

# Ecology 1

Name: \_\_\_\_\_

Class: \_\_\_\_\_

Date: \_\_\_\_\_

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Time: **77 minutes**

Marks: **71 marks**

Comments:

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1.

Farmers can increase crop yield by controlling the conditions that plants grow in.

(a) Draw **one** line from each substance to how the substance increases crop yield.

Substance	How the substance increases crop yield
	Add mineral ions to the soil
Fertiliser	Decreases carbon dioxide concentration in the soil
Herbicide	Increases oxygen concentration in the air
	Kills weeds that compete with crops

(2)

(b) **Figure 1** shows a food chain for a farmer's field.

**Figure 1**

Seeds → Mice → Owls

Which is the secondary consumer in the food chain?

Tick (✓) **one** box.

Seeds

Mice

Owls

(1)

- (c) Bees are insects that live in hives.  
The bees fly in and out of the hives.

**Figure 2** shows a crop growing in a field.

The farmer has added bee hives to increase the number of bees in the field.

**Figure 2**



Increasing the number of bees and other insects increases crop yield.

Which are **two** ways that increasing the number of insects in an area will increase crop yield?

Tick (✓) **two** boxes.

Insects change the soil pH around the crop.

Insects eat leaves from the crop.

Insects eat pests on the crop.

Insects pollinate the crop.

Insects shelter in the crop.

**(2)**

(d) Some farmers increase the size of hedgerows between fields where crops grow.

Suggest **one** reason why.

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(1)

Peat comes from peat bogs.

(e) Peat can be used to produce garden compost.

The table below compares peat compost with a sample of soil.

	<b>Mineral ion concentration</b>	<b>Speed at which water drains through</b>
Peat compost	Low	Slow
Soil	High	Fast

Young plants have short roots.

Explain **one** advantage of growing young plants in peat compost instead of in soil.

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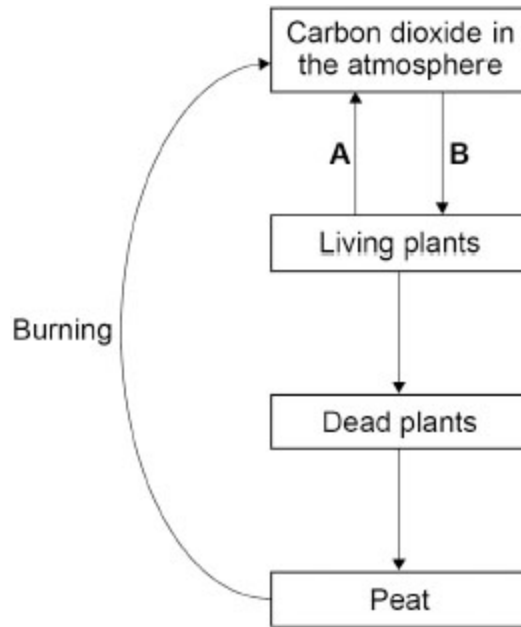
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(2)

Peat can also be burnt as fuel.

Figure 3 shows part of the carbon cycle.

Figure 3



(f) Name process **A** and process **B**.

Choose answers from the box.

condensation	photosynthesis	respiration	transpiration
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Process **A** \_\_\_\_\_

Process **B** \_\_\_\_\_

(2)

(g) Peat contains carbon compounds.

Explain why burning peat contributes to climate change.

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(2)

(h) Decay is an important process in the carbon cycle.

Which **two** types of organism cause decay?

Tick (✓) **two** boxes.

- |          |                          |
|----------|--------------------------|
| Algae    | <input type="checkbox"/> |
| Animals  | <input type="checkbox"/> |
| Bacteria | <input type="checkbox"/> |
| Fungi    | <input type="checkbox"/> |
| Plants   | <input type="checkbox"/> |

(2)

(i) Deforestation affects the carbon cycle.

Give **one** use of the land after the land has been cleared by deforestation.

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(1)

