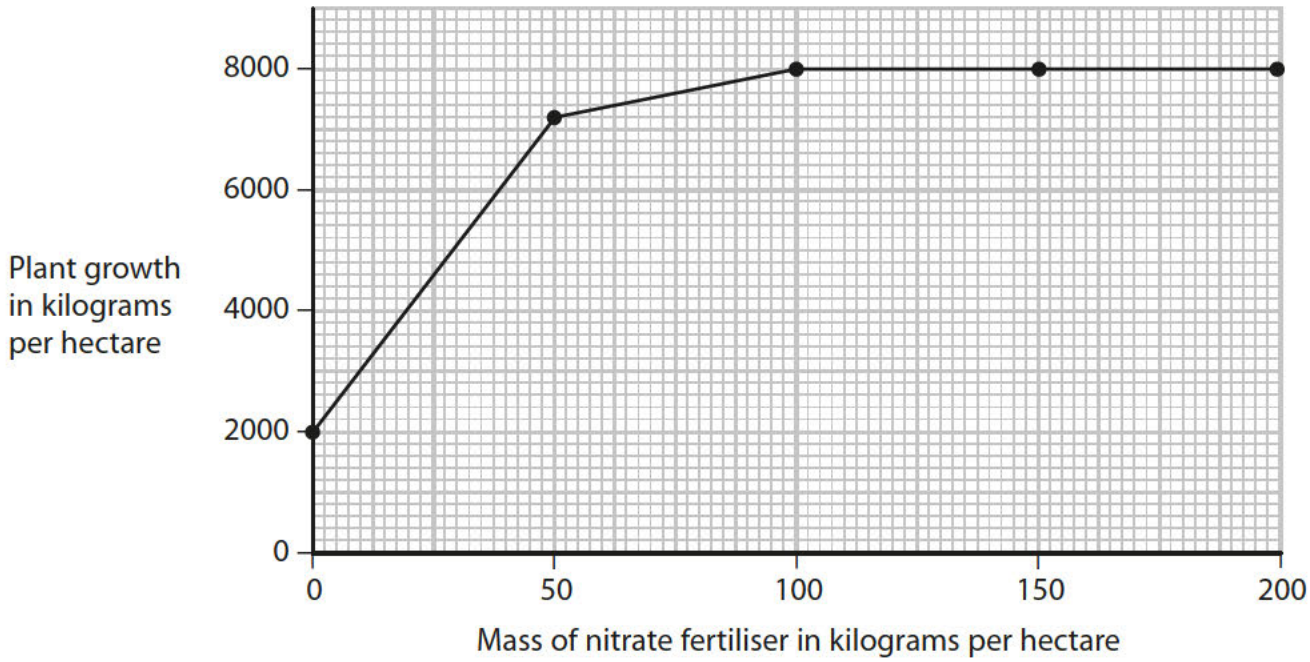
(iii) Explain how nitrate ions get into the root cells of plants.

(3)

(c) The graph shows the change in plant growth when different masses of nitrate fertiliser are added to fields.

(i) On the graph, mark with a cross (X) the point at which the concentration of nitrate ions ceases to be a limiting factor in the growth of the plant.

(1)



(ii) Calculate the percentage increase in plant growth when the mass of nitrate fertiliser is increased from 50 to 100 kilograms per hectare.

(2)

.....%

(iii) Suggest why crops still grow when no nitrate fertiliser is added.

(1)

.....

.....

.....

(Total for Question = 14 marks)

3 Fish produce and release nitrogenous waste.

(a) Suggest why two fish of the same size may produce different masses of nitrogenous waste.

(1)

.....

.....

.....

(b) The table shows the mass of nitrogenous waste released into the environment by four different fish farms.

Type of fish farm	Nitrogenous waste released in kg per 1000 kg fish produced
salmon	48.2
halibut	67.1
cod	72.3
haddock	72.3

Calculate the mass of nitrogenous waste released into the environment when 400 kg of cod fish are produced. Show your working.

(2)

mass = ... kg

(c) Nitrogenous waste released into the environment can cause eutrophication.

Describe the process of eutrophication and the effects that it can have on the environment.

(5)

(d) Fish farms remove nitrogenous waste to improve the growth of fish.

