Questions

Q1.

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

Figure 15 shows the estimates of the number and biomass of some of the organisms in the garden.

organism	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 15

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

(1)

....

(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.

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 × 104 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)

....

....

(Total for question = 3 marks)

Q3.

Fish eat fish food.

The fish food contains energy.

Some of this energy is used by the fish for growth.

Figure 6 shows this energy transfer.

Each square in Figure 6 represents 1 kJ of energy.

energy used in
growth of fish

energy in eaten
fish food
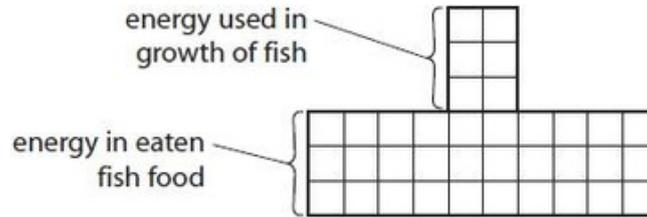
Figure 6

(i) Calculate the percentage of energy from the fish food that has been used in the growth of fish.

(2)

.... %

(ii) Describe what happened to the fish food that was eaten but was not used in the growth of the fish.

(2)

....

....

....

....

(Total for question = 4 marks)

Q4.

Figure 9 shows caterpillars eating nettle leaves.

(Source: © bbbb/Shutterstock)

Figure 9

A caterpillar has a body mass of 6.0 grams.
One week later, its body mass had increased to 7.5 grams.
Caterpillars convert 10% of food eaten into body mass.

(i) Calculate the mass of nettles that the caterpillar ate.

(2)

.... grams

(ii) Describe what happens to food eaten that is not converted into the body mass of the caterpillar.

(2)

....

....

....

....

....

(Total for question = 4 marks)

Q5.

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 14 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 14

(i) Using data from Figure 14, 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 ....

....

2 ....

....

(Total for question = 5 marks)

Q6.

Figure 25 shows the mass of meat eaten in the world from 1980 to 2010.
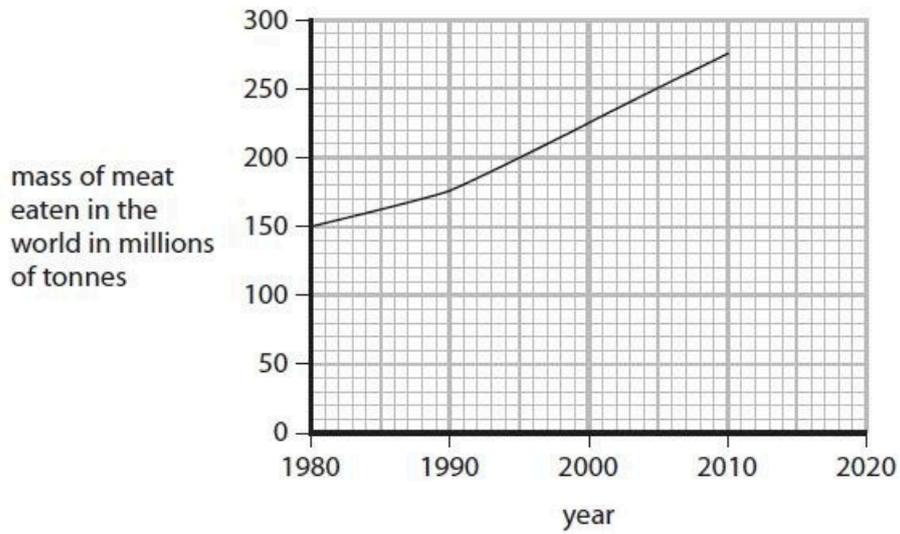
Figure 25

Calculate the rate of increase in the mass of meat eaten in the world from 2000 to 2010.

.... millions of tonnes per year

(Total for question = 2 marks)

Q7.

The animal shown in Figure 3 is a tick burrowing into the skin of a human.

© IanRedding/Shutterstock

Figure 3

Use words from the box to complete the sentences.

enzymes	food	herbivores
parasites	producers	prey

(i) The tick burrows into the skin to obtain ....

(1)

(ii) When a tick burrows into human skin the tick benefits but the human is harmed.

This means that ticks are classed as ....

(1)

(Total for question = 2 marks)

Q8.

A scientist investigated the distribution of invertebrates found in a garden.

