PEARSON EDEXCEL GCSE COMBINED SCIENCE (HIGHER) · 1SC0

BIOLOGY



EXAM QUESTION PACK

TOPIC 9: ECOSYSTEMS AND MATERIAL CYCLES (PAPER 2)

SCORE	PERCENTAGE
/105	%

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Q1.

A student was investigating the populations of organisms in a garden.

Figure 1 shows the estimates of the number and biomass of some of the organisms in the garden.

organisms	number	mean biomass of each organism in grams	biomass of population in grams
cabbages (plants)	80	70	5600
earthworms	620	3.4	?
slugs	30	4.1	123
hedgehogs	1	620	620
squirrels	2	600	1200

Figure 1

(i) Calculate the biomass of the population of earthworms in the garden.

(1)

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(ii) Hedgehogs eat slugs and earthworms.

Slug pellets were used to kill the slugs.

Explain how killing the slugs would affect the population of earthworms in this garden.

(2)

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(iii) Describe a method that could be used to estimate the population of slugs in the garden.

(3)

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(Total for question = 6 marks)

Q2.

Scientists use a technique called mark and recapture to estimate animal populations in a habitat.

A sample of the population is captured and a harmless mark is added to each animal.

These animals are released and after a period of time the population is sampled again.

This second sample includes some recaptured animals that have marks on them.

The population can be estimated using this equation

$$\text{population size} = \frac{\text{number marked in the first sample} \times \text{size of the second sample}}{\text{number recaptured in the second sample}}$$

A scientist used this technique to determine the change in the population size of snails in a pond from March to July.

Figure 9 shows the results.

month	number marked in the first sample	size of the second sample	number of recaptured animals	population size
March	18	22	8	50
July	12	18	10	

Figure 9

(i) Using data from Figure 9, calculate the difference in the population size from March to July.

(3)

Difference in the population size .....

(ii) State **two** factors the scientist should control when sampling the habitat in March and July.

(2)

1 .....

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2 .....

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(Total for question = 5 marks)

Q3.

Figure 6 shows the global movement of carbon into or out of the atmosphere.

process	movement of carbon into or out of the atmosphere in gigatonnes per year
photosynthesis	120.1
respiration	119.6
ocean uptake	92.8
ocean loss	90.0
combustion of fossil fuels	6.4

Figure 6

Calculate the net mass of carbon added to the atmosphere each year.

(2)

..... gigatonnes

(Total for question = 2 marks)

Q4.

Figure 1 shows an area of woodland with some small plants growing in the ground between the trees.



(Source: © Maksym Holovinov/Shutterstock)

Figure 1

The scientist selects an area near the edge of the woodland where many stinging nettles are growing.

This area is partly shaded by the trees.

Describe how the scientist should use a belt transect to investigate how light intensity affects the growth of stinging nettles.

(3)

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(Total for question = 3 marks)

Q5.

Nitrogen is cycled through the environment.

Describe the roles of bacteria in the nitrogen cycle.

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(Total for question = 4 marks)

Q6.

Leguminous plants have nodules on their roots that have colonies of nitrogen-fixing bacteria.

Clover is a leguminous plant.

Describe how a quadrat could be used to sample the population of clover in a 500m^2 field.

(3)

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(Total for question = 3 marks)

Q7.

Explain how cabbages, earthworms and squirrels contribute to the carbon cycle.

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(Total for question = 3 marks)

Q8.

Nitrogen-fixing bacteria provide nitrates for the plants and release any excess into the soil.

Explain how leguminous plants such as clover could be used to reduce the amount of artificial fertilisers.

(4)

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(Total for question = 4 marks)

Q9.

Scientists use a technique called mark and recapture to estimate animal populations in a habitat.

A sample of the population is captured and a harmless mark is added to each animal.

These animals are released and after a period of time the population is sampled again.

This second sample includes some recaptured animals that have marks on them.

The population can be estimated using this equation

$$\text{population size} = \frac{\text{number marked in the first sample} \times \text{size of the second sample}}{\text{number recaptured in the second sample}}$$

A scientist used this technique to determine the change in the population size of snails in a pond from March to July.

Figure 9 shows the results.

month	number marked in the first sample	size of the second sample	number of recaptured animals	population size
March	18	22	8	50
July	12	18	10	

Figure 9

This pond is affected by eutrophication.

Explain **one** possible cause of eutrophication.

(2)

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(Total for question = 2 marks)

Q10.

* Reforestation has a beneficial effect on air composition and biodiversity.

Animal conservation projects can also have a beneficial effect on biodiversity.

Explain the beneficial effects of reforestation and animal conservation projects.

