Write your name here

| Surname | Other names |
|---|---|
| | |

**Pearson Edexcel**
**Level 1/Level 2 GCSE (9-1)**

| Centre Number | Candidate Number |
|---|---|
| | |

# Biology

## Paper 2

**Higher Tier**

| Sample Assessment Materials for first teaching September 2016 | Paper Reference |
|---|---|
| **Time: 1 hour 45 minutes** | **1BI0/2H** |

| **You must have:** | Total Marks |
|---|---|
| Calculator, ruler | |

## Instructions

- Use **black** ink or ball-point pen.
- **Fill in the boxes** at the top of this page with your name, centre number and candidate number.
- Answer **all** questions.
- Answer the questions in the spaces provided – *there may be more space than you need.*
- Calculators may be used.
- Any diagrams may NOT be accurately drawn, unless otherwise indicated.
- You must **show all your working out** with **your answer clearly identified** at the **end of your solution**.

## Information

- The total mark for this paper is 100.
- The marks for **each** question are shown in brackets – *use this as a guide as to how much time to spend on each question.*
- In questions marked with an asterisk (*), marks will be awarded for your ability to structure your answer logically showing how the points that you make are related or follow on from each other where appropriate.

## Advice

- Read each question carefully before you start to answer it.
- Try to answer every question.
- Check your answers if you have time at the end.

*Turn over* ▶

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**Answer ALL questions. Write your answers in the spaces provided.**

**Some questions must be answered with a cross in a box ☒.**
**If you change your mind about an answer, put a line through the box ☒ and then mark your new answer with a cross ☒.**

**1** Figure 1 shows a diagram of the heart.

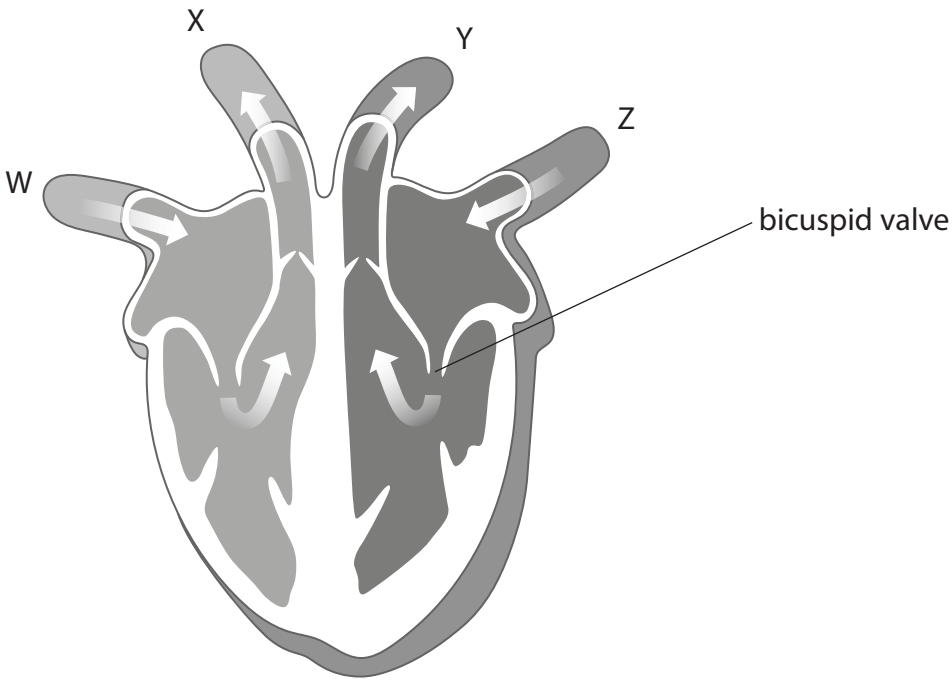



**Figure 1**

(a) (i) Vessel X takes

**(1)**

- ☒ **A** deoxygenated blood to the body
- ☒ **B** deoxygenated blood to the lungs
- ☒ **C** oxygenated blood to the body
- ☒ **D** oxygenated blood to the lungs

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(ii) Give one reason why the wall of the left ventricle is thicker than the right.

