B16- Adaptations, interdependence and competition- Exam Practice 1

Q1.

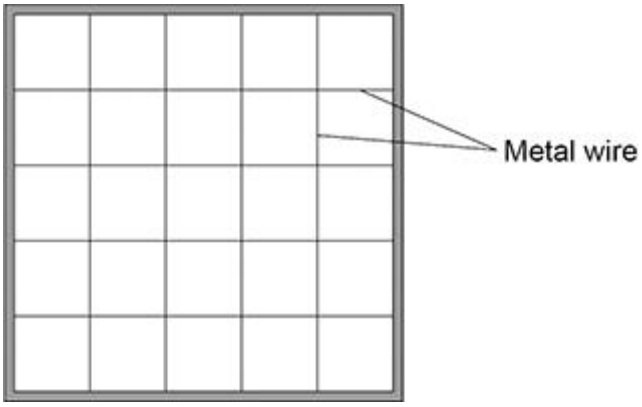
A student estimated the percentage cover of buttercup plants in a field.

The student used a quadrat.

The quadrat was divided into 25 equal squares.

Figure 1 shows the quadrat.

Figure 1



This is the method used.

1. Place the quadrat on the ground.
2. Record how many squares in the quadrat contain buttercup plants.
3. Place the quadrat in a new position in the field.
4. Record how many squares in the quadrat contain buttercup plants.
5. Repeat steps 3 and 4 another three times.

(a) What method should the student have used for placing the quadrat?

Tick (✓) **one** box.

Place the quadrat where there are many buttercup plants.	☐
Place the quadrat only where there are no trees.	☐
Place the quadrat using random coordinates.	☐
Use the same person to place all the quadrats.	☐

(1)

The student calculated the percentage cover of buttercup plants for each quadrat.

The table below shows the student's results.

Quadrat number	Number of squares containing buttercup plants	Percentage cover of buttercup plants
1	10	40
2	13	52
3	22	88
4	20	80
5	10	40
	Mean	**X**

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

_____

_____

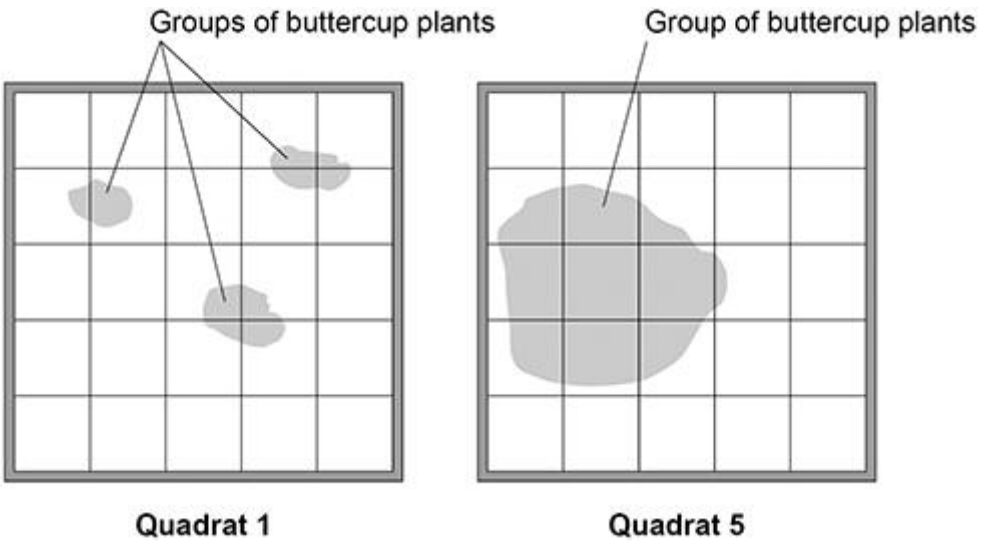
X = _____ %

(2)

The table above shows that quadrat **1** and quadrat **5** each had 40% cover of buttercup plants.

Figure 2 shows the results for quadrat **1** and quadrat **5**.

Figure 2



(c) The student's method of estimating the percentage cover of buttercup plants is **not** accurate.

How does **Figure 2** show this?

Tick (✓) **one** box.

