

# Ecology 2

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

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

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

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Time: **85 minutes**

Marks: **79 marks**

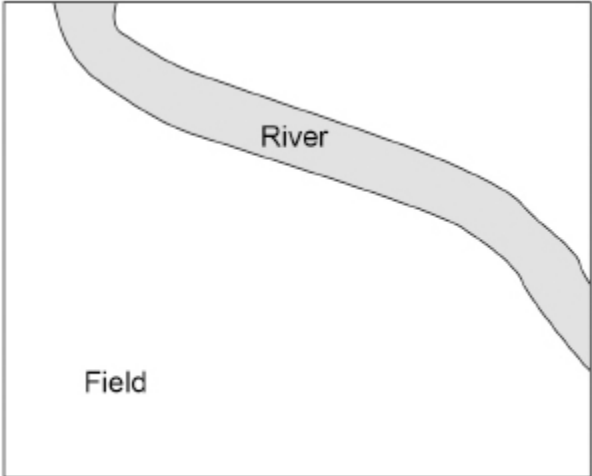
Comments:

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1.

Figure 1 shows a river next to a field.

Figure 1



- (a) Describe a method to investigate how the distance from the river affects the number of different plant species in the field.

You should explain how to use a transect in your method.

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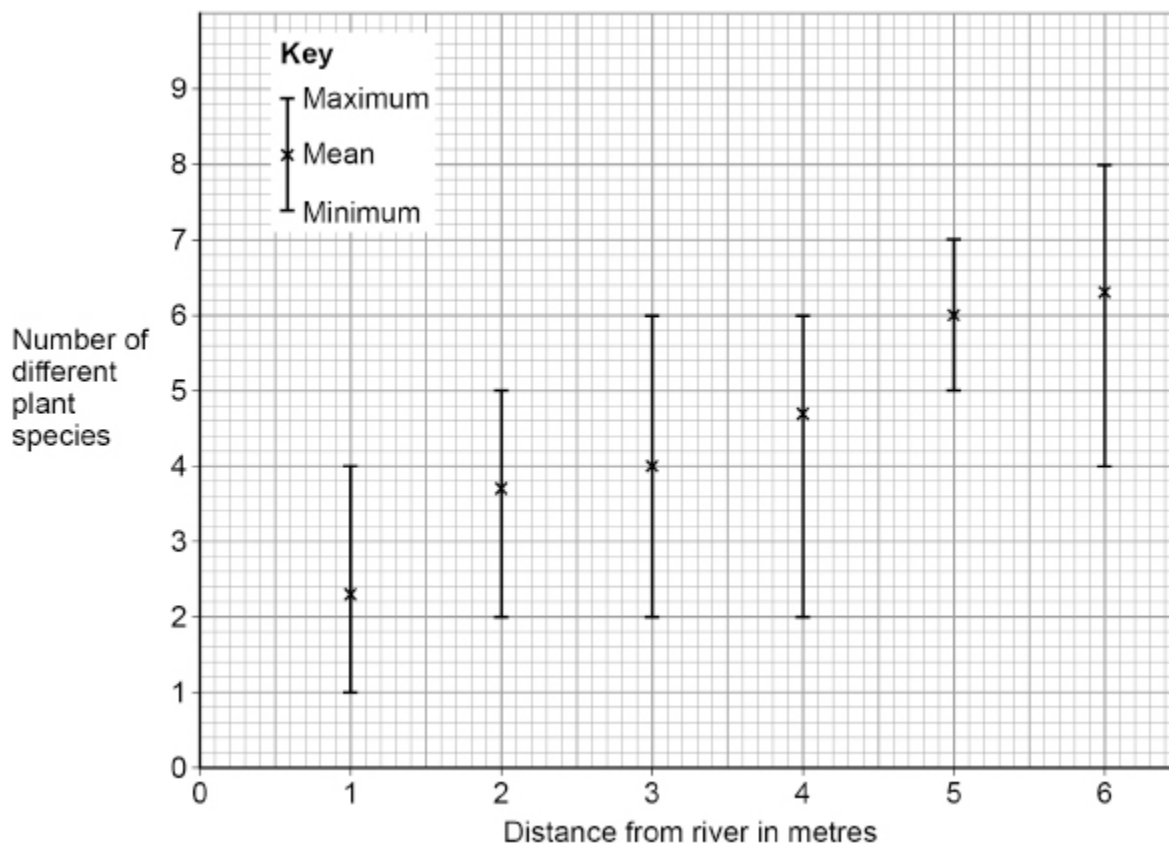
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(4)