**(1)**

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.....

Valves in the human heart may become damaged and no longer function.

(iii) Describe what would happen to the flow of blood in the left side of the heart if the bicuspid valve did not function effectively.

**(2)**

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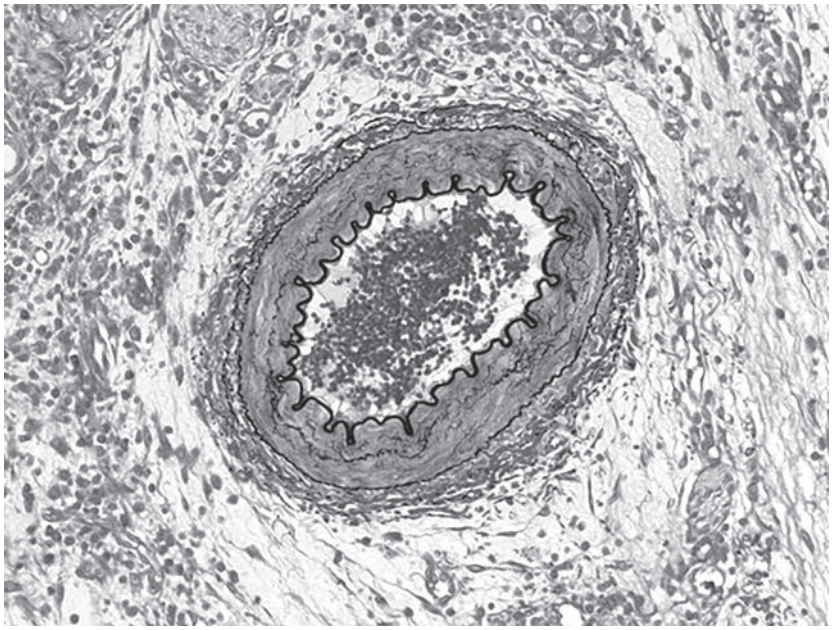
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Figure 2 shows a photomicrograph of a blood vessel.



(Source: Microscape/Science Photo Library)

**Figure 2**

(b) Explain how the structure of this blood vessel is related to its function.

**(2)**

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Figure 3 shows a diagram of the circulatory system of a fish.

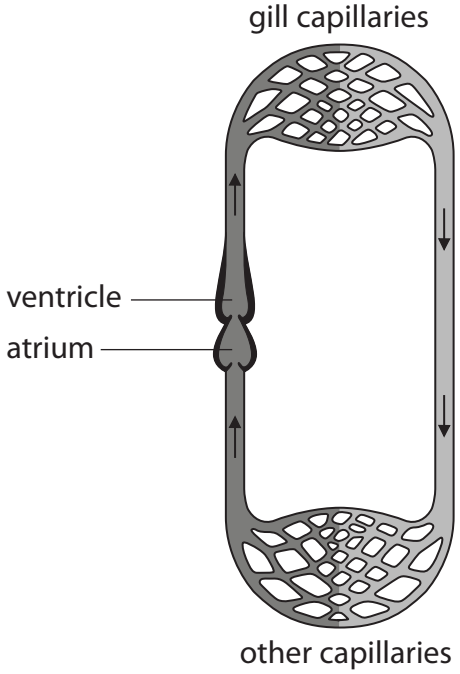



**Figure 3**

(c) Compare the differences between the structure of the circulatory system of a fish and the human circulatory system.

**(4)**

**(Total for Question 1 = 10 marks)**

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**2** Blood tests can be used to check a person's blood glucose and hormone levels.

Figure 4 shows the results of two blood tests carried out on three people to check their blood glucose levels. Person 1 is healthy.

| | blood glucose level (mmols/l) | |
|---|---|---|
| | **after fasting for 12 hours** | **two hours after drinking 75 g glucose** |
| person 1 | 5.4 | 6.4 |
| person 2 | 5.6 | 9.0 |
| person 3 | 7.8 | 12.1 |

**Figure 4**

(a) (i) Compare the glucose levels of person 1 with the glucose levels of person 2 after fasting for 12 hours.