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(Total for question = 6 marks)

Q11.

Figure 1 shows an area of woodland with some small plants growing in the ground between the trees.



(Source: © Maksym Holovinov/Shutterstock)

Figure 1

A scientist recorded the mean light intensity and the mean number of small plants per m^2 for six 25 m^2 areas of the woodland.

Figure 2 shows the results.

area of woodland	mean light intensity in lux	mean number of small plants per m^2
A	1500	2.7
B	1300	1.6
C	1000	1.1
D	800	0.6
E	550	0.3
F	350	0.1

Figure 2

(i) Explain the effect of light intensity on the number of small plants per m^2.

(2)

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(ii) State **one** variable the scientist should have controlled to make sure the light intensity measurements could be compared.

(1)

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(Total for question = 3 marks)

Q12.

Figure 15 shows the results of this investigation.

seedling in test tube	length at the start in mm	length after 7 days in mm
1	4	11
2	6	17
3	5	26

Figure 15

(i) Explain why there are differences in the change in the lengths of the seedlings.

(2)

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(ii) Explain how nitrate ions were absorbed by the seedling in test tube 3.

(3)

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(Total for question = 5 marks)

Q13.

Farmers use crop rotation to reduce the need to add nitrate fertilisers to the soil.

Plants such as peas and beans have a mutualistic relationship with nitrogen-fixing bacteria.

Explain why farmers use these plants in their crop rotation cycle.

(3)

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(Total for question = 3 marks)

Q14.

Figure 2 shows water lilies growing in a lake in Europe.



© lynn gladwell/123RF

Figure 2

One water lily plant was brought from America 10 years ago and planted in the lake shown in Figure 2.

Explain why this non-indigenous plant now covers the whole surface of the lake.

(3)

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(Total for question = 3 marks)

Q15.

Tropical fish excrete ammonia, which is an alkali.

The pH level of water in a tropical fish tank needs to be maintained between 6.6 and 7.4 for the fish to survive.

This is the optimum pH range for the bacteria that are responsible for the conversion of ammonia into nitrites and then nitrates.

Nitrosomonas bacteria convert ammonia into nitrites.

Nitrobacter bacteria convert nitrites into nitrates.

(i) *Nitrosomonas* bacteria are an example of

(1)

☒ **A** nitrogen fixing bacteria

☒ **B** nitrifying bacteria

☒ **C** denitrifying bacteria

☒ **D** *Helicobacter* bacteria

(ii) Explain why *Nitrosomonas* and *Nitrobacter* bacteria are needed in tropical fish tanks.

(2)

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An aquatic plant in the fish tank had a concentration of nitrates higher than the water in the fish tank.

(iii) Explain how this aquatic plant can uptake nitrates from the water in the fish tank.

(2)

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(Total for question = 5 marks)

Q16.

Figure 5 shows part of the nitrogen cycle.

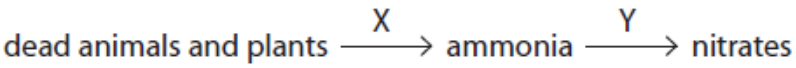


Figure 5

(i) Identify the types of microorganism involved in process X and process Y.

(2)

X .....

Y .....

(ii) Explain how crop rotation increases nitrate levels in the soil.

(3)

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(iii) Explain why increased nitrate levels in the soil improve crop yield.

(2)

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(Total for question = 7 marks)

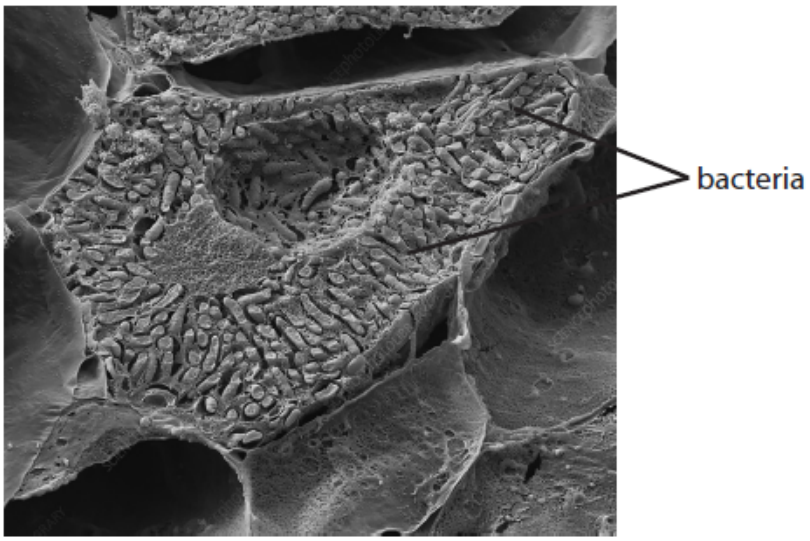
Q17.