- (b) Students used a valid method to investigate how the distance from the river affects the number of different plant species in the field.

Figure 2 shows the results.

Figure 2



What is shown by the data in **Figure 2**?

Tick (✓) **one** box.

Fewer different species are always recorded nearer to the river.

The mean value students can be most certain about is 5 metres from the river.

The number of species recorded 6 metres from the river is anomalous.

(1)





(b) What type of factor is water in the soil?

Tick (✓) **one** box.

A biotic factor

A control factor

An abiotic factor

(1)

(c) Give **two** factors which might affect the number of buttercups growing on the school field.

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

1 \_\_\_\_\_

2 \_\_\_\_\_

(2)

(d) Complete the sentence.

Choose the answer from the box.

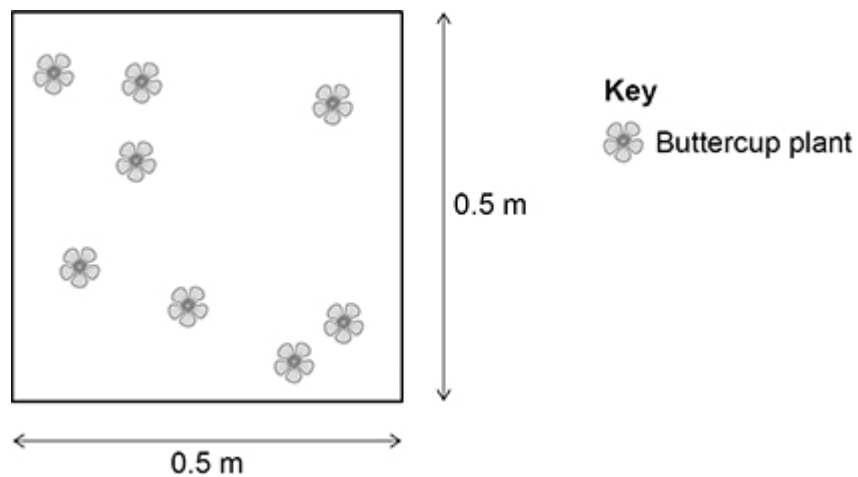
<b>a control</b>	<b>the dependent</b>	<b>the independent</b>
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In this investigation the number of buttercups in each quadrat was

\_\_\_\_\_ variable.

(1)

The diagram below shows a quadrat on an area of the school field.



(e) Calculate the area of the quadrat.

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Area of the quadrat = \_\_\_\_\_ m<sup>2</sup>

(1)

(f) The mean number of buttercups in one quadrat was 8

Calculate the number of buttercups per m<sup>2</sup>

Use your answer from part (e)

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Number of buttercups = \_\_\_\_\_ per m<sup>2</sup>

(2)

In a laboratory another group of students investigated the effect of soil acidity on the growth of beans.

This is the method used.

1. Put soil with a neutral pH in two large boxes.
2. Add acid to the soil in one box.
3. Plant some bean seeds in each box.
4. Water the seeds over 3 weeks.
5. After 3 weeks, measure the height of the bean plants in each box.
6. Calculate the mean height of bean plants in each box.

(g) Give **two** improvements the students could make to the method to give more valid results.