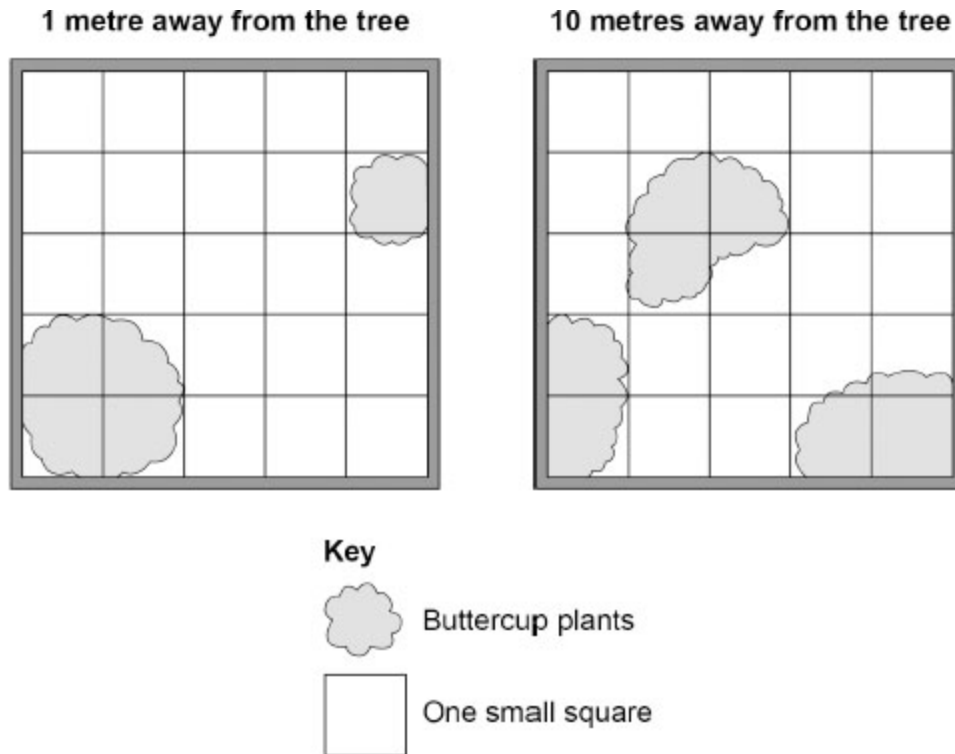
(Total 15 marks)

2.

Buttercups are small plants.

A student investigated the distribution of buttercup plants at different distances from a tree.

The figure below shows a piece of equipment being used to sample two areas.



(a) What is the scientific name of the equipment shown in the figure above?

Tick (✓) **one** box.

Grid

Quadrat

Transect

(1)

(b) Each small square on the figure above represents a percentage cover of 4%.

The student counted every small square that was **at least half** covered by buttercup plants.

At 1 metre away from the tree, buttercup plants had a percentage cover of 20%.

Determine the percentage cover of buttercup plants at **10 metres** away from the tree.

Use the figure above.

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Percentage cover = \_\_\_\_\_ %

(2)

(c) What is the independent variable in the investigation?

Tick (✓) **one** box.

Distance from the tree

Number of species

Time of year

(1)

(d) What is an advantage of calculating percentage cover instead of counting the number of buttercup plants in an area?

Tick (✓) **one** box.

Percentage cover is affected by the number and size of individual plants.

Percentage cover is always the same for individual plants of any species.

Percentage cover is larger than the number of individual plants.

(1)

The student investigated the percentage cover of buttercup plants around a different tree.

The table below shows the results.

Distance from the tree in metres	Percentage (%) cover					
	Result 1	Result 2	Result 3	Result 4	Result 5	Mean
1	12	8	4	12	4	X
10	24	12	8	28	8	16

(e) Calculate mean value **X** in the table above.

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**X** = \_\_\_\_\_ %

(2)

(f) Give **one** conclusion about the effect of distance from the tree on the percentage cover of buttercup plants.

Use the table above.

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(1)

(g) Give **two** other factors that affect the percentage cover of buttercup plants around the tree.

Do **not** refer to distance from the tree.

1 \_\_\_\_\_

\_\_\_\_\_

2 \_\_\_\_\_

\_\_\_\_\_

(2)

(h) The table above shows the results of the investigation.

Suggest **two** improvements to the investigation.

1 \_\_\_\_\_

\_\_\_\_\_

2 \_\_\_\_\_

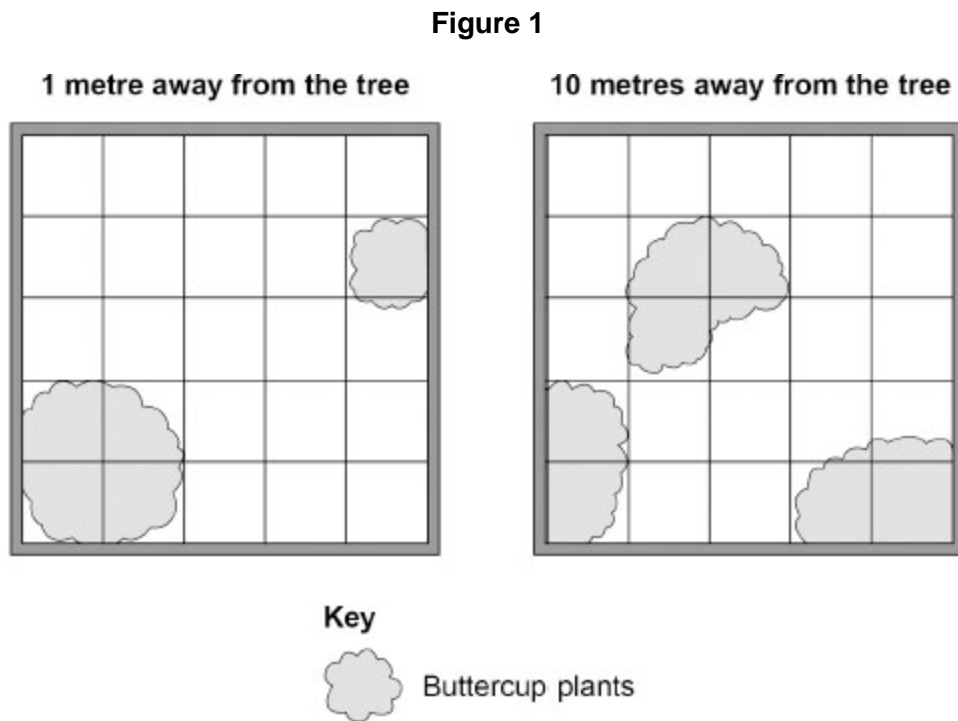
\_\_\_\_\_

(2)  
(Total 12 marks)

**3.** Buttercups are small plants.

Students investigated the distribution of buttercup plants at different distances from a tree.