Figure 10 shows 30 invertebrates that the scientist collected.
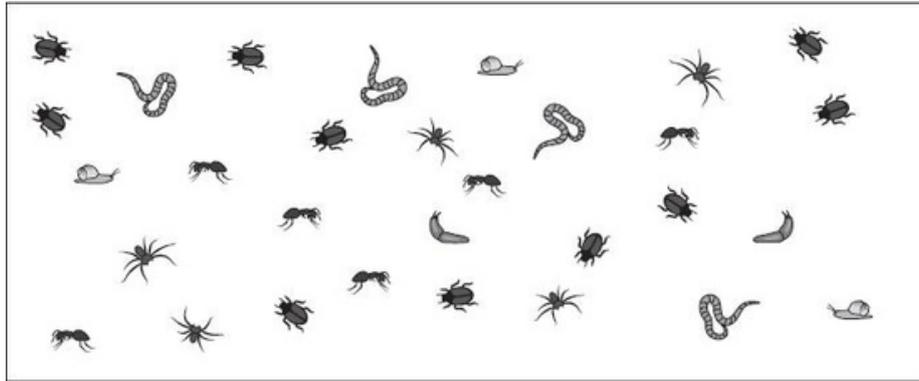
key					
beetle	snail	ant	spider	slug	worm

(i) Complete the table by filling in the tally and number for the spiders and worms.

(2)

invertebrate	tally	number of invertebrates
ant	IIII I	6
beetle	IIII IIII	10
slug	II	2
snail	III	3
spider		
worm		

(ii) The scientist selected an invertebrate at random to observe it in more detail.

State the probability that the invertebrate selected is an ant.
Give your answer in its simplest form.

(2)

....

(iii) State how the type of food used to bait the pitfall trap could affect the number of different invertebrates caught.

(1)

....

....

(Total for question = 5 marks)

Edexcel Biology GCSE - Trophic Levels & Ecosytems

Q9.

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 ☒.

(i) Flatworms from New Zealand that eat slugs are now living in the UK.

Which term describes a species from one country that is living in another country?

(1)

☒ A   pathogenic
☒ B   non-pathogenic
☒ C   indigenous
☒ D   non-indigenous

(ii) Figure 5 shows tiny white animals called mites on the skin of a slug.

The mites feed on blood.
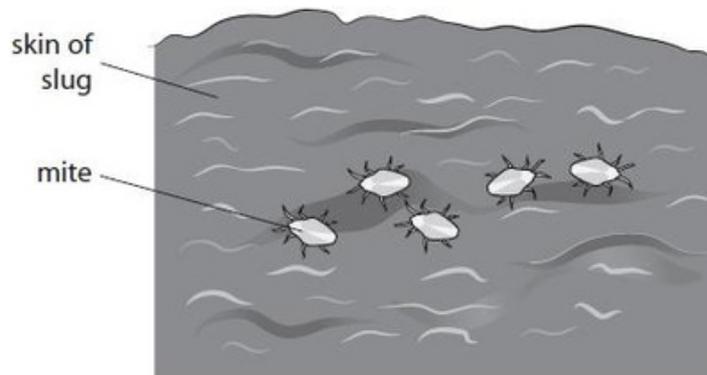
Figure 5

Explain why these mites are classed as parasites.

(2)

....

....

....

....

(Total for question = 3 marks)

Q10.

Figure 11 shows a British glow-worm.

© Dom Greves Digital

Figure 11

Read the following extract before answering the questions.

Female glow-worms produce bright lights in the summer to attract males.
Glow-worm larvae are predators of slugs and snails, but adult glow-worms do not feed.
Females only have a few weeks to attract a mate and lay eggs, before the females die.

Female glow-worms are found attached to grass plants in a large field.

(i) Describe a sampling technique to find the mean number of female glow-worms in 1 m2 of the field.

(3)

....

....

....

....

....

....

(ii) The mean number of female glow-worms in 1 m2 of the field is 5.

The field has a total area of 800 m2.
Estimate the number of female glow-worms in the whole field.

(1)

....

(Total for question = 4 marks)

Q11.

Figure 2 shows an area of woodland with some small plants growing in the ground between the trees.

(Source: © Maksym Holovinov/Shutterstock)

Figure 2

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)

....

....

....

....

....

....

....

(Total for question = 3 marks)

Q12.

A scientist investigated the distribution of invertebrates found in a garden.

The scientist also counted the number of snails in four 1m2 areas of the garden.

The garden had a total area of 40 m2.

Describe how the scientist can use this information to estimate the number of snails in the garden.

....

....

....

....

....

(Total for question = 2 marks)

Q13.

Figure 5 shows the maximum numbers of oxpeckers observed on four types of mammal.
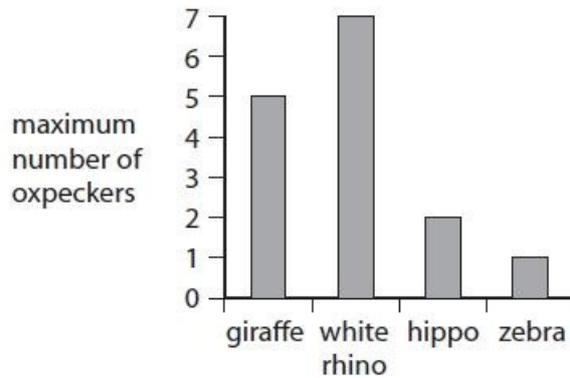
Figure 5

(i) Describe the difference in the maximum number of oxpeckers on the white rhino and on the hippo.

(2)

....

....

....

....

....

(ii) Give one reason why more oxpeckers were observed on giraffes than on zebras.