1 \_\_\_\_\_

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2 \_\_\_\_\_

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(2)

The students then carried out a valid investigation.

The table below shows the students' results.

Bean plant	Height of bean plants in cm	
	Acid soil	Neutral soil
1	8	11
2	6	12
3	4	11
4	10	17
5	7	19
<b>Mean</b>	7	<b>X</b>

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

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**X** = \_\_\_\_\_ cm

**(2)**

(i) What conclusion can the students make about the effect of acid soil on the growth of bean plants?

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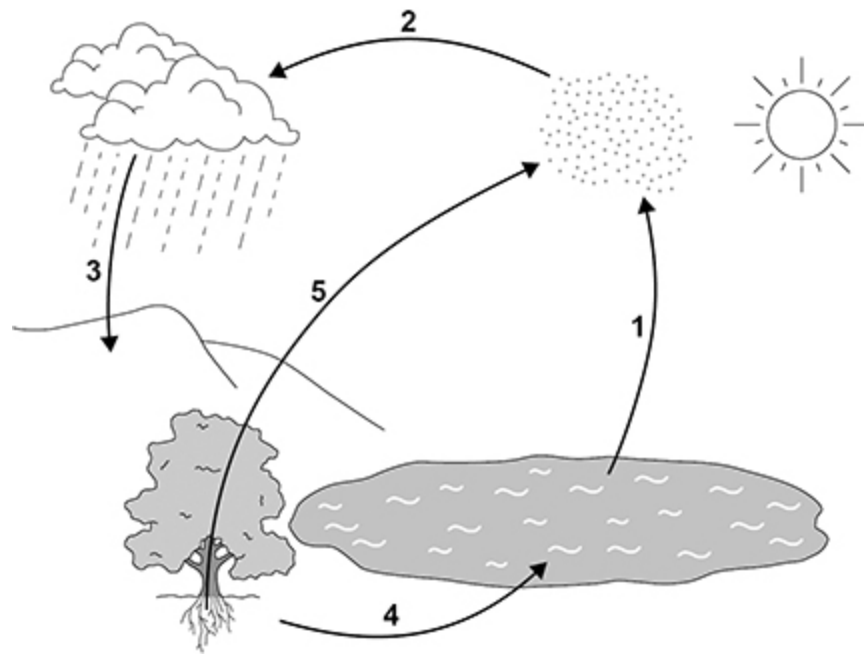
**(1)**

**(Total 16 marks)**



The water cycle provides water for plants and animals on land before the water goes into lakes and seas.

The diagram below represents the water cycle.



(b) Name the processes 1 to 5 shown on above diagram.

1. \_\_\_\_\_
2. \_\_\_\_\_
3. \_\_\_\_\_
4. \_\_\_\_\_
5. \_\_\_\_\_

(5)

(c) In 2007 the population of the world was 6 000 000 000

A study found that 4.5% of the population had severe water shortage.

Calculate how many people had severe water shortage.

Give your answer in standard form.

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Number of people (in standard form) = \_\_\_\_\_

**(3)**

(d) Why do more people have severe water shortage now than in 2007?

Tick (✓) **two** boxes.

Climate change has increased the area of deserts.

Each person drinks less water.

More water is used to grow crops.

Sea levels have risen because the ice caps are melting.

Some countries have built de-salting factories for seawater.

**(2)**

Leaves on a tree contain carbon compounds.

In autumn the leaves fall to the ground.

- (e) Microorganisms in the soil recycle carbon from the leaves so that the carbon is used for new plant growth.

Explain how.

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(4)

- (f) What is **one** benefit of fallen leaves for living plants?

Tick (✓) **one** box.

Energy is released for living plants.

Insect pests in the soil are killed.

Nitrates are released into the soil.

Oxygen is supplied to root cells.

(1)

(Total 16 marks)

5.

On a school field:

- one area of the soil was usually wet
- another area of the soil was usually dry.