**(1)**

.....

.....

(ii) Compare the glucose levels of person 3 with the glucose levels of person 1, two hours after drinking 75 g glucose.

**(1)**

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Person 3 cannot produce the hormone that controls blood glucose levels.

(iii) State the hormone that person 3 cannot produce.

**(1)**

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(b) Figure 5 shows the level of progesterone for a female during five different stages of the menstrual cycle.

| days in the menstrual cycle | progesterone level (nmol/l) |
|---|---|
| 1–9 | 1.85 |
| 10–14 | 1.48 |
| 15–17 | 14.28 |
| 18–23 | 35.27 |
| 24–28 | 17.11 |

**Figure 5**

(i) Describe the changes in progesterone levels during the 28-day cycle.

**(2)**

(ii) Explain why progesterone levels changed following day 14.

**(2)**

(iii) Use Figure 5 to explain if the female is pregnant.

**(2)**

**(Total for Question 2 = 9 marks)**

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**3** A gardener investigated the ability of four types of compost to hold water.

50 $cm^3$ of water was added to each type of compost.

Figure 6 shows the volume of water retained by four different types of compost.

| type of compost | A | B | C | D |
|---|---|---|---|---|
| mass of compost /g | 500 | 500 | 1000 | 1000 |
| volume of water retained / $cm^3$ | 15 | 29 | 45 | 34 |
| total mass of compost after water was added /g $cm^{-3}$ | 515 | 529 | 1045 | 1034 |

**Figure 6**

(a) (i) Calculate the percentage change in mass for compost B.

**(2)**

.....%

(ii) Explain which compost would be best to use for a pot containing strawberry plants to be grown during a hot summer.

**(2)**

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(iii) State **one** way to improve this investigation in order to compare the results without having to calculate the percentage change in mass.

**(1)**

(b) One method of preserving strawberries is by using them to make jam.

Figure 7 shows a method for making strawberry jam.

Procedure:

Measure 2 kg of crushed strawberries. Place in a bowl.
Add sugar, mix well, and allow to stand for 10 minutes.
Transfer to a saucepan and heat until boiling.
Stir apple pectin into fruit and continue stirring over a high temperature until the gel point is reached and there is a reduction in the water content.
Pour jam into sterilised jars, leaving 1 cm of space at the top and cover.

**Figure 7**

(i) Explain why reducing the water content of the strawberries will help to preserve them.

**(2)**

(ii) Give a reason for sterilising the jars before adding the jam.

**(1)**

**(Total for Question 3 = 8 marks)**

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**4** A student wanted to investigate the effect of light on the growth of cress seedlings.

The student had three pots of seedlings grown in different conditions.

Pot A was placed in a window with light from one direction only.

Pot B was placed in a cupboard with no light.

Pot C was placed with light from above.

Figure 8 shows the seedlings at the end of the investigation.

(a) (i) Label the pots of cress seedlings A, B and C.

**(2)**



(Source: Nigel Cattlin/Science Photo Library)

**Figure 8**

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(ii) What is the response shown by the cress seedlings in Pot A?

**(1)**

- ☒ **A** negative gravitropism
- ☒ **B** negative phototropism
- ☒ **C** positive gravitropism
- ☒ **D** positive phototropism

(iii) State the plant hormone that causes the cress seedlings to grow towards the light.

**(1)**

.....

.....

(b) The student wanted to find out where the hormone that caused the response to directional light was found.

The student had two growing plant shoots and placed them both in a window with light coming from one direction.

Describe a method the student could use to show that the hormone was found in the tip of the plant shoot.

**(2)**

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(c) Figure 9 shows a cross section through a pine leaf.