(1)

....

....

....

(Total for question = 3 marks)

Q14.

Devise a method a scientist could use to investigate how temperature affects nettle growth.

(4)

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(Total for question = 4 marks)

Q15.

Since 2003, in France, people have been buying Siberian chipmunks as pets but then releasing them into the wild when they are no longer wanted.

They are now classified as an invasive species.

Figure 25 shows a Siberian chipmunk (*Tamias sibiricus*).

© 2011, Søren Brøndum Christensen

Figure 25

Siberian chipmunks eat acorns, which are the seeds of oak trees.

In Siberia, the natural predators of Siberian chipmunks are wild dogs.

(i) Figure 26 shows the biomass of three organisms in a food chain from one area of Siberia.

organisms	biomass in kg
acorns	20650
chipmunks	2200
wild dogs	230

Figure 26

Draw a pyramid of biomass for this food chain.

(2)
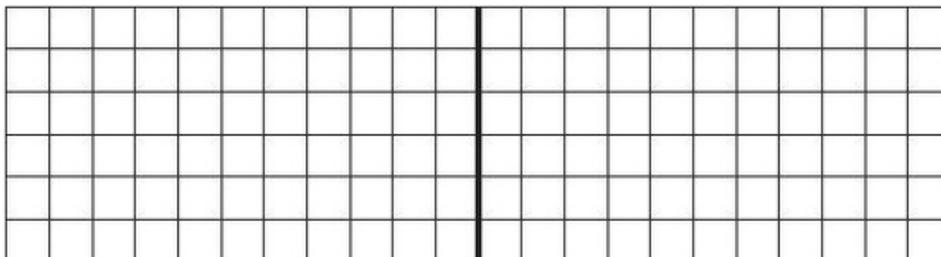
(ii) In France, Siberian chipmunks have very few natural predators.

Describe how this affected the Siberian chipmunk population in France.

(2)

....

....

....

....

(iii) The percentage of energy transferred from the acorns to the chipmunks is 9.5%.

The energy contained in the acorns is 97 500 kJ.
Calculate the amount of energy transferred to the chipmunks.
Give your answer to the nearest whole number.

(3)

.. kJ

(Total for question = 7 marks)

Q16.

Plankton, krill and cod are found in the Arctic ocean.

Figure 5 shows the mass of organisms in an area of the Arctic ocean.

plankton   ⟶   krill   ⟶   cod

20000g   4000g   1200g
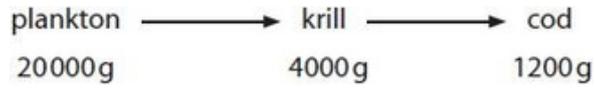
Figure 5

(i) Draw an accurate pyramid of biomass for this food chain.

(2)
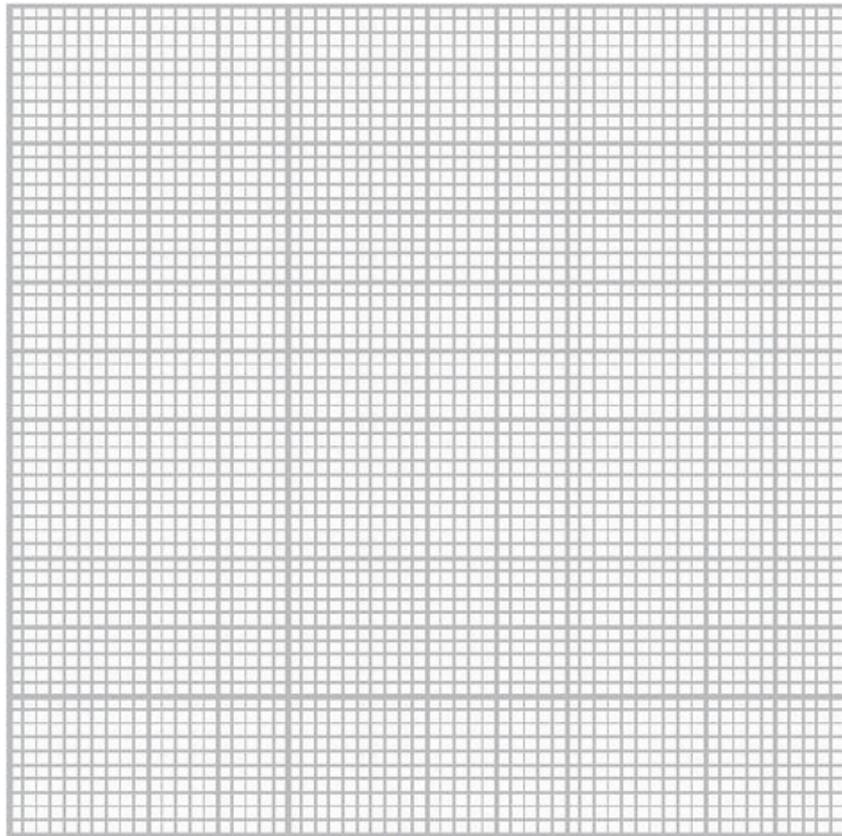
(ii) Give two reasons why all the biomass from the krill is not transferred to the cod.