Students investigated the effect of water in the soil on the number of buttercup plants growing in each area.



6.

Figure 1 shows one species of bird on a bird feeder.

Figure 1



The birds use their beaks to reach nuts inside the bird feeder.

Cats sometimes eat the birds.

(a) Give the food chain for the birds, cats and nuts.

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(2)

(b) Which organism in the food chain you gave in part (a) is the primary consumer?

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(1)

(c) Cats are one biotic factor that affects the size of the bird population.

Which **two** of the following are **biotic** factors?

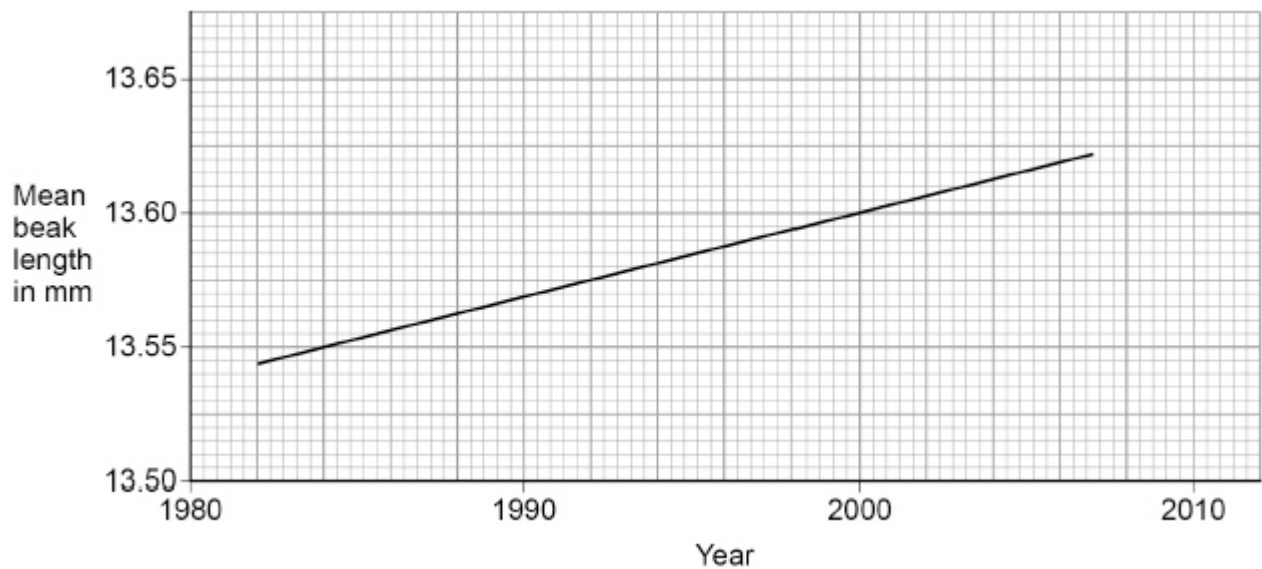
Tick (✓) **two** boxes.

- Food
- Pathogens
- Sunlight
- Temperature
- Water

(2)

**Figure 2** shows the mean beak length of this species of bird from 1982 to 2007.

**Figure 2**



(d) What was the mean beak length in 2000?

Mean beak length = \_\_\_\_\_ mm

(1)

(e) What type of adaptation is beak length?

Tick (✓) **one** box.

Behavioural

Chemical

Structural

(1)

**Figure 2** shows evidence of evolution in this species of bird.

(f) Scientists have concluded that beak length in this species of bird is increasing.

Complete the sentences about the evolution of this species of bird.

Choose answers from the box.

<b>excretion</b>	<b>generation</b>	<b>mutation</b>
<b>reproduction</b>	<b>respiration</b>	<b>variation</b>

The difference in beak length in the bird population is called \_\_\_\_\_.

A change in a gene affects the beak length.

Change in a gene is called \_\_\_\_\_.