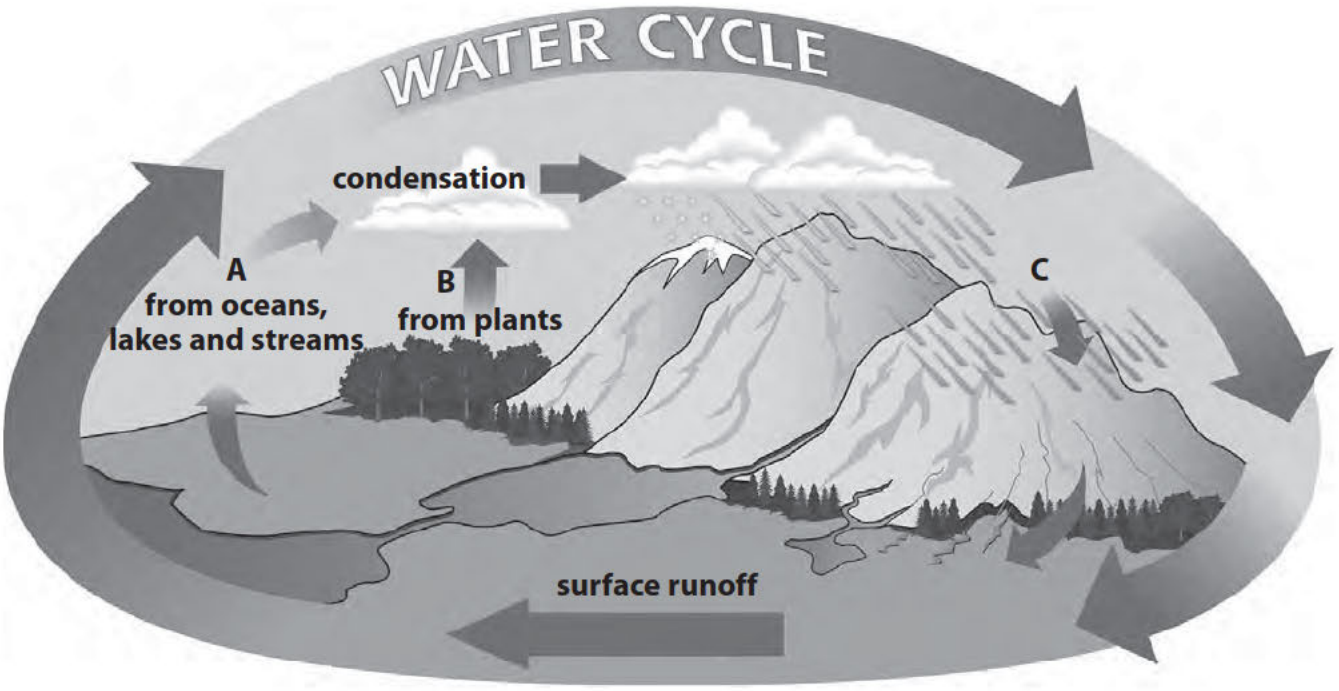
Another method to improve the growth of fish is vaccination.

Explain how the process of vaccination improves the growth of fish.

(4)

(Total for Question = 12 marks)

4 The diagram shows the water cycle.



(a) Name the processes A, B and C shown in the diagram.

(3)

A .....

B .....

C .....

(b) (i) Explain the possible consequences of deforestation for the water cycle.

(2)

.....

.....

.....

.....

.....

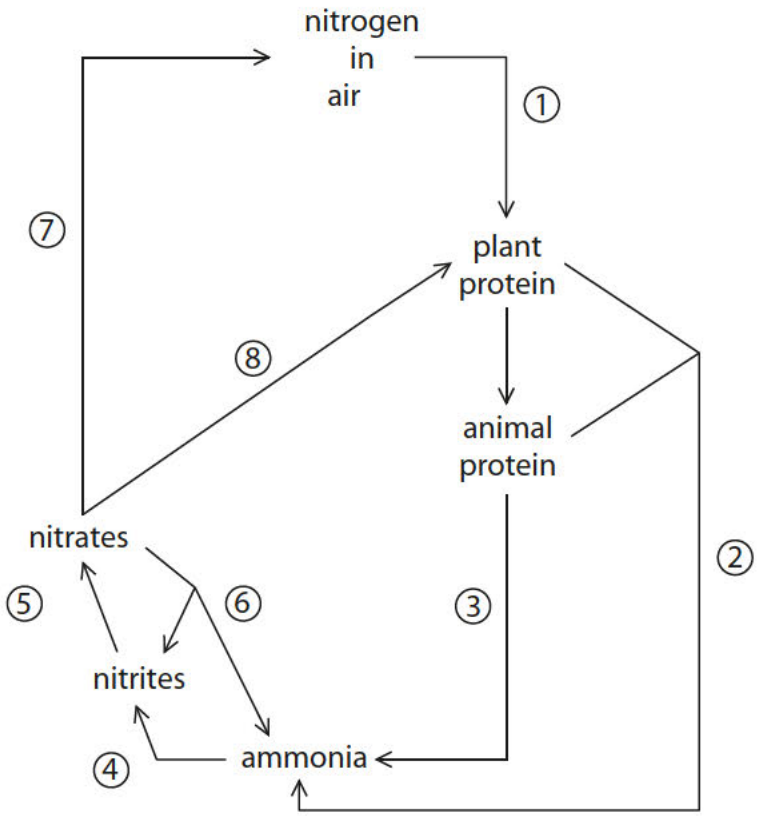
.....

(ii) Deforestation also affects the carbon cycle.
Explain these effects.

(4)

(Total for Question = 9 marks)

5 The diagram shows the nitrogen cycle. Different stages have been numbered 1 to 8.



(a) The table lists the stages involved in the nitrogen cycle.