Answer the question with a cross in the box you think is correct ☒. If you change your mind about an answer, put a line through the box ☒ and then mark your new answer with a cross ☒.

Figure 4 shows a cross-section of a root nodule on a leguminous plant.

Bacteria in the root nodule provide the leguminous plant with nitrogen compounds.

The leguminous plant provides the bacteria with sugars.



(Source: © Nigel Downer / Science Photo Library)

Figure 4

(i) Which term describes the relationship between this leguminous plant and the bacteria?

(1)

☒ **A** parasitism

☒ **B** indigenous

☒ **C** biodiversity

☒ **D** mutualism

(ii) The width of this root nodule is 7.5 mm.

Give the width in µm.

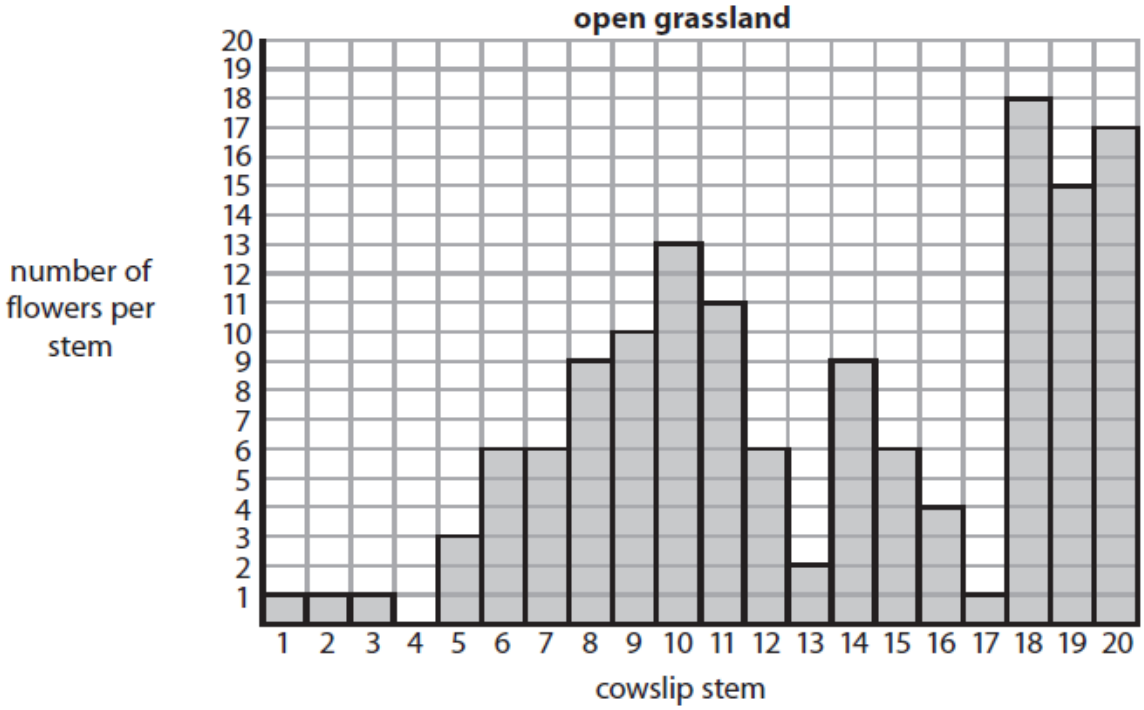
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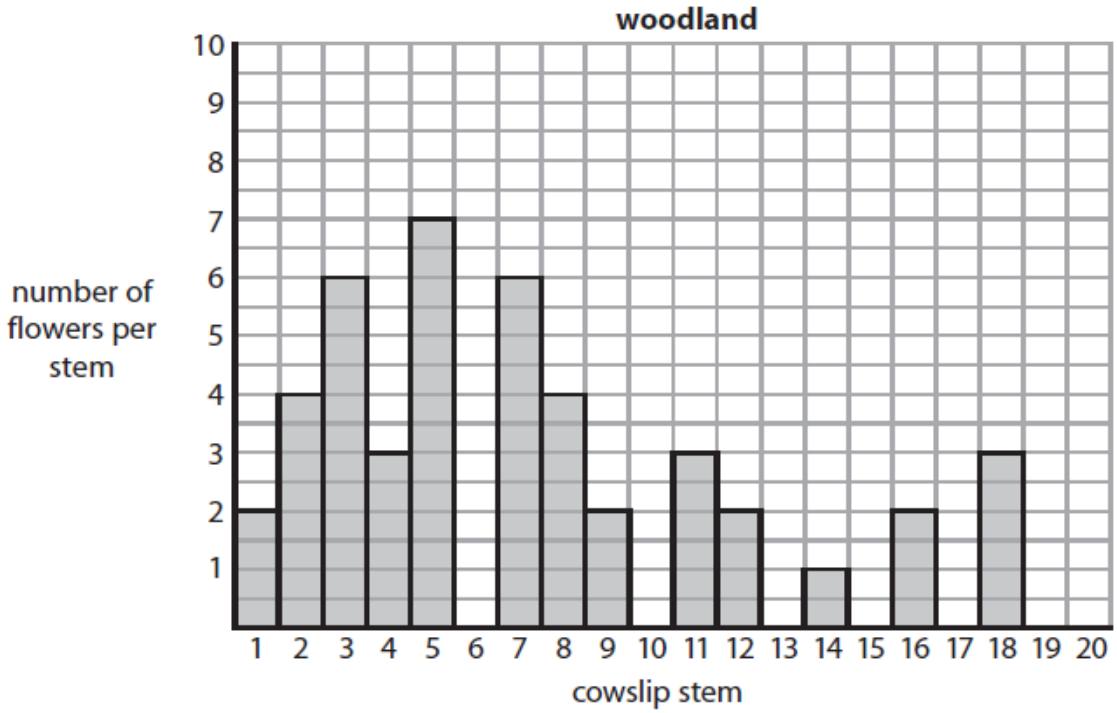
..... µm