The birds with the longest beaks get more food.

Getting more food improves a bird's chances of survival and \_\_\_\_\_.

This process of evolution takes place over more than one \_\_\_\_\_.

(4)

- (g) Birds of this species:
- live for about 3 years
  - produce up to 24 eggs every year.

Why is evolution easier to study in birds than in humans?

Tick (✓) **one** box.

Birds breed less frequently than humans.

Birds have a shorter life cycle than humans.

Birds have fewer offspring than humans.

(1)

- (h) Bacteria also provide evidence for evolution.

Which statement describes evidence for evolution?

Tick (✓) **one** box.

Bacteria can become resistant to antibiotics.

Decomposition can be caused by bacteria.

Some bacteria are pathogens.

(1)

(Total 13 marks)

7.

Mineral ions are important chemicals in an ecosystem.

- (a) Plants take in nitrate ions dissolved in water.

Which part of a plant takes in nitrate ions?

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(1)



## Mark schemes

- 1.** (a) measure / string / transect / line at right angles to river (edge)  
*allow measure / string perpendicular to river (edge)*  
*allow shown on **Figure 1***  
*allow measure / string / transect / line straight from the river into the field*  
*ignore measure / string / transect / line from the river into the field unqualified* 1
- place quadrat at intervals (along transect)  
*allow place quadrat at named intervals (of between 1 m and 10 m)*  
*allow place quadrats along transect*  
*do **not** accept place quadrat at random intervals* 1
- count the (different plant) species (in each quadrat) at each distance  
*ignore references to counting numbers of plants **or** percentage cover* 1
- repeat for 2 more transects  
*allow 2 or more repeats (of transect)*  
*allow repeat at 2 or more locations (along the river)*  
*allow 3 or more correct transect lines shown on **Figure 1*** 1
- (b) the mean value students can be most certain about is 5 metres from the river 1
- (c) moisture levels in the soil 1
- (d) **Level 3:** Relevant points (reasons / causes) are identified, given in detail and logically linked to form a clear account. 5-6
- Level 2:** Relevant points (reasons / causes) are identified, and there are attempts at logical linking. The resulting account is not fully clear. 3-4
- Level 1:** Points are identified and stated simply, but their relevance is not clear and there is no attempt at logical linking. 1-2
- No relevant content.** 0

## Indicative content

### consequences of increasing number of cows

- fewer plants
- due to more trampling
- due to more plants being eaten (by cows)
  
- (fewer plants so) less photosynthesis
- so more carbon dioxide in the atmosphere
  
- (more) cows will release carbon dioxide
- from respiration
  
- (more) cows release methane
  
- deforestation to provide farmland
  
- more (cow) faeces entering river / streams / watercourses

### environmental implications

- carbon dioxide is a greenhouse gas
- methane is a greenhouse gas
- global warming may be greater
- description of consequence(s) of global warming
- description of consequence(s) of (cow) faeces entering river / streams / watercourses
- less land available to grow crops
- effects of deforestation (eg reduced biodiversity)

For **Level 3**, explanations include consequence(s) and linked environmental implication(s).

[12]

2.

- (a) **Level 2:** The method would lead to the production of a valid outcome. All key steps are identified and logically sequenced.

3-4

**Level 1:** The method would not lead to a valid outcome. Some relevant steps are identified, but links are not made clear.