(2)

1 ....

....

2 ....

....

(Total for question = 4 marks)

Q17.

Figure 3 shows food webs for two gardens.
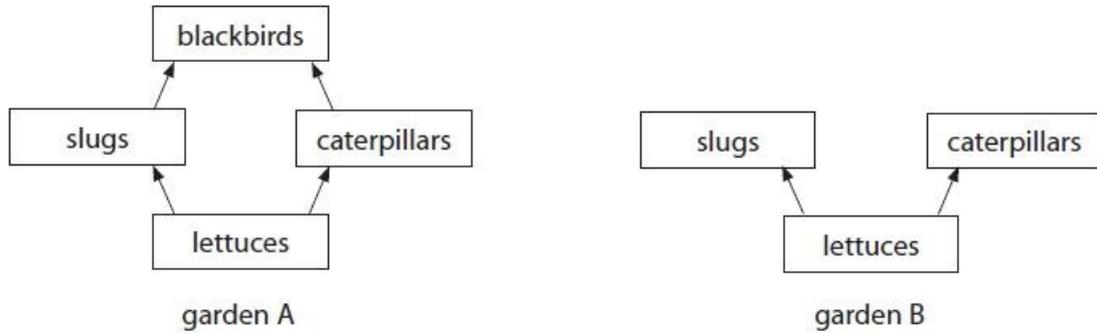
Figure 3

Slug pellets are put on the soil around the lettuce plants in garden A and garden B.

Slug pellets kill slugs.

(i) A scientist predicts that the number of caterpillars will decrease in garden A.

   Give one reason why the number of caterpillars will decrease in garden A.

(1)

....

....

(ii) The scientist predicts that the number of caterpillars will increase in garden B.

   Give one reason why the number of caterpillars will increase in garden B.

(1)

....

....

(iii) Figure 4 shows the population of slugs in garden A for five years.

Slug pellets were used during the first year.
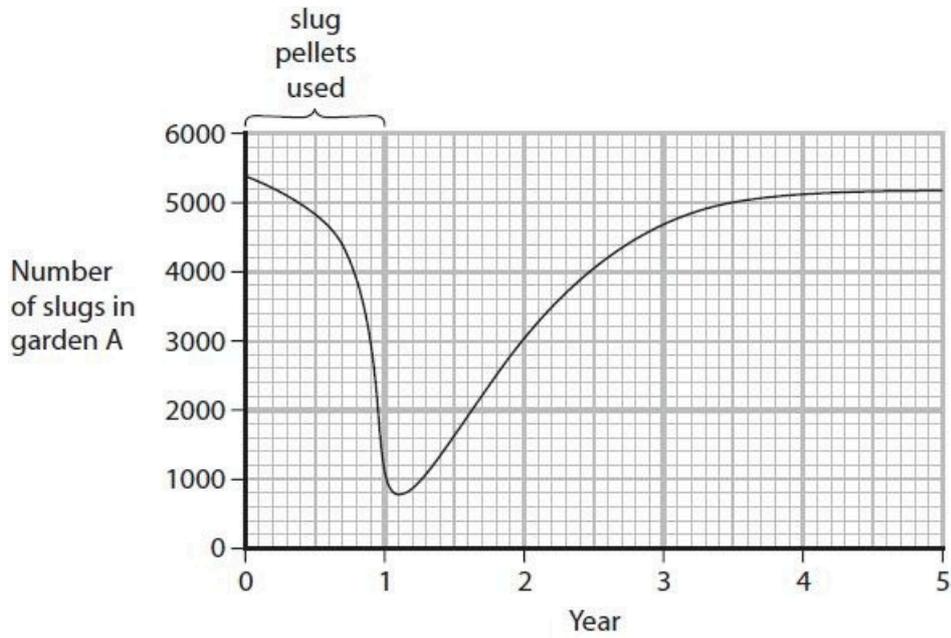
Figure 4

Describe the trend in the slug population from year 1 to year 5.

(2)

....

....

....

....

(Total for question = 4 marks)

Q18.

Algae are green plants.

Figure 10 shows the number of algae in a lake in the United Kingdom during one year.