**Figure 1** shows quadrats being used to sample two areas.



(a) What was the independent variable in this investigation?

\_\_\_\_\_

\_\_\_\_\_

(1)

- (b) Students counted every small square in the quadrat that was **at least half** covered by buttercup plants.

Determine the percentage cover of buttercup plants **10 metres** away from the tree.

Use **Figure 1**.

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Percentage cover = \_\_\_\_\_ %

**(3)**

- (c) The students placed:

- several quadrats 1 metre away from the tree
- several quadrats 10 metres away from the tree.

Give **two** factors the students should consider when deciding how many times to place a quadrat at each distance.

Do **not** refer to time available.

1 \_\_\_\_\_

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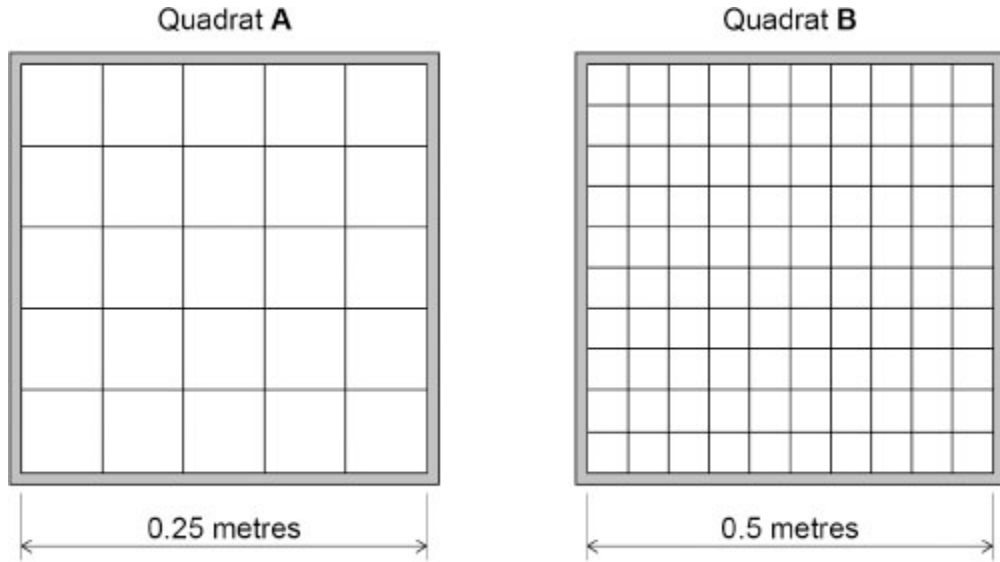
2 \_\_\_\_\_

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**(2)**

(d) **Figure 2** shows two different quadrats.

**Figure 2**



Not to scale

Explain **two** advantages of using quadrat **B** instead of quadrat **A** in the investigation.

You should include calculations in your answer.

1 \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

2 \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

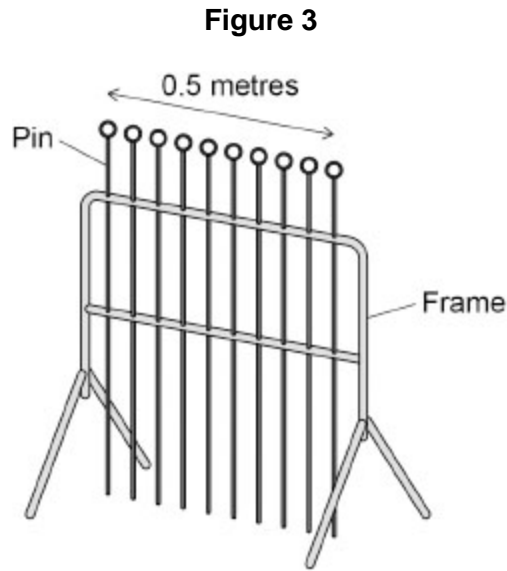
\_\_\_\_\_

\_\_\_\_\_

(4)

A point quadrat can also be used to estimate the percentage cover of plants in an area.

Figure 3 shows a point quadrat.



When using a point quadrat, the pins are pushed down to the soil.

The number of pins that touch a buttercup plant is counted.

(e) What are **two** advantages of using a point quadrat compared with using a square quadrat?

Tick (✓) **two** boxes.

With a point quadrat, a plant that is smaller than half a square is more likely to be counted.

With a point quadrat, each species of plant is easier to identify.