Quadrat 1 has more groups of buttercup plants.	☐
The area of buttercup plants in quadrat 5 is much larger.	☐
The buttercup plants are in ten squares in both quadrats.	☐

(1)

(d) The student wanted to get a more valid estimate of the percentage cover of buttercup plants in the field.

Suggest **two** improvements to the method to make the results more valid.

1 _____

_____

2 _____

_____

(2)

(e) Give **three** environmental factors that would affect the growth of buttercup plants in a field.

1 _____

2 _____

3 _____

(3)

(Total 9 marks)

Q2.

Earthworms:

- live in soil
- feed on dead and decaying plant matter
- have soft, moist skin
- exchange gases through their skin.

(a) Give **two** abiotic factors and **two** biotic factors that could affect the size of an earthworm population.

Abiotic factors

1 _____

_____

2 _____

_____

Biotic factors

1 _____

_____

2 _____

(4)

(b) Students investigated the populations of earthworms in the soil in two different areas:

- Area **A**: a grass lawn
- Area **B**: a farmer's field.

Chemical **X** can be mixed with water and poured onto the soil.

The mixture brings earthworms to the surface of the soil but does **not** harm the earthworms.

Plan an investigation using chemical **X** to compare the number of earthworms per m^2 in areas **A** and **B**.

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

(6)

(Total 10 marks)

Combined Higher Questions

Q3.

Ragwort is a weed that grows on farmland.

Ragwort is poisonous to horses.

(a) Plan an investigation to estimate the size of a population of ragwort growing in a rectangular field on a farm.

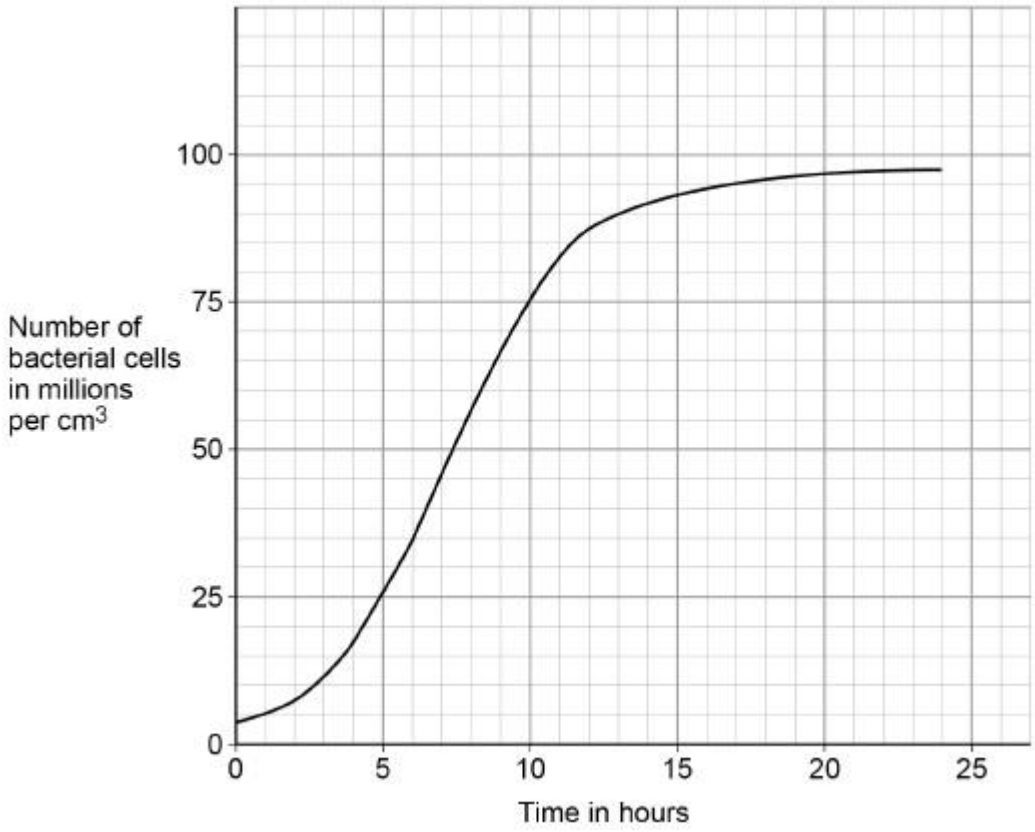
(4)

The herbicide glyphosate will kill ragwort and other weeds.