number of algae

Jan   Feb   Mar   Apr   May   Jun   Jul   Aug   Sept   Oct   Nov   Dec

month
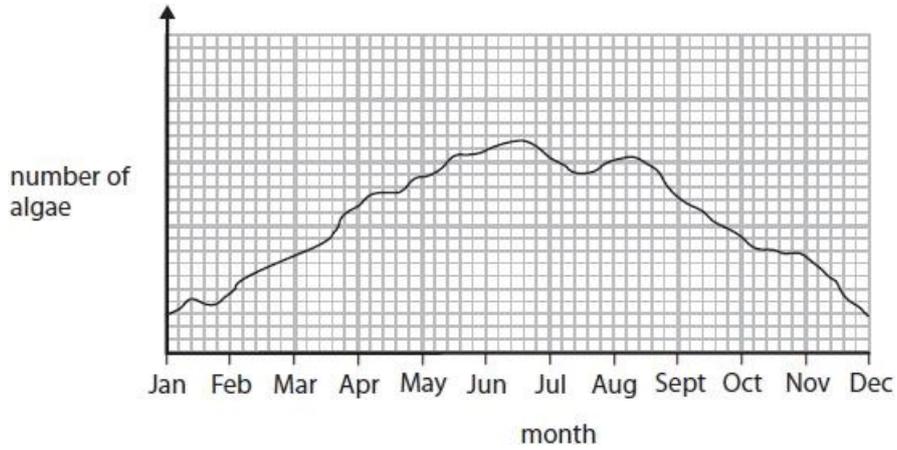
Figure 10

Explain the changes in the number of algae in the lake from February to June.

(3)

....

....

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....

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....

....

(Total for question = 3 marks)

Q19.

Figure 2 shows an area of woodland with some small plants growing in the ground between the trees.

(Source: © Maksym Holovinov/Shutterstock)

Figure 2

A scientist recorded the mean light intensity and the mean number of small plants per m2 for six 25 m2 areas of the woodland.

Figure 3 shows the results.

area of woodland	mean light intensity in lux	mean number of small plants per m²
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 3

(i) Explain the effect of light intensity on the number of small plants per m2.

(2)

....

....

....

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

(1)

....

....

(Total for question = 3 marks)

Q20.

Figure 8 shows an area of nettle plants.

(Source: © stevemart/Shutterstock)

Figure 8

Grass does not grow among the nettles.

Explain why grass does not grow where there are nettles.

(2)

....

....

....

....

....

....

....

(Total for question = 2 marks)

Q21.

Plankton, krill and cod are found in the Arctic ocean.

Figure 5 shows the mass of organisms in an area of the Arctic ocean.

plankton $\longrightarrow$ krill $\longrightarrow$ cod
20000g   4000g   1200g
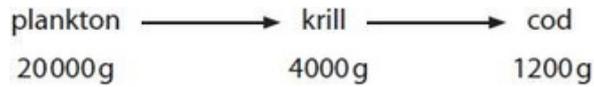
Large amounts of krill are now being caught to produce krill oil as a dietary supplement for humans.
(i) Explain how this will affect the cod.

(2)

....

....

....

....

(ii) Give one other factor that could affect the number of krill in the Arctic ocean.

(1)

....

....

(Total for question = 3 marks)

Q22.

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 ☒.

There are three levels of organisation in an ecosystem.

Which order shows the levels of organisation from lowest to highest?

(1)

☒ A   community, population, organism
☒ B   community, organism, population
☒ C   organism, community, population
☒ D   organism, population, community

(Total for question = 1 mark)

Q23.

A scientist investigated the distribution of invertebrates found in a garden.

Figure 9 shows an invertebrate about to fall into a pitfall trap.
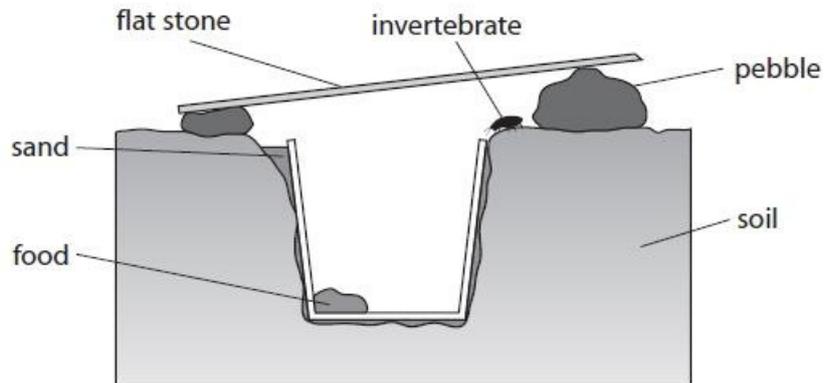
Figure 9

The steps the scientist used to set up the pitfall trap are shown below.

The steps are not in the correct order.

1. put some sand around the beaker

2. put a beaker, baited with food, in the hole

3. place a flat stone on pebbles over the beaker

4. check the pitfall trap each day

5. dig a hole in the garden

Complete the steps in the correct order, from left to right.

The first number has been written in for you.

| 5 | | | | |

(Total for question = 2 marks)

Q24.

Figure 11 shows a British glow-worm.

© Dom Greves Digital

Figure 11

Read the following extract before answering the questions.

Female glow-worms produce bright lights in the summer to attract males.
Glow-worm larvae are predators of slugs and snails, but adult glow-worms do not feed.
Females only have a few weeks to attract a mate and lay eggs, before the females die.

What will happen if the population of snails decreases?