With a point quadrat, no judgement of cover is needed.

With a square quadrat, a buttercup plant covering other plants cannot be counted.

With a square quadrat, the results are less likely to be biased.

(2)

(f) The percentage cover of buttercup plants can be estimated using the equation:

$$\text{percentage cover} = \frac{\text{number of times a pin touched a buttercup plant}}{\text{total number of pins used}} \times 100$$

30 students each collected results from 50 pins.

The students then put **all** their results together.

Buttercup plants had a percentage cover of 7%.

Calculate the number of times a pin touched a buttercup plant.

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Number of times a pin touched a buttercup plant = \_\_\_\_\_

(3)

(Total 15 marks)

4.

Limpets are small animals with shells.

Limpets attach to rocks on sea shores.

**Figure 1** shows limpets on rocks.

**Figure 1**



(a) Limpets eat algae.

Limpets are prey for crabs.

Give the food chain for algae, crabs and limpets.

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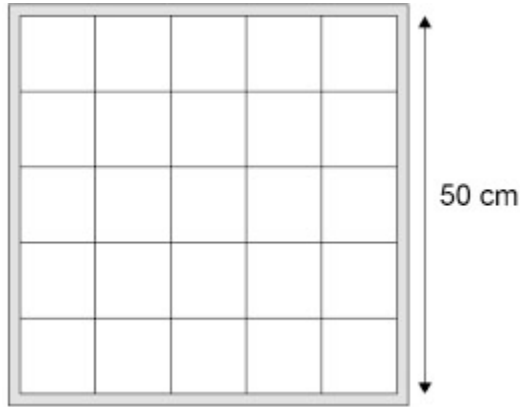
(1)

Students estimated the population of limpets on a sea shore.

The students were given a square quadrat.

**Figure 2** shows the quadrat.

**Figure 2**



(b) Calculate the area of the quadrat in  $\text{m}^2$ .

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Area of quadrat = \_\_\_\_\_  $\text{m}^2$

**(2)**

(c) The total area of the sea shore was  $1800 \text{ m}^2$ .

The students sampled 2% of the total area of the sea shore.

Calculate the number of times the students needed to use the quadrat for the 2% sample.

Use your answer from part (b)

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Number of times = \_\_\_\_\_

**(2)**

(d) Explain why throwing a quadrat is **not** a random method to estimate population size.

Do **not** refer to safety in your answer.

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(2)

(e) Describe **one** method the students could use to plan where the quadrat should be randomly placed each time.

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(2)

(f) Suggest **one** hazard the students should be aware of when collecting data on the sea shore.

Do **not** refer to throwing quadrats in your answer.

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(1)

(g) Populations of limpets are monitored to assess the impact of pollution in water.

Suggest **one** type of pollution in water that may affect the population of limpets.

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(1)

(Total 11 marks)

**5.** Otters are mammals that live in river ecosystems.

The figure below shows an otter.



(a) Define the term 'ecosystem'.

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(1)

(b) Otters are an important species for the stability of the river community.

Describe **two** ways animal species may be important for the stability of a whole community.

1 \_\_\_\_\_

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2 \_\_\_\_\_

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(2)

Sewage was accidentally added to a river.

The sewage moved with the river water and affected:

- the number of bacteria in the water
- the concentration of dissolved oxygen in the water.

Samples of river water were analysed at different distances from where the sewage was added.

The table below shows the results.

Distance from where sewage was added in km	Number of bacteria $\times 1000/\text{mm}^3$	Concentration of dissolved oxygen in $\text{mg}/\text{dm}^3$
0.0	4	5.4
1.0	75	4.8
2.0	125	4.3
3.0	145	3.8
4.0	160	3.3
5.0	216	2.7

- (c) The number of bacteria at 5.0 km was greater than the number of bacteria where the sewage was added.

Calculate how many times greater.

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Number of times greater = \_\_\_\_\_

(1)

(d) A student concluded:

'number of bacteria  $\propto$  concentration of dissolved oxygen'

Explain why the student's conclusion is **not** correct.

Use the table above.

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**(2)**

(e) Otters:

- live in water and on the land
- eat mainly fish.

The concentration of dissolved oxygen has decreased in a river where otters live.

Explain how the decrease in the concentration of dissolved oxygen in the river water will affect the population of otters.

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**(3)**

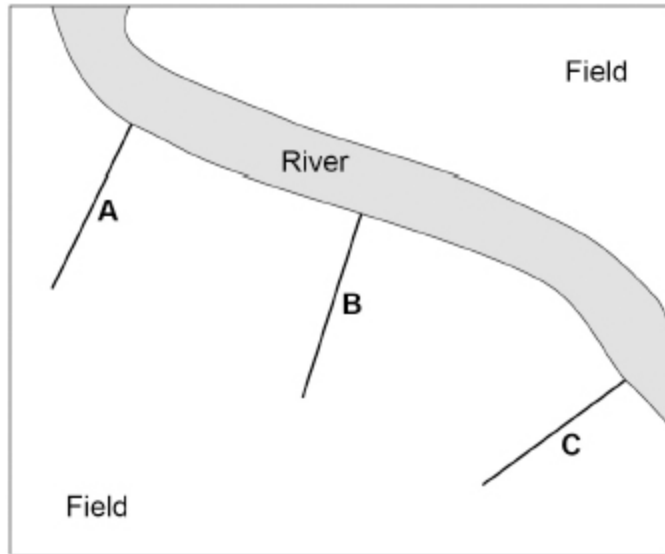
**(Total 9 marks)**

6.