Complete the table by giving the correct number, or numbers, corresponding to each stage.

The first one has been done for you.

(4)

Stage	Number
absorption	8
denitrification	
nitrogen fixation	
excretion	
decomposition	

(b) Explain how nitrates are absorbed into plants at stage 8.

(3)

.....

.....

.....

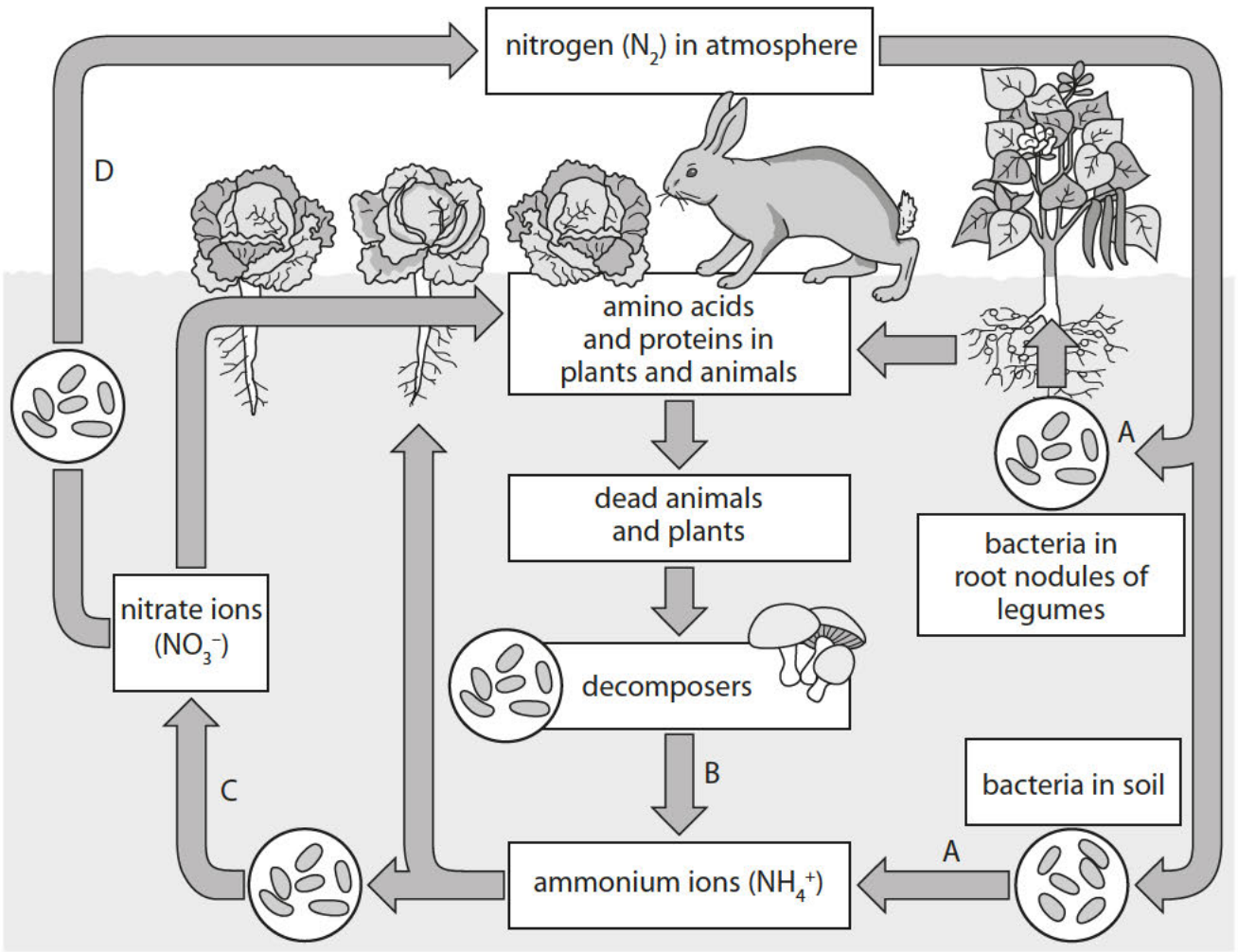
.....

.....

.....

(Total for Question = 7 marks)

6 The diagram shows the nitrogen cycle with four different stages labelled A, B, C and D.



(a) Name the processes A, B, C and D.

(4)

A .....

B .....

C .....

D .....

(b) Name two different groups of organisms that act as decomposers.

(2)

1 .....

2 .....

(c) The nitrogen in a nitrate ion in the soil can become the nitrogen in a protein molecule in an animal.

Explain how this happens.

(4)

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

(d) Farmers sometimes add fertiliser to the fields in which they grow their crops.

Suggest two advantages of using animal waste as a fertiliser rather than using a chemical fertiliser.

(2)

1 .....

.....

2 .....

.....

(Total for Question = 12 marks)