(Total for question = 2 marks)

Q18.

Cowslips are flowering plants.
Each cowslip stem can produce different numbers of flowers.
The graphs show the number of flowers on 20 stems of cowslip growing in open grassland and 20 stems of cowslip growing in woodland.





(i) In the open grassland, 60% of cowslips have stems with five or more flowers.

Use the information from the graph to calculate the percentage of cowslips in the woodland that have stems with five or more flowers.

(2)

..... %

(ii) Suggest reasons why there are more stems with five or more flowers in the open grassland.

(2)

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Q19.

A student investigated the effect of nitrate ion concentration on plant growth. She placed barley seedlings in three test tubes containing different concentrations of nitrate fertiliser.

Test tube 1 contained distilled water with 1 pellet of nitrate fertiliser.
Test tube 2 contained distilled water with 2 pellets of nitrate fertiliser.
Test tube 3 contained distilled water with 3 pellets of nitrate fertiliser.

After 7 days, the lengths of the seedlings were measured.

Figure 13 shows an example of the apparatus used.

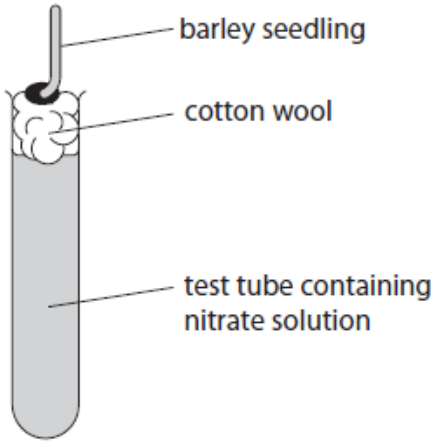


Figure 13

(i) Describe a control for this investigation.

(2)

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(ii) The nitrate fertiliser contains the chemical compound potassium nitrate. The hazard symbol on the bag of potassium nitrate fertiliser is shown in Figure 14.



Figure 14

Which hazard does this symbol represent?

(1)

☒ **A** flammable

☒ **B** oxidising

☒ **C** corrosive

☒ **D** explosive

(iii) Give a method, other than measuring the change in length, that would show the growth of the seedlings.

(1)

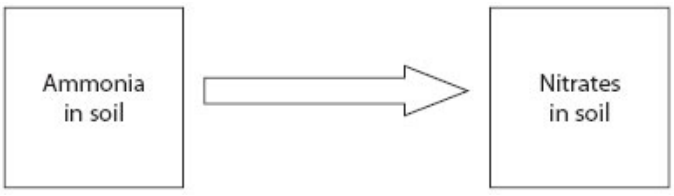
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(Total for question = 4 marks)

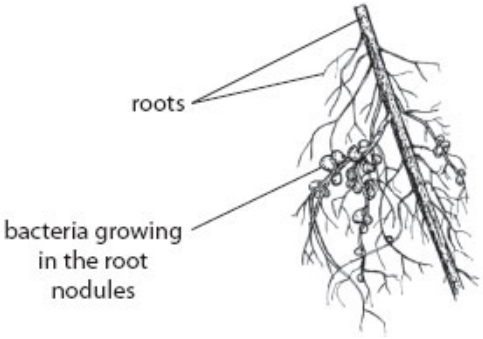
Q20.