A student investigated how the distance from a river affects the number of different plant species.

Figure 1 shows a river between two fields.

Figure 1



- (a) **A**, **B** and **C** show the positions of three transects.

Where should the student position another transect for this investigation?

Draw the extra transect line on **Figure 1**.

(1)

- (b) The student recorded the number of different plant species at 1 m intervals along each transect.

Which piece of equipment should be used at 1 m intervals along the transect?

Tick (✓) **one** box.

Microscope

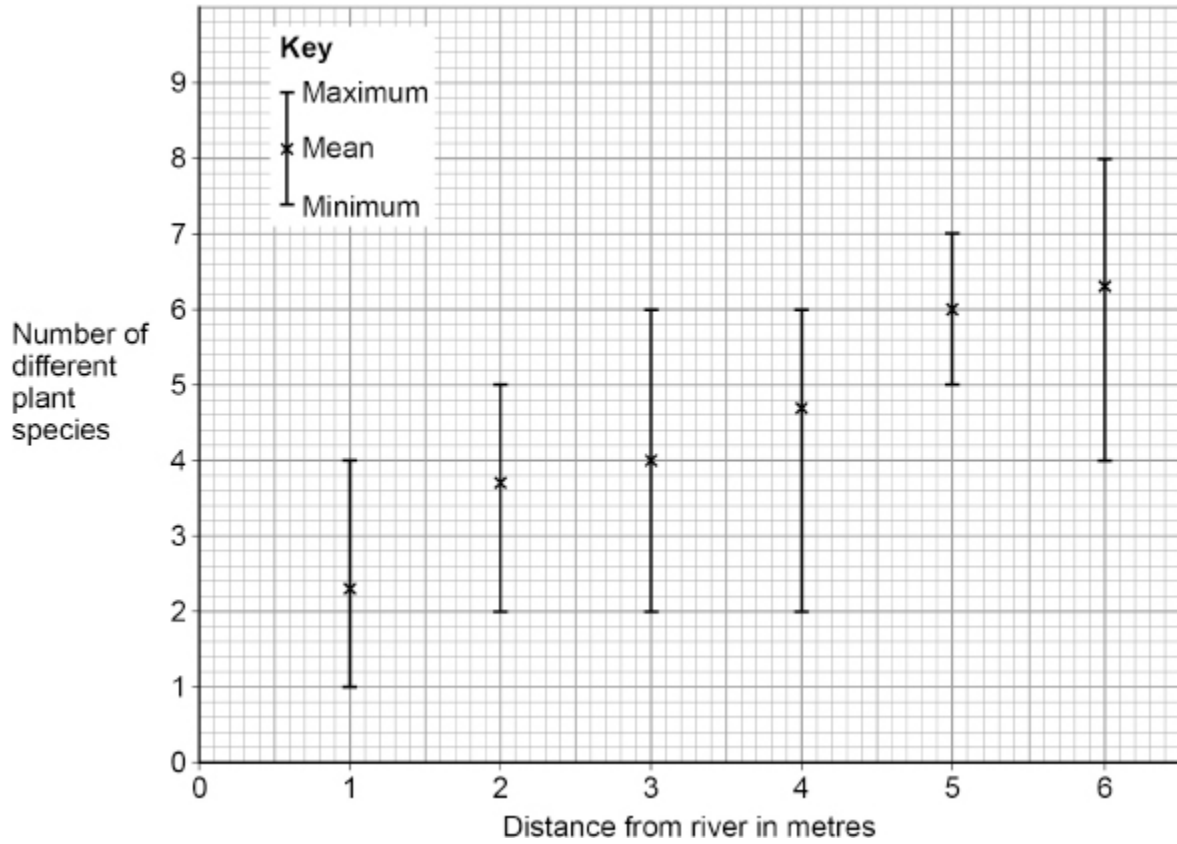
Quadrat

Timer

(1)

Figure 2 shows the results.

Figure 2



(c) What was the mean number of different plant species 5 m from the river?

Mean = \_\_\_\_\_

(1)

(d) What is the effect of increasing distance from the river on the mean number of different plant species?

\_\_\_\_\_  
\_\_\_\_\_

(1)

- (e) The minimum and maximum values on **Figure 2** show the range of results at each distance from the river.

Why is it useful to know the range of results?

Tick (✓) **one** box.

To calculate the mean result

To know the uncertainty of the mean

To show the mode of the results

(1)

- (f) Cows are kept in the fields.

Fewer plants are found where the cows often walk on the ground.

The number of cows is one **biotic** factor that affects the number of plants.

Which **two** factors are **abiotic** factors?