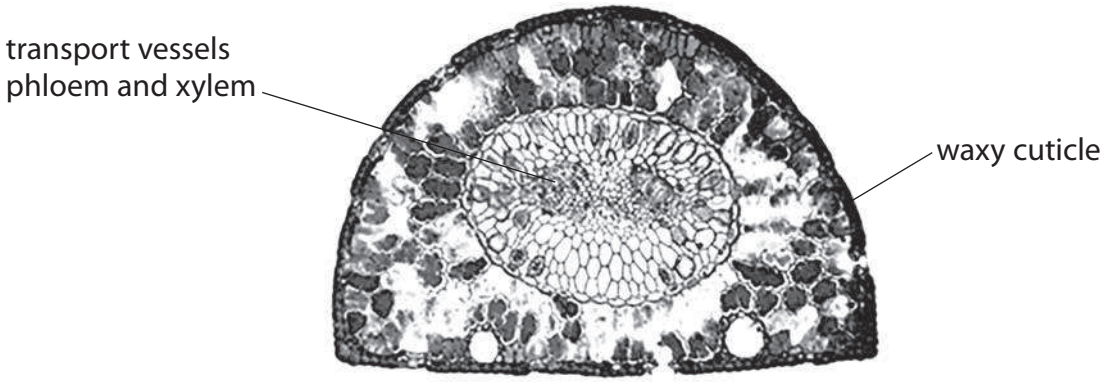



**Figure 9**

(i) Explain why the waxy cuticle is important for this pine leaf.

**(2)**

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(ii) The transport vessels are labelled on Figure 9.

Which row of the table is correct for the movement of sucrose through the plant?

**(1)**

| | | method of transport of sucrose through the plant | structure through which sucrose is transported |
|---|---|---|---|
| ☒ | **A** | transpiration | xylem |
| ☒ | **B** | transpiration | phloem |
| ☒ | **C** | translocation | xylem |
| ☒ | **D** | translocation | phloem |

**(Total for Question 4 = 9 marks)**

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**5** A scientist investigated the effect of light intensity on the rate of photosynthesis of the aquatic *Cabomba* plant.

A lamp was used as a source of light. The lamp was placed at different distances (*d*) from the *Cabomba* plant, and the number of bubbles produced in 60 seconds was counted.

The number of bubbles produced in 60 seconds was used to calculate the rate of photosynthesis.

The light intensity was then calculated using the inverse square law $\left(\frac{1}{d^2}\right)$.

Figure 10 shows the scientist's results.

| distance (*d*) of lamp from *Cabomba* (cm) | light intensity (arbitrary units) | bubbles produced in 60 seconds |
|---|---|---|
| 5 | 0.0400 | 79 |
| 10 | 0.0100 | 21 |
| 15 | 0.0044 | 12 |
| 20 | 0.0025 | 7 |
| 25 | | 5 |
| 30 | 0.0011 | 4 |

**Figure 10**

(a) (i) Calculate the light intensity when the lamp is 25 cm from the *Cabomba* plant.

**(2)**

light intensity = ..... arbitrary units

(ii) Use information from Figure 10 to describe the effect of light intensity on the rate of photosynthesis.

**(2)**

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(iii) Give another method of measuring light intensity rather than calculating it.

**(1)**

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(iv) The scientist counted the number of bubbles produced by the *Cabomba* plant.

Another scientist stated that this was not the best method of measuring the volume of gas produced.

Explain how you could improve the method to measure the volume of gas released more accurately.

**(2)**

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(b) Explain what would happen to the levels of gas produced if the light intensity decreased to 0.0001 arbitrary units.

**(2)**

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**(Total for Question 5 = 9 marks)**

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**6** Figure 11 shows the equipment used for measuring respiration in peas.



A B C

(Source: Martin Shields/Science Photo Library)

**Figure 11**

- Respirometer A contains germinating peas.
- Respirometer B contains peas that are not germinating.
- Respirometer C contains glass beads.

All three respirometers are placed in a water bath at 25 °C for 30 minutes.
The reduction in oxygen levels in each respirometer is measured using a data logger.

(a) Explain why the respirometers are placed in a water bath at 25 °C.

**(2)**

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(b) A student recorded the change in oxygen levels in the germinating peas over a 30-minute period.

The results are shown below.

A 10 mins (–0.8) ml, 20 mins (–1.6) ml, 30 mins (–2.4) ml

B 10 mins (–0.1) ml, 20 mins (–0.1) ml, 30 mins (–0.1) ml

C No change

(i) Complete the table for these results.