The diagram shows one of the stages of the nitrogen cycle.



Leguminous plants such as beans and peas have bacteria growing inside nodules on their roots.

The diagram shows some nodules on a root.



Explain the relationship between this bean plant and the bacteria growing in the root nodules.

(3)

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Q21.

Figure 1 shows an area of woodland with some small plants growing in the ground between the trees.



(Source: © Maksym Holovinov/Shutterstock)

Figure 1

Name a group of organisms that break down the dead leaves and release mineral ions into the soil.

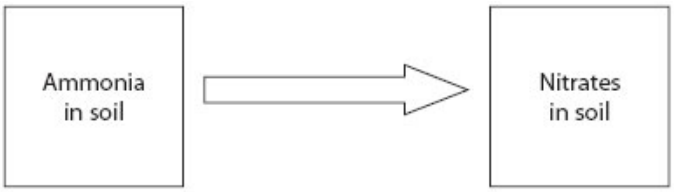
(1)

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(Total for question = 1 mark)

Q22.

The diagram shows one of the stages of the nitrogen cycle.



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

The name of this stage is

(1)

☒ **A** decomposition

☒ **B** denitrification

☒ **C** nitrification

☒ **D** nitrogen fixation

(ii) Explain how plants use the nitrates from the soil.

(2)

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(iii) Describe how the over-use of nitrate fertilisers can cause eutrophication.

(4)

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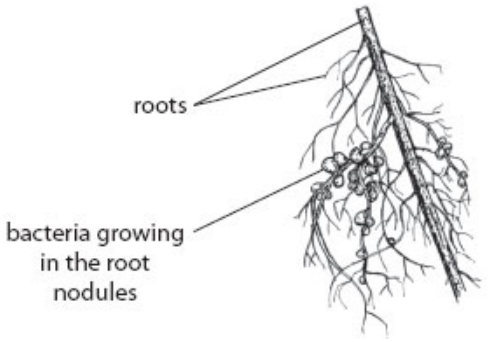
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(b) Leguminous plants such as beans and peas have bacteria growing inside nodules on their roots.

The diagram shows some nodules on a root.



Explain the relationship between this bean plant and the bacteria growing in the root nodules.

(3)

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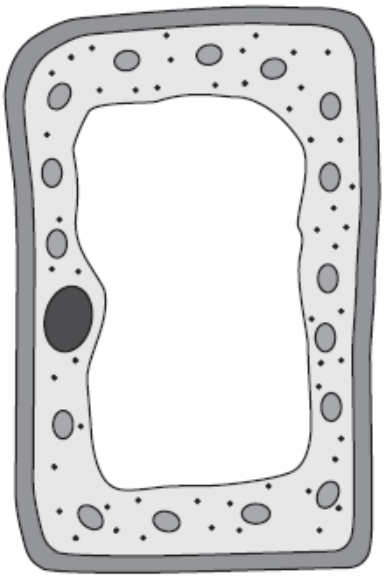
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(Total for Question is 10 marks)

Q23.

Photosynthesis

The diagram shows a plant cell.



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

This plant cell is a

(1)

☒ **A** xylem vessel

☒ **B** phloem vessel

☒ **C** root hair cell

☒ **D** leaf palisade cell

(b) Explain how water moves from cell to cell in a leaf.

(2)

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(c) Some small plants can grow on the bark of trees.