1-2

**No relevant content**

0

## Indicative content

- place quadrat randomly / systematically
- description of how randomness is achieved  
**or**  
description of how systematic placement is achieved
- count number of buttercups in quadrat
- record number
- repeat quadrat (in another location in the same wet soil area)
- (repeat) at least 5 times
- calculate a mean number of buttercups per quadrat
- the area of the wet soil area is 100 m<sup>2</sup>
- estimate the buttercup population using the area of the quadrat

(b) an abiotic factor

1

(c) any **two** from:

- light (intensity)  
*allow shade*  
*ignore sun*
- temperature
- competition  
*allow other plants growing there*
- herbivores / grazing  
*allow pests **or** named pest*
- pollinators  
*allow insects or named pollinator*
- trampling / mowing
- wind (direction / strength)
- soil pH **or** soil type
- ions / minerals / nutrients in the soil  
*allow named mineral*
- pathogens  
*allow infection*  
*ignore disease unqualified*
- herbicides  
*allow pesticides*

2

(d) (the) dependent

1

(e) **Mark with (f)**

$$0.25 \text{ (m}^2\text{)}$$

1

(f) **Mark with (e)**

$$8 \div 0.25$$

*allow ecf from part (e)*

*allow  $8 \times 4$*

1

$$= 32 \text{ (buttercups per m}^2\text{)}$$

1

(g) any **two** from:

- repeat
- same volume of water
- same mass / volume of soil
- more acidity / pH levels
- same number of bean seeds
- same spacing / depth of seeds
- same species / variety / type of bean seeds
- same size boxes
- same light (intensity)
- same temperature

*allow same amount of water*  
*allow same amount of soil*  
*if neither marking point awarded, allow put them in the same place*  
*eg greenhouse*

2

(h) 
$$\frac{11+12+11+17+19}{5}$$

1

**or**

$$\frac{70}{5}$$

$$14 \text{ (cm)}$$

1

(i) bean plants grow less well (in acid soil)

**or**

bean plants are shorter (in acid soil)

*allow converse*

1

**[16]**

**3.**

**Level 3:** Relevant points (reasons/causes) are identified, given in detail and logically linked to form a clear account.

5–6

**Level 2:** Relevant points (reasons/causes) are identified, and there are attempts at logical linking. The resulting account is not fully clear.

3–4

**Level 1:** Points are identified and stated simply, but their relevance is not clear and there is no attempt at logical linking.

1–2

**No relevant content**

0

**Indicative content**

Increase in world population

- sewage (released into rivers / lakes / seas)
  - causes algae to grow
  - algae block light
  - causing plants to die and decompose
  - leading to lack of oxygen in the water
  - (sewage) could contain pathogens

Need to produce more food for world's population

- fertilisers (used on farms to increase crop yield, leach into rivers / lakes / seas)
  - causes algae to grow
  - leading to lack of oxygen in the water
- herbicides / pesticides (used on farms to increase crop yield, run into rivers / lakes / seas)
  - build-up in food chains

Increasing demand for products / energy

- toxic chemicals or named toxic chemicals (run into rivers / lakes / seas)
  - from factories / industry **or** power stations
  - build-up in food chains
  - chemicals may cause mutations **or** chemicals may act as hormones
  
  - radiation leaks from nuclear (power stations)
  - (oil) spills from extraction / rigs / tankers in oceans
  
  - acid rain formation
  - acidification of lakes
  
  - increased carbon dioxide emissions causes acidification of oceans

Buildup of waste products

- litter / plastics (thrown in rivers / lakes / seas)
  - example of effect on living organisms, such as plastics consumed or plastics build up in stomach or plastics get stuck around beaks
  - (most) plastics are not biodegradable
  - build-up of microplastics in water animals

Consequence of the above is that organisms living in rivers / lakes / seas are harmed / die

For **Level 3** students need to consider different types of pollution

[6]

4.