Tick ✓ **two** boxes.

Consumers

Light intensity

Moisture levels

Pathogens

Predators

(2)

(g) Explain why a decrease in the number of plants across the world increases global warming.

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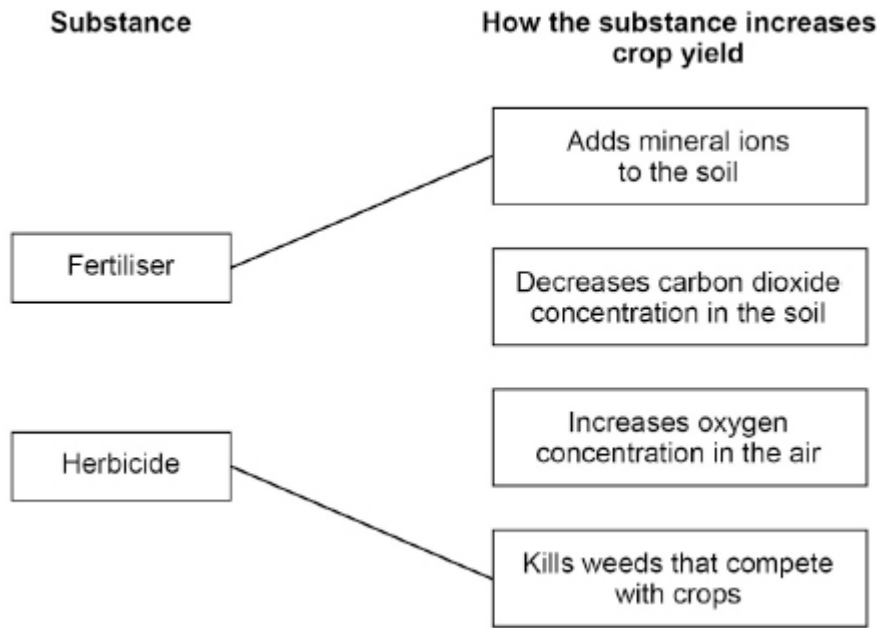
**(2)**

**(Total 9 marks)**

# Mark schemes

1.

(a)



do **not** accept more than one line from a box on the left

2

(b) owls

1

(c) insects eat pests on the crop

1

insects pollinate the crop

1

- (d) any **one** from:
- as a habitat for (beneficial) insects / animals  
*allow as a shelter / space for (beneficial) insects / animals*
  - to keep (larger) animals out  
**or**  
to keep people out  
*allow to protect (the crop) from (larger) animals*  
*allow to protect (the crop) from people*  
*ignore keep insects / birds out*  
*ignore to protect the crop unqualified*  
*ignore to stop pests eating the crop*
  - (to increase) biodiversity  
*allow to increase the number of insects / plants*  
*allow descriptions of increasing biodiversity*
  - to reduce wind speed  
*allow act as wind break*
  - as a habitat for predators of crop damaging organisms  
*ignore to reduce pests unqualified*
  - to prevent / reduce soil erosion  
*ignore so more (crop) can be grown*

1

- (e) water takes more time to drain (through)
- allow converse if clearly referring to soil*  
*allow there will be more water (in the peat compost)*  
*allow water drains / moves slower*  
*allow water drains / moves more slowly*  
*ignore water drains slow / slowly*

1

(so) water is more likely to be taken up by plants  
*allow (so) there is more time for plants to take up water*

**or**

(so) do not need to water plants (as) frequently  
*allow (so) reduces water use*

**or**

(which is an advantage because) young plants cannot reach water that is deep  
(in soil / compost)

*ignore references to cost*  
*allow 2 marks for water more likely to be taken up by plants before it drains away*

1

- (f) (A) respiration 1
- (B) photosynthesis
- answer line takes precedence* 1
- (g) (burning peat) releases / increases carbon dioxide  
*allow (burning peat) releases / increases CO<sub>2</sub>*  
*ignore burning releases carbon*  
*do **not** accept peat contains carbon dioxide* 1
- (which) causes / increases global warming  
*allow (which) is a greenhouse gas*  
*allow (which) causes the greenhouse effect*  
*ignore (which) causes / increases climate change* 1
- (h) bacteria 1
- fungi 1
- (i) farming (cattle / biofuel / crops / animals)  
*allow examples of farming a crop / animal*  
*allow building*  
*allow named type of building eg houses / factories*  
*allow mining*  
*allow landfill*  
*allow reforestation / rewilding* 1

[15]

- 2.** (a) quadrat 1
- (b)  $7 \times 4$   
*allow  $\frac{7}{25} \times 100$*  1
- 28 (%)  
*allow 1 mark for a correct calculation from an incorrect attempt at counting squares (in the range 5 to 10) covered by buttercups* 1
- (c) distance from the tree 1

(d) percentage cover is affected by number and size of individual plants

1

(e)

$$\frac{12+8+4+12+4}{5}$$

allow  $\frac{40}{5}$

1

8 (%)

1

(f) higher percentage cover 10 m from tree

*allow ecf from question (e) with correct mathematical analysis of difference in incorrectly calculated mean*