(1)

☒ A   the population of glow-worms will increase
☒ B   adult glow-worms will eat more snails
☒ C   glow-worm larvae will eat more slugs
☒ D   adult female glow-worms will glow more brightly

(Total for question = 1 mark)

Q25.

Figure 11 shows a British glow-worm.

© Dom Greves Digital

Figure 11

Read the following extract before answering the questions.

Female glow-worms produce bright lights in the summer to attract males.
Glow-worm larvae are predators of slugs and snails, but adult glow-worms do not feed.
Females only have a few weeks to attract a mate and lay eggs, before the females die.

Female glow-worms have an enzyme called luciferase.
The glow is produced when this enzyme catalyses a reaction between oxygen and a protein.
A scientist devised a plan to investigate the effect of oxygen concentration on this reaction.

The scientist had:

*   five flasks of water each with a different concentration of dissolved oxygen
*   a solution of the protein
*   a solution of the enzyme.

The first step of this plan is:

Step 1. Add some of the protein solution to each of the five flasks.

(i) Describe the next two steps that should be in this plan to obtain results for this investigation.

(2)

Step 2

   ....

   ....

Step 3

   ....

   ....

(ii) Which procedure would improve the investigation?

(1)

☒ A   change the concentration of the protein solution in each flask
☒ B   change the volume of the protein solution added to each flask
☒ C   keep the concentration of dissolved oxygen the same in each flask
☒ D   keep the volume of each solution the same in each flask

(iii) The enzyme luciferase works best at pH 8.

Explain why the activity of the enzyme decreases at pH 5.

(2)

....

....

....

....

....

(Total for question = 5 marks)

Q26.

Figure 4 shows a bird called an oxpecker eating ticks that are living on a zebra.

© MartinMaritz/Shutterstock

Figure 4

(i) Name the type of relationship where both the oxpecker and the zebra benefit.

(1)

....

(ii) Zebras eat grass.

Complete the food chain that includes zebras, ticks, oxpeckers and grass.

(2)

```
┌──────┐     ┌──────┐     ┌──────┐     ┌──────┐
│      │ ──▶ │      │ ──▶ │      │ ──▶ │      │
└──────┘     └──────┘     └──────┘     └──────┘
```
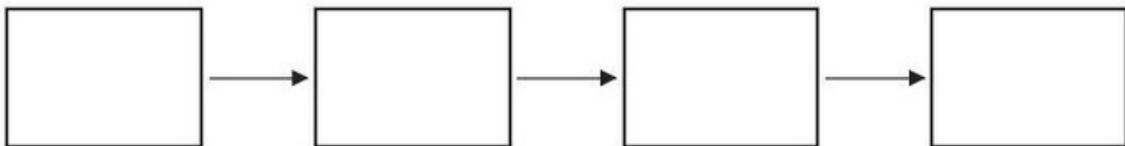
(Total for question = 3 marks)

Q27.

The student collected and weighed some fresh leaves from a beech tree.

- The leaves were placed on top of soil in a tray.
- This was repeated for leaves from three other types of tree.
- The trays were kept in the same abiotic conditions for 40 days.
- The leaves were reweighed after 40 days.

(i) State two abiotic factors that should be kept the same in this investigation.

(2)

1 ....

2 ....

(ii) Explain how this investigation could be improved to make the results more comparable.

(2)

....

....

....

....

(Total for question = 4 marks)

Q28.

Figure 8 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.
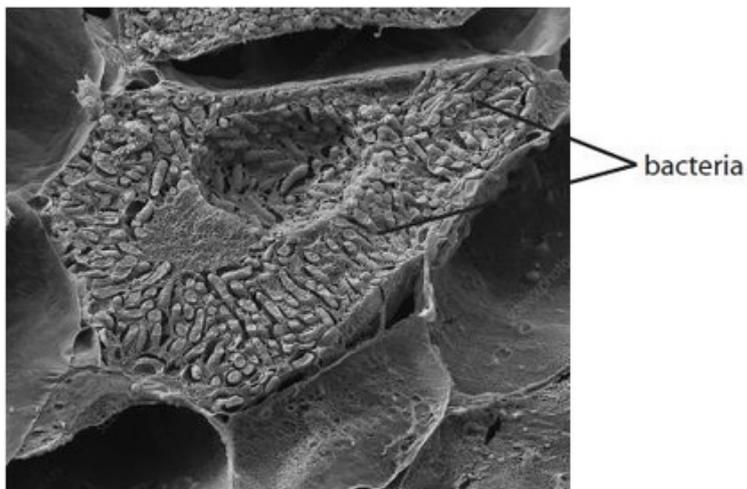
(Source: © Nigel Downer / Science Photo Library)

Figure 8

(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.

(1)

.... μm

(Total for question = 2 marks)

Q29.