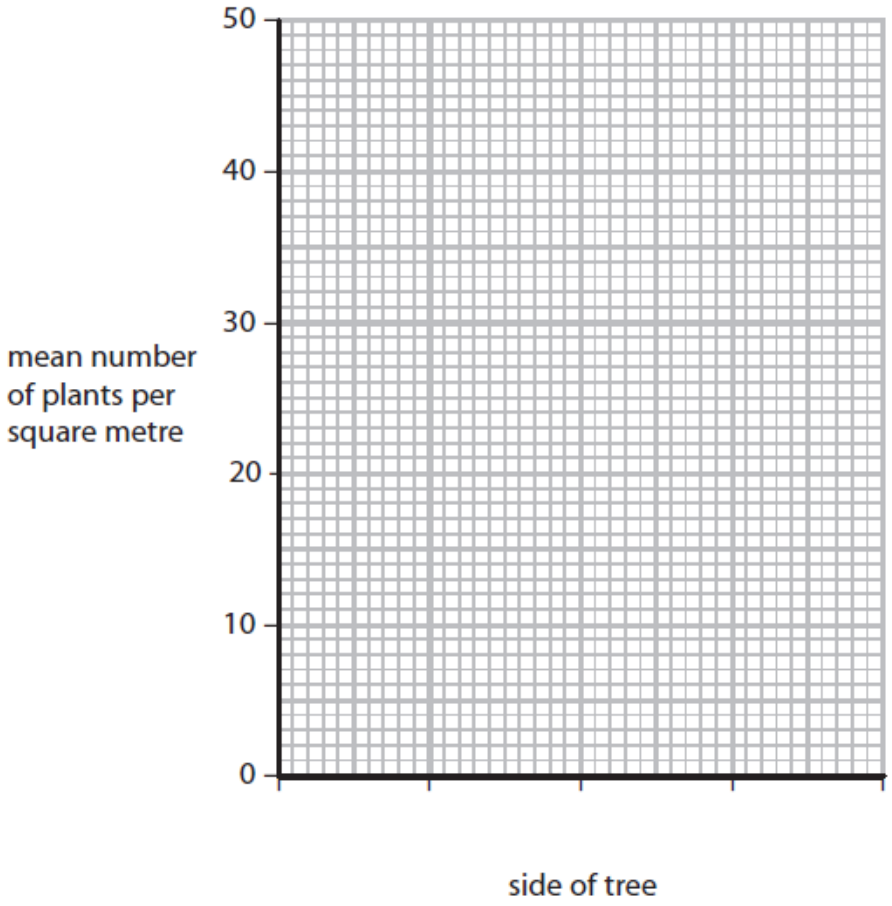
The distribution of two plant species, species A and species B, growing on the north and south side of a tree was investigated.

The results are shown in the table.

	mean number of plants per square metre	
side of tree	species A	species B
North	48	12
South	0	36

(i) Draw a bar chart to illustrate the data in this table.

(2)



(ii) Which piece of equipment would be used to measure the distribution of plants on the bark of the tree?

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

(1)

☒ **A** a pooter

☒ **B** a sweep net

☒ **C** a pitfall trap

☒ **D** a quadrat

(iii) Suggest reasons for the distribution of species B on the north and south sides of the tree.

(2)

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(Total for question = 8 marks)

Q24.

Plants cannot use nitrogen directly from the air but need it to make proteins.

Explain how plants get the nitrogen they need to make protein.

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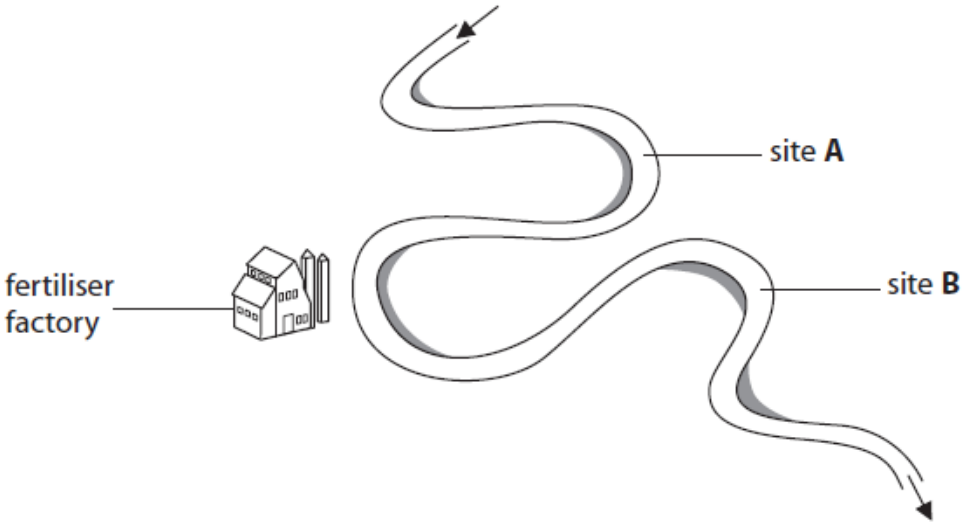
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Q25.

Pollution

The diagram shows a river and the location of a fertiliser factory.

The arrows indicate the direction of the flow of the river.



A scientist recorded the nitrate concentrations of the water at site **A** and site **B**.

Her results are shown in the table.

site	nitrate concentration / mg per dm^3			
	sample 1	sample 2	sample 3	mean
A	17	25	18	20
B	49	64	58	

(a) (i) Calculate the mean nitrate concentration found at site **B**.

(2)

answer = ... mg per dm^3

(ii) The scientist observed algae and some dead fish in the river at site **B**.