*allow converse if clearly referring to 1 m from tree **or** closer to the tree*

*allow higher percentage cover further from tree*

*allow more cover / buttercups further from tree*

*allow cover is double further from tree*

*allow twice as much / many further from tree*

1

(g) any **two** from:

- light

*allow shade **or** less / more light*

*allow (tree) leaves drop and cover buttercups ignore Sun*

- temperature
- water / moisture

*allow rain*

- type of soil
- pH (of soil)

*allow acidity / alkalinity (of soil)*

- minerals / ions

*allow salts **or** named examples of ions, such as nitrate*

*allow fertiliser(s)*

*ignore nitrogen / nutrients*

- oxygen in soil
- wind (strength / direction)
- herbicide

*allow weedkiller*

- competition from other plants
- herbivores / grazers (of buttercups)

*allow animals / insects eat / damage buttercups*

- (number of) pollinators
- time of year

*allow season*

*ignore time unqualified*

- size of tree / roots / canopy
- disease / pathogen (of buttercups)
  - ignore (availability of) space*
  - ignore carbon dioxide*
  - ignore weather / climate*

*if no other mark awarded allow 1 mark for biotic **and** abiotic*

2

(h) any **two** from:

- repeat at more distances **or** at another distance (from the tree)
  - allow specific distances, between 0 m and 10 m or beyond 10 m*
- repeat at each distance more (than 5) times
  - allow repeat (at each distance) more than 5 times*
  - allow repeat at 1 m and 10 m more (than 5) times*
  - allow repeat the (whole) investigation*
  - ignore repeat 5 times*
- repeat for other trees
- measure other (named) factor(s)

2

[12]

3.

(a) distance from the tree

*allow distance*

1

(b) 7 (squares)

1

$$\frac{7}{25} \times 100$$

allow  $0.28 \times 100$

allow correct working shown from an incorrect attempt at counting squares (in the range 6 to 10) covered by buttercups

1

28 (%)

allow a correct calculation from an incorrect attempt at counting squares (in the range 6 to 10) covered by buttercups 1 AO2

**alternative route**

(percentage cover of one small square)

$$\left(\frac{100}{25} =\right) 4$$

$$7 \times 4$$

allow correct working shown with incorrectly calculated percentage cover of one small square

28 (%)

allow a correct calculation from an incorrect attempt at counting squares (in the range 6 to 10) covered by buttercups

1

(c) any **two** from:

- whether the sample is representative
- the size of the quadrat
- the number of students

allow the number of quadrats (available)

- how many quadrats fit around the tree at 1 m

allow size of tree

allow if the same (quadrat) area is being sampled repeatedly

- factors such as buildings **or** other tree(s)

2

(d) (quadrat **B**) samples a larger area

allow converse if clearly referring to quadrat **A**

ignore references to time

allow (quadrat **B**) is larger / wider

1

(because) 0.25 (m<sup>2</sup>) rather than 0.0625 (m<sup>2</sup>)

*allow  $\frac{1}{4}$ (m<sup>2</sup>) rather than  $\frac{1}{16}$ (m<sup>2</sup>)*

*allow 2500 cm<sup>2</sup> rather than 625 cm<sup>2</sup>*

*allow by 4 times*

1

(quadrat **B**) gives more accurate / precise results

*allow (quadrat **B**) is more representative*

*allow (quadrat **B**) has greater resolution*

*allow need to use quadrat **A** 4 times (as many times) to have the same accuracy / precision as quadrat **B***

*ignore (quadrat **B**) is more reliable / valid / repeatable*

1

(because) to the nearest 1% (of the quadrat) rather than nearest 4%

*allow (because) quadrat **B** has 100 (small) squares rather than 25 (small) squares*

*do **not** accept quadrat **B** has smaller squares (within quadrat)*

1

(e) with a point quadrat, a plant that is smaller than half a square is more likely to be counted

1

with a point quadrat, no judgement of cover is needed

1

(f)

$$7 = \frac{n}{30 \times 50} \times 100$$

allow  $7 = \frac{n}{1500} \times 100$

1

$$n = \frac{7}{100} \times 1500$$

allow  $n = 0.07 \times 1500$

allow  $n = 7 \times 15$

allow a correct rearrangement using 50 pins as total number of pins used

allow correct rearrangement with an incorrect calculation of number of pins used

1

$$n = 105$$

allow a correct calculation using 50 pins as total number of pins used

allow correct calculation with an incorrect calculation of number of pins used

allow **2** marks for:

$$\left(\frac{7}{100} \times 50\right) = 3.5$$

1

[15]

4.