Scientists use bacteria for the genetic engineering of crop plants to make the crops resistant to glyphosate.

Figure 1 shows the growth of a culture of the bacteria in a solution of nutrients at 25 °C

Figure 1



(b) Why did the rate of reproduction increase between 2 hours and 7 hours?

_____

_____

(1)

(c) After 12 hours, the rate of reproduction decreased.

Suggest **three** ways the scientists could maintain a high rate of reproduction in the bacterial culture.

1 _____

_____

2 _____

_____

3 _____

_____

(3)

(d) The rate of reproduction of the bacteria is fastest at 7 hours.

How many times faster is the rate of reproduction at 7 hours than the rate at 12 hours?

_____

Rate at 7 hours is _____ times faster.

(4)

(e) Scientists transferred a gene for resistance to the herbicide glyphosate into the bacteria.

The genetically-modified (GM) bacteria can then transfer the glyphosate-resistance gene to a crop plant.

Explain the advantage of making crop plants resistant to glyphosate.

(3)

(Total 15 marks)

Q4.

On a rocky shore, when the tide goes in and out, organisms are exposed to the air for different amounts of time.

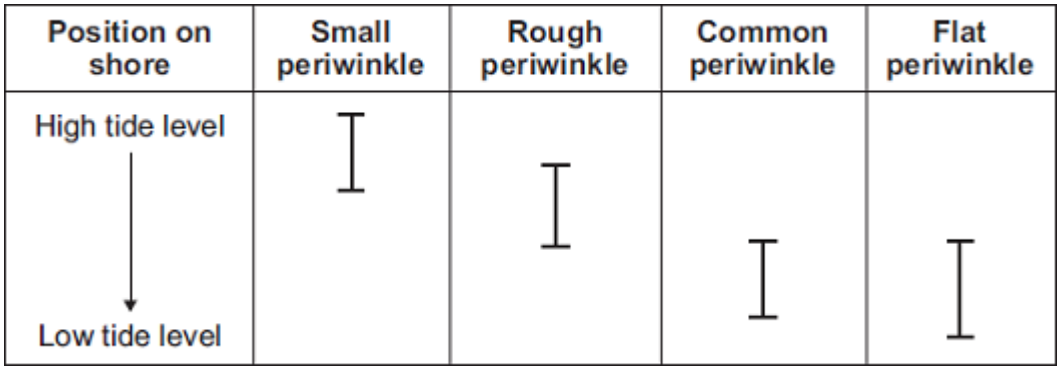
(a) On hot, windy days when the tide is out the concentration of the salt solution in rock pools may become very high.

What term is used to describe organisms that can survive in severe conditions such as very high concentrations of salt solution?

(1)

(b) Periwinkles are types of snail.
Students surveyed the different types of periwinkle living on a rocky shore.

The diagram shows the results of the students' survey.
The highest position that the sea water reaches on the shore is called the high tide level.
Each bar represents the range of habitats for each type of periwinkle.



(i) Which **two** types of periwinkle are likely to compete with each other to the greatest extent?

_____

(1)

(ii) Explain your answer to part (b)(i).

_____

_____

(1)

(iii) The small periwinkle can survive much nearer to the high tide level than the flat periwinkle.

Suggest **two** reasons why the flat periwinkle cannot survive near to the high tide level.

1. _____

_____

_____

2. _____

_____

_____

(2)

(Total 5 marks)

Q1.

(a) place the quadrat using random coordinates

1

(b) $\frac{40 + 52 + 88 + 80 + 40}{5}$

or $\frac{300}{5}$

1

60

1

(c) the area of buttercup plants in quadrat 5 is much larger

1

(d) any **two** from:

- place (many) more quadrats
  allow repeat
  allow combine results with results of other students
- divide quadrats into more / smaller squares
- estimate actual percentage cover in quadrat (instead of counting squares)
- only count squares with at least 50% cover
  allow use a point quadrat
  ignore place quadrats randomly

2

(e) any **three** from:

- light
- water
  allow rain / moisture
- minerals / ions / salts
  allow named example such as nitrate / phosphate
  allow fertiliser
- pH
- temperature
- herbivores
  allow named example
- trampling / cultivation
- pathogens / disease
- use of weedkiller

allow wind

allow oxygen / air in the soil

ignore carbon dioxide

ignore weather

3

[9]

Q2.