These were not present at site **A**.

Give an explanation for these observations.

(4)

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*(b) Scientists observe living organisms in an environment to assess the level of pollution.

Describe how the level of water pollution and air pollution can be assessed using living organisms.

(6)

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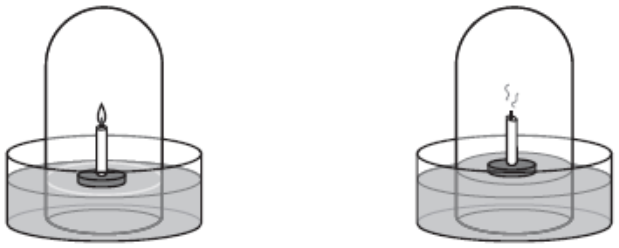
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(Total for question = 12 marks)

Q26.

Joseph Priestley was a scientist who investigated how green plants and combustion affected the carbon cycle.

Figure 7 shows his first experiment.



candle sealed in a bell jar

candle after 3 minutes

Figure 7

(i) State why the candle was not burning after three minutes.

(1)

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(ii) Joseph Priestley continued the investigation but placed a plant inside the bell jar as shown in Figure 8.



Figure 8

He observed that the candle stayed alight for two minutes more than the candle in the bell jar in the first experiment.

Explain his observation.

(2)

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(iii) State **two** variables that would need to be controlled to compare these two experiments.

(2)

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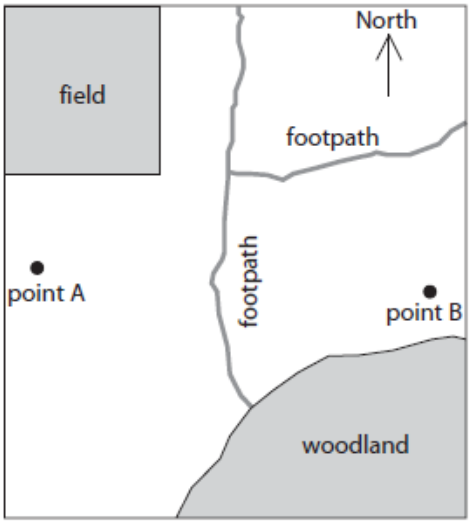
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(Total for question = 5 marks)

Q27.

A student investigated the distribution of poppy plants in a park.

Figure 1 shows a sketch of the park and a diagram of a poppy plant.



© Creative Commons License



poppy plant

Figure 1

The student placed a 1 m^2 quadrat at 10 metre intervals between point A and point B and recorded the number of poppy plants in each quadrat.

(i) Name the technique the student used to study the distribution of poppy plants.

(1)

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Figure 2 shows the number of poppy plants at 10 metre intervals from point A to point B.

distance from point A in metres	number of poppy plants in the 1 m^2 quadrat
0 (point A)	12
10	10
20	11
30	8
40 (point B)	6

Figure 2

(ii) Explain the effect of the woodland on the distribution of poppy plants.

(3)

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(iii) Devise a plan, that uses a quadrat, to estimate the number of poppy plants in the field.

(3)

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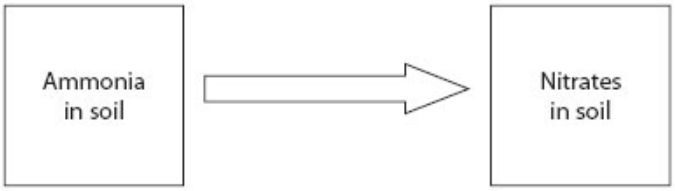
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(Total for question = 7 marks)

Q28.

The diagram shows one of the stages of the nitrogen cycle.



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

The name of this stage is

(1)

☒ **A** decomposition

☒ **B** denitrification

☒ **C** nitrification

☒ **D** nitrogen fixation

(ii) Explain how plants use the nitrates from the soil.

(2)

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(iii) Describe how the over-use of nitrate fertilisers can cause eutrophication.

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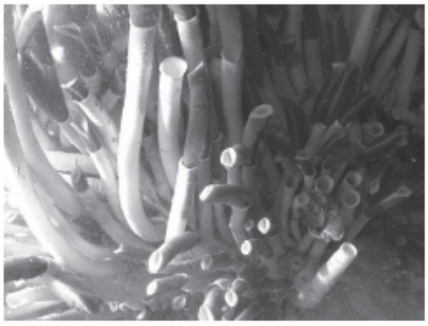
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Q29.

The photograph shows another type of worm.

These are tube worms that live near hydrothermal vents.



Explain the relationship between these tube worms and chemosynthetic bacteria.