(a) alga(e) → limpet(s) → crab(s)

direction of arrows must be correct

1

(b)  $(50 \text{ (cm)} \times 50 \text{ (cm)}) = 2500 \text{ (cm}^2\text{)}$

allow conversion cm to m

$$(50 \div 100 =) 0.5 \text{ (m)}$$

1

$$\left(\frac{2500}{100 \times 100}\right) = 0.25 \text{ (m}^2\text{)}$$

(allow  $\frac{1}{4} \text{ (m}^2\text{)}$ )

allow

$$(0.5 \times 0.5 =) 0.25 \text{ (m}^2\text{) for 2 marks}$$

$$\text{allow } \left(\frac{1}{2} \times \frac{1}{2} =\right) \frac{1}{4} \text{ (m}^2\text{) for 2 marks}$$

1

(c)

$$(1800 \times \frac{2}{100} =) 36 \text{ (m}^2\text{)}$$

*allow (1800 × 0.02 =) 36 (m<sup>2</sup>)*

1

$$(\frac{36}{0.25} =) 144 \text{ (quadrats)}$$

*allow (36 × 4 =) 144 (quadrats)*

*allow a correct calculation of number of quadrats with an incorrect calculation of 2% of 1800*

*allow ecf from part (b)*

1

(d) (location of sample will be) biased / chosen

*allow students may aim for limpets*

*allow students may aim to avoid limpets*

*allow students may stand / start near groups of limpets*

1

**or**

(location of sample will be) limited by how far students can throw

(therefore) results will not be representative (of (actual) abundance)

*allow population size will be too high / low*

1

(e) tape measure along two (perpendicular) sides (of sea shore)

**or**

allocate co-ordinates (to sea shore)

**or**

divide area into a grid

1

use random number generator

*allow description of generating random number(s) for example*

*pulling numbers from container*

*do **not** accept throwing quadrats*

1

(f) any **one** from:

*allow named example of a hazard*

- water

*allow sea*

- tide

*allow waves*

- rocks

*allow slippery / uneven surfaces*

- quicksand
- named hazardous material on the sea shore eg needles, glass
- sewage
- animals

*allow appropriate named animal for example crab / jellyfish*

1

(g) any **one** from:

- fertiliser
- sewage
- toxic chemicals

*allow named toxic chemical eg herbicide / pesticide / insecticide / DDT / (crude) oil*

*allow (micro)plastics*

*allow (dissolved) carbon dioxide*

*allow heavy metals*

*allow thermal pollution*

1

[11]

5.

(a) the interaction of (a community of living) organisms and (the non-living parts of) their environment / habitat

*allow the interaction of (a community of) biotic parts and the abiotic parts of their environment / habitat*

*allow the interaction of a community and (the non-living parts of) their environment / habitat*

1

(b) any **two** from:

- may be a predator therefore control prey population  
*allow named examples throughout*  
*allow may be predator so keep prey population (fairly) constant*
- may be prey so provide energy to predator  
*ignore may be prey so provide food to predator*
- may be a primary consumer therefore control plant / algae population
- may alter habitat for other species (to survive)
- may provide shelter for other species (to survive)
- may maintain biodiversity
- may disperse seed / pollen

2

(c)

$$\left(\frac{216}{4}\right) = 54$$

*allow*

$$\left(\frac{216\ 000}{4000}\right) = 54$$

1

(d) as number of bacteria increases, the concentration of dissolved oxygen decreases

*ignore references to inversely proportional*

*allow as bacteria increases, oxygen decreases*

*allow there is a negative correlation*

*allow converse*

1

(the relationship is)

**not** number of bacteria increases and the concentration of oxygen increases (in the same ratio)

*allow (the relationship is) **not** as bacteria increases, oxygen increases*

*allow whereas proportional (relationship) would mean as one increases the other increases (in the same ratio)*

*allow converse*

1

- (e) (decrease in oxygen concentration causes a) decrease in the number of fish  
*allow (decrease in oxygen concentration means) more fish die* 1
- (because) fish need oxygen to respire (aerobically)  
*allow invertebrates need oxygen to respire **and** fish eat invertebrates*  
*do **not** accept implications that otters require oxygen from water*  
*do **not** accept energy produced / made / created by respiration* 1
- (therefore) otter population decreases due to less food  
*allow rate of reproduction (in otter population) is lower due to less food*  
*allow otters migrate to another river / area / habitat*  
*ignore decrease in oxygen causes decrease in otter population unqualified*  
**alternative answer**  
*(decrease in oxygen concentration means) more bacteria are present (1)*  
*(so) more fish die (from bacterial infection) (1)*  
*(therefore) otter population decreases due to less food*  
**or**  
*rate of reproduction (in otter population) is lower due to less food*  
**or**  
*otters migrate to another river / area / habitat (1)* 1

[9]

6. (a) line approximately perpendicular to river  
*allow on either side of river ignore length of line*  
*do **not** accept a line parallel to the river* 1
- (b) quadrat 1
- (c) 6 / six  
*ignore calculation / range given if mean is clear* 1
- (d) increases 1
- (e) to know the uncertainty of the mean 1
- (f) light intensity 1
- moisture levels 1

- (g) more / increased carbon dioxide (in air)  
**or**  
less carbon dioxide absorbed / used (by plants)

1

(due to) less photosynthesis

*allow (due to) more decay / burning (of plants)*

*allow 2 marks for less carbon dioxide used for photosynthesis*

*if no other mark awarded allow 1 mark for carbon dioxide is used in photosynthesis*

1

[9]