(a) **abiotic**

any **two** from:

- water

  allow moisture / humidity / rain(fall)

  allow dryness
- oxygen / air (in soil)

  ignore carbon dioxide
- pH (of soil)

  allow acidity / alkalinity (of soil)
- minerals / ions

  allow salts

  allow named example of an ion

  ignore nutrients
- temperature
- size of soil particles **or** texture / type of soil

  allow named examples of soil types

  ignore space / toxins / weather

2

biotic

any **two** from:

- food

  allow amount of dead / decaying matter (in soil)

  ignore nutrients
- predators / consumers / carnivores

  allow example − such as birds
- disease / pathogens / bacteria / fungi

  allow microorganisms / microbes / parasites /

2

*if **no** other marks awarded allow **2** marks for **four** factors in reverse categories*

(b) **Level 3:** The method would lead to the production of a valid outcome. The key steps are identified and logically sequenced.

5–6

Level 2: The method would not necessarily lead to a valid outcome. Most steps are identified, but the method is not fully 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

- same concentration of chemical / **X** applied to the soil
- same volume / amount of chemical / **X** applied to the soil
- same size of area sampled – eg 1 m^2 or 0.25 m^2
- use of a quadrat
- same time between application and collecting worms
- same time allowed for collecting worms after application

- each sample area selected randomly
- method of achieving randomness – eg random coordinates

- (collect and) count worms in each of areas **A** and **B**

- at least 5 repeats in each of areas **A** and **B**
- calculate mean (per unit area) **or** total for each of areas **A** and **B**
- compare means / totals for areas **A** and **B**

[10]

Q3.

(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 necessarily lead to a valid outcome. Most steps are identified, but the plan is not fully logically sequenced.

1–2

No relevant content

0

Indicative content

- use of quadrat
- (quadrat) of given area / dimensions – e.g. 0.25 m^2 or 1 m × 1 m
- quadrats are placed randomly
- method of obtaining randomness – e.g. random coordinates from a calculator **or** throw over shoulder **or** throw with eyes closed
- suitable number of quadrats (10 or more **or** a large number)
- count number of plants (in each quadrat)
- calculation of mean per quadrat or per unit area
- determination of area of field (length × width)
- population = mean per m^2 × area of field

(b) more bacteria so more divisions / reproduction (per unit time)

1

(c) any **three** from:

- add (more) sugar
- add (more) amino acids / protein

  if neither point given, allow add (more) nutrients
- add (more) oxygen

- increase temperature
  allow in range 26 °C to 40 °C
  allow maintain optimum temperature
- remove toxins / waste **or** maintain pH
- stir the culture
  *if no other mark awarded allow **1** mark for add more food*

3

(d)

*an answer in the range of 2.9 to 3.4 scores **4** marks*

*an answer in the range of 2.08 to 3.77 scores **3** marks*

tangent drawn to the curve at 12 hours

*do **not** accept if there is an incorrect tangent at 7 hours*

1

calculation of rate at 7 hours $\frac{\Delta y}{\Delta x}$

allow an answer that correctly rounds to a value in range 10.0 to 11.7

1

calculation of rate at 12 hours $\frac{\Delta y}{\Delta x}$

allow an answer that correctly rounds to a value in range 3.1 to 4.8

1

3.3

allow in range 2.9 to 3.4 if both rates are in the correct ranges

1

(e) can use the glyphosate / weed killer to kill weeds but not kill / affect crop

*allow **only** kills weeds*

1

(so) less competition for light / water / minerals / ions

allow less competition for nutrients

ignore food / carbon dioxide / space

1

(so) crops have high(er) yield

allow crops grow better / well

1

[15]

Q4.

(a) extremophile(s)

1

(b) (i) common (periwinkle) and flat (periwinkle)

*either order, **both** required*

1

(ii) (common and flat) both live in the same habitat / area / named area

allow habitats overlap the most

1

(iii) any **two** from:

- would have wrong food
- would otherwise be exposed to (specific) predators
- cannot tolerate extended exposure to air **or** reduced submersion in seawater

  allow cannot tolerate temperature / dehydration
- cannot tolerate high salt concentration (in rock pools)

  allow low salt concentration (in rock pools)
- cannot compete with small periwinkle

2

[5]