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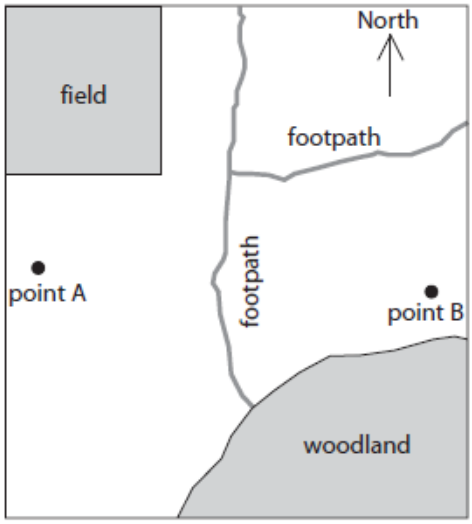
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Q30.

A student investigated the distribution of poppy plants in a park.

Figure 1 shows a sketch of the park and a diagram of a poppy plant.



© Creative Commons License


poppy plant

Figure 1

The woodland is a protected conservation area.

Explain why this woodland increases the biodiversity of the park.

(2)

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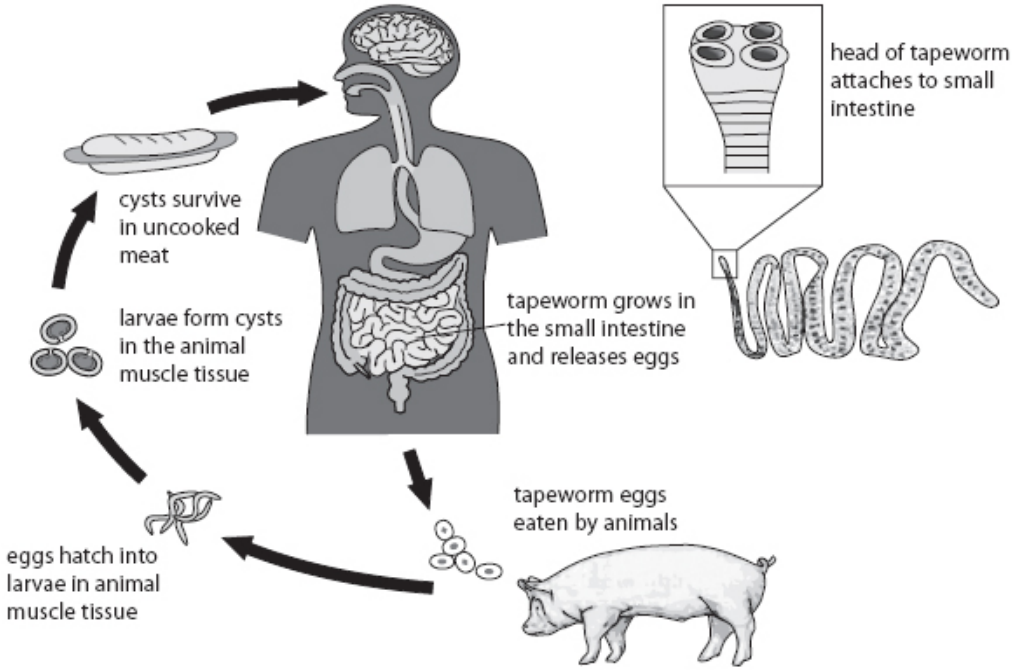
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(Total for question = 2 marks)

Q31.

(a) The diagram shows the life cycle of the human tapeworm.



(i) The tapeworm absorbs food in the human intestine.

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

A tapeworm is an example of a

(1)

- ☒ **A** living indicator
- ☒ **B** mutualist
- ☒ **C** parasite
- ☒ **D** producer

(ii) Use information in the diagram to describe how an adaptation of the tapeworm enables it to live in the human intestine.

(2)

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(iii) Using information in the diagram, suggest how humans could avoid becoming infected with tapeworms.

(2)

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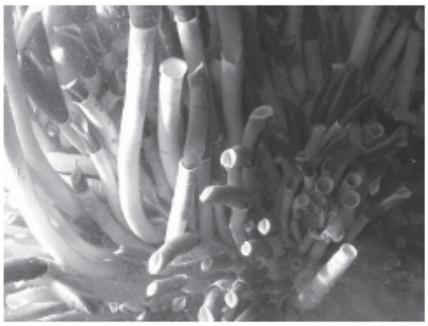
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(b) The photograph shows another type of worm.

These are tube worms that live near hydrothermal vents.



Explain the relationship between these tube worms and chemosynthetic bacteria.

(3)

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(Total for Question = 8 marks)