(a) aerobic respiration

1

(b) 1. evaporation

*allow evaporate(s) / evaporating*

1

2. condensation

*allow condense(s) / condensing*

1

3. precipitation

*allow rain(ing) / rainfall*

*allow named precipitation*

*ignore precipitates*

1

4. draining / drainage

*allow run-off / percolation / infiltration*

*allow groundwater / underground flow*

1

5. transpiration

1

(c)  $6\,000\,000\,000 \times \frac{4.5}{100}$

*allow  $6\,000\,000\,000 \times 0.045$*

1

270 000 000

1

$2.7 \times 10^8$

*allow an incorrectly calculated number of people given in correct standard form*

1

- (d) climate change has increased the area of deserts 1
- more water is used to grow crops 1
- (e) decay / decomposition of leaves 1
- allow leaves are broken down*
- respiration (by microorganisms / decomposers) 1
- ignore aerobic / anaerobic*
- ignore respiration by worms / detritivores / insects / leaves*
- respiration releases carbon dioxide
- or**
- microorganisms release carbon dioxide 1
- carbon dioxide is used in photosynthesis (for new plant growth)
- do **not** accept carbon dioxide absorbed in the roots* 1
- (f) nitrates are released into the soil 1

[16]

- 5.** (a) any **one** from: 1
- competition 1
  - allow other plants / trees (growing in the field)*
  - herbivores 1
  - allow named herbivore*
  - allow pests*
  - trampling / mowing
  - pollinators 1
  - allow insects or named pollinator*
  - pathogens 1
  - allow infection*
  - ignore disease unqualified*

(b) any **six** from:

- mark out (grid) area in wet and dry area  
*allow mark out a transect in each of the two areas*
- method for placing quadrat(s)  
*allow description of a method to place quadrat(s) randomly / systematically*  
*do **not** accept throwing quadrats randomly*  
*ignore percentage cover of buttercups*
- count / record number of buttercups (in the quadrat)
- use at least 5 quadrats in each area
- take soil moisture readings
- use suitable equipment for readings, eg soil moisture meter
- calculate the mean (in each area)
- use the mean and area to calculate total number in wet area and total number in dry area  
*allow (for each area)*  
*total number of buttercups divided by total area sampled, multiplied by total area for **2** marks*

**OR**

any **six** from (6):

- transect between wet area and dry area
- place quadrat(s) regularly along transect  
*allow description of a method to place quadrat(s) systematically*
- count / record number of buttercups (in the quadrat)
- use at least 5 quadrats along transect
- take soil moisture readings
- use suitable equipment for readings, eg soil moisture meter
- repeat transects
- calculate the mean at each distance along the transects

6

[7]

6.

(a) nut(s) → bird(s) → cat(s)

*allow **1** mark for organisms in correct order (left to right)*  
*but arrows incorrect or missing*

*allow **2** marks for cat(s) ← bird(s) ← nut(s)*

*do **not** accept cat(s)bird(s) nut(s)*

*do **not** accept cat(s) →bird(s) →nut(s)*

2

- (b) birds  
*answer must be consistent with food chain given in question (a)*  
*if no answer to question (a)*  
*allow bird(s)* 1
- (c) food 1
- pathogens 1
- (d) 13.60 (mm)  
*allow 13.6 (mm)* 1
- (e) structural 1
- (f) variation 1
- mutation 1
- reproduction 1
- generation  
*must be in this order* 1
- (g) birds have a shorter life cycle than humans 1
- (h) bacteria can become resistant to antibiotics 1
- [13]**
- 7.** (a) root (hairs) 1
- (b) carbon  
*in either order*  
*allow carbon dioxide* 1
- water  
*if no other mark awarded allow oxygen for 1 mark* 1

(c) **Level 2:** Scientifically relevant facts, events or processes are identified and given in detail to form an accurate account.

4–6

**Level 1:** Facts, events or processes are identified and simply stated but their relevance is not clear.

1–3

No relevant content

0

### **Indicative content**

- microorganisms decay (the dead plant)
- microorganisms respire
- using carbon compounds / glucose
- releasing carbon dioxide
- into the atmosphere
- new plants take in carbon dioxide
- (carbon dioxide) for photosynthesis
- making glucose
- converted into correctly named cell materials

(when plants are decayed)

Nitrate / mineral ions

- are released into soil
- to be taken up by new growing plants

Water

- plants dehydrate or water evaporates when they die
- recycled as rain needed by growing plants

**[9]**