A student investigated the width of leaves on nettle plants growing in two areas next to a woodland.
Figure 5a shows a nettle plant and Figure 5b shows a map of the woodland showing area A and area B.
The woodland caused area A to be in the shade.
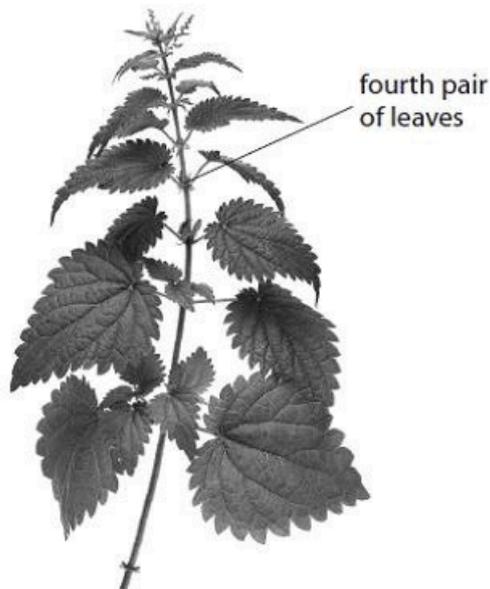
(Source: © Alila Medical Media/Shutterstock)
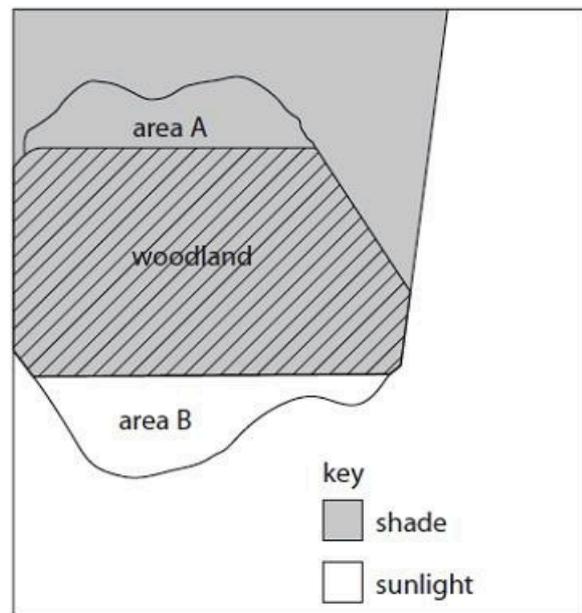
Figure 5a   **Figure 5b**

The student also studied some of the animals in areas A and B.

The student saw caterpillars eating the leaves of some nettles.

The student also saw a toad eating a large beetle.

Large beetles eat ladybirds.

Ladybirds eat caterpillars.

(i) Give the food chain for these feeding relationships.

(3)

(ii) Frogs also eat large beetles.

Figure 7 shows the energy transferred between these animals.

690 kJ

large beetles $\longrightarrow$ frog
750 kJ   60 kJ
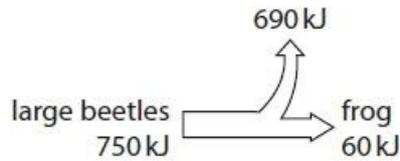
Figure 7

Calculate the percentage efficiency of energy transfer from the large beetles to the frog.

(2)

.... %

(iii) Give two reasons why only some of the energy in the biomass of the large beetles is transferred
to the biomass of the frog.

(2)

1 ....

....

2 ....

....

(Total for question = 7 marks)

~~Mark Scheme~~

Q1.

Question number	Answer	Mark
(i)	2108 (g)	(1) AO2.1

Question number	Answer	Additional Guidance	Mark
(ii)	An explanation linking • population of earthworms will decrease (1) • because more earthworms will be eaten by hedgehogs (1)	accept earthworms will die out accept hedgehogs have only one food source accept population of earthworms will increase as more {food/cabbages} available (2 marks)	(2) AO2 1

Question number	Answer	Additional Guidance	Mark
(iii)	A description including • use of quadrat / belt transect (1) • count the number of slugs in the sampled area (1) • multiplication factor to make the estimate (1)	accept description of quadrat 1m x 1m /1m² accept calculate the mean numbers of slugs from all samples	(3) AO3 3a

Q2.

Question number	Answer	Additional guidance	Mark
(i)	• $2.1 \times 10^4 = 21\ 000 \times 0.1 =$ 2 100 in the water beetle (1) • 210 J in the bird (1)	award full marks for correct numerical answer without working	(2)

Question number	Answer	Mark
(ii)	it limits the length of the food chain	(1)

Q3.

Question Number	Answer	Mark
(i)	data 6(kJ) and 30(kJ) (1) evaluation $6 \div 30 \times 100 = 20$ (%)	(2) AO2.1

Question Number	Answer	Additional guidance	Mark
(ii)	A description including **two** from: • it is egested (1) • used in respiration / for energy (1) • for swimming / movement / biochemical reactions / reproduction (1) • as heat (1)	accept excreted	(2) AO2.1

Q4.

Question number	Answer	Additional guidance	Mark
(i)	substitution (7.5 – 6.0 =) 1.5(g) (1) evaluation (1.5) x 10 = 15 (g)	Award full marks for correct answer with no working shown	(2) AO2.1

Question number	Answer	Mark
(ii)	A description including two from: • some food is egested / not digested (1) • some food is respired / used to released energy (1) • in homeostasis / keeping warm / movement / metabolism / lost to surroundings as heat (1)	(2) AO1.1

Q5.