**(2)**

| | | | |
|---|---|---|---|
| | | | |
| | | | |
| | | | |
| | | | |

(ii) Calculate the rate of oxygen consumption per second for the results in respirometer A.

**(2)**

..... ml/second

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(iii) Explain why respirometer A has the highest rate of oxygen consumption.

**(2)**

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(c) Some respirometers read the movement of a bubble along capillary tubing.

Carbon dioxide can affect the measuring of oxygen used in this type of respirometer.

State a chemical that could be placed in the respirometer that would stop carbon dioxide affecting the experiment.

**(1)**

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**(Total for Question 6 = 9 marks)**

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**7** A diabetic athlete is advised to estimate the number of grams of carbohydrate in his meals in order to calculate the number of units of insulin he will need to inject to lower his blood glucose concentration.

Each unit of insulin he injects reduces his blood glucose concentration by 1.5 mmol $dm^{-3}$.

He needs to inject 1 unit for every 10 grams of carbohydrate he consumes.

Figure 12 shows the estimated carbohydrates in the breakfast eaten by the athlete.

| food consumed | estimated carbohydrate /grams |
|---|---|
| orange juice | 25 |
| 2 slices brown toast | 68 |
| 350 grams baked beans | 38 |
| tea with sugar | 25 |

**Figure 12**

(a) (i) Calculate how many units of insulin the athlete would need to inject to control the rise in blood glucose levels.

Give your answer to two significant figures.

**(2)**

..... units of insulin

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(ii) The athlete miscalculated his carbohydrate intake to be greater than his actual intake.

Explain how the increase in the number of units injected would affect his blood glucose concentrations.

**(2)**

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(b) (i) A patient visits his doctor because he is putting on weight but does not think he is increasing his calorie intake.

The patient has a height of 1.9 m and a body mass of 120 kg.

What is his BMI?

**(1)**

- ☒ **A** 0.0083
- ☒ **B** 33.2
- ☒ **C** 0.016
- ☒ **D** 66.4

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The doctor diagnosed this person with an underactive thyroid gland.

*(ii) Explain why an underactive thyroid could cause this patient to have an increased body mass.

**(6)**

**(Total for Question 7 = 11 marks)**

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**8** (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 $2.1 \times 10^4$ 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)**

..... J

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

**(1)**

.....

.....

(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)**

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

**(2)**

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)**

**(Total for Question 8 = 11 marks)**

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**9** The kangaroo rat is a mammal that can survive in desert environments and can tolerate much higher concentrations of sodium ions in their bloodstream than humans.

Figure 16 shows an image of the kangaroo rat.



(Source: Richard R. Hansen/Science Photo Library)

**Figure 16**

(a) The name of the process that controls water levels in the body is

**(1)**

☒ **A** diffusion

☒ **B** osmosis

☒ **C** osmoregulation

☒ **D** thermoregulation

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(b) (i) Explain how the blood entering the nephron of the kangaroo rat is filtered to remove excess sodium ions and water.

**(3)**

The kangaroo rat has a longer loop of Henle than most mammals.

(ii) Explain why this adaptation is beneficial to the kangaroo rat.

**(2)**

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The volume of ADH stored in the pituitary gland of the kangaroo rat was measured.

Figure 17 shows the average results for 500 kangaroo rats.

| concentration of sodium chloride fed to kangaroo rats (mol $dm^{-3}$) | volume of ADH stored in the pituitary gland (arbitrary units) |
|---|---|
| 0.00 | 45 |
| 0.25 | 40 |
| 0.50 | 10 |
| 0.75 | 8 |
| 1.00 | 8 |

**Figure 17**

*(iii) Explain how ADH helps to control the levels of water and sodium ions in the bloodstream.

**(6)**

**(Total for Question 9 = 12 marks)**

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**10** 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.

(a) (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)**

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

Clover is a leguminous plant.

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

**(3)**

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

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

**(4)**

**(Total for Question 10 = 12 marks)**

**TOTAL FOR PAPER = 100 MARKS**

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