Question Number	Answer	Additional Guidance	Mark
(i)		award full marks for correct answer with no working	(3) AO2
	substitution (12 x 18 ÷10) = 21.6 (1)		
	whole organism (1) = 21 / 22	e.c.f. from incorrect substitution **using data from the table**	
	(50 – 21 / 22) = 28 / 29	e.c.f. from incorrect whole organism award two marks for 28.4 or 27.9 or 22 or 21 without working	

Question Number	Answer	Mark
(ii)	Any **two** from: • sample at the (same) time of day (1) • sample for the (same) length of time (1) • use the (same) equipment / techniques (1) • (same) time period between first and second sample (1) • (same) marking process (1) • do not harm organisms when sampling (1)	(2) AO2

Q6.

Question number	Answer	Additional guidance	Mark
	substitution (from graph) increase = 275 − 225 (= 50) (1) evaluation rate = 50 ÷ 10 = 5	accept tolerance +/- 2 for graph readings accept values of 4.6 to 5.4 award full marks for answer without working	(2) AO2.1

Q7.

Question number	Answer	Mark
(i)	food reject if more than one word is used from the box	(1) AO2.1

Question number	Answer	Mark
(ii)	parasites reject if more than one word is used from the box	(1) AO2.1

Q8.

Question number	Answer	Mark
(i)	spider / ‖‖‖ / 5 ; worm / ‖ ‖ / 4 • Spider line correct (1) • Worm line correct (1)	(2) AO1.2

Question number	Answer	Additional guidance	Mark
(ii)	Substitution 6 out of 30 / 6 in 30 / 6/30 (1) Simplest form 1 in 5 / 1/5 / 0.2 / 20%	accept there are 6 ants and there are 30 invertebrates. award full marks for correct answer with no working.	(2) AO3.1

Question number	Answer	Mark
(iii)	One type of food may only attract some invertebrates / some foods may attract many different types of invertebrates.	(1) AO3.2

Q9.

Question Number	Answer	Mark
(i)	D non-indigenous **The only correct answer is D** *A is not correct because pathogenic means disease causing* *B is not correct because non-pathogenic means does not cause disease* *C is not correct because indigenous means that the slugs have not come from another country*	(1) AO1.1

Question Number	Answer	Additional guidance	Mark
(ii)	An explanation including: • parasites live in / on their host (1) • parasites feed off their host (1)	accept (because the mites) live on the slug / the slug is the host (for the mites) accept (because the mites) feed on the slug / suck the slug's blood.	(2) AO2.1

Q10.

Question number	Answer	Mark
(i)	An answer that provides a description by making reference to **three** of the following points: • use of <u>quadrat</u> (1) • random placement (of quadrat) (1) • **count** the number of (female) glow-worms in the quadrat / 1m² / square (1) • use several samples (1) • total number found ÷ number of samples (1)	(3) AO 2 1

Question number	Answer	Mark
(ii)	4000 / 4 X 10³	(1) AO 1 1

Q11.

Question Number	Answer	Additional guidance	Mark
	A description including **three** from:		(3)
	• place a quadrat along a {rope / tape} measure (1)	reject quadrant accept good descriptions of quadrats – e.g. ½ metre wire square	AO3 3a
	• tape measure to measure along the transect (1)		
	• measure light intensity at different distances (from the wood) (1)	accept use a light meter/lux meter	
	• measure the stinging nettles {along the transect / at different light intensities} (1)		
	• way of measuring growth of stinging nettles (in the quadrats) (1)	accept named examples – e.g. {height / mass/ dry mass / number of leaves / number of plants}	

Q12.

Question number	Answer	Mark
	A description including: • Calculate a mean / average (1) • Multiply mean by 40 / the area (1) OR • Add together the number of snails in the 4 areas (1) • Multiply by 10 (1)	(2) AO1.2

Q13.

Question number	Answer	Additional guidance	Mark
(i)	A description including: • there are more oxpeckers on the (white) rhinos (than hippos) (1) • manipulated data (1)	Manipulated data could include: 7 - 2 = difference of 5 7 ÷ 2 = 3.5 times more oxpeckers (2 marks)	(2) AO3.1

Question number	Answer	Additional guidance	Mark
(ii)	There are more ticks / food (on the giraffes than the zebras)	accept other reasons such as (giraffes are) larger / thinner skinned / more tolerant of oxpeckers	(1) AO3.1

Q14.

Question number	Answer	Additional guidance	Mark
	A method that combines four points to provide a method:		(4) AO3.3a
	• put nettles in different temperatures (1)	minimum is in two different temperatures.	
	• time period stated (1)	minimum time 2 days	
	• control of one relevant variable. (1)	reject keep the temperature the same.	
	• a way of measuring growth stated eg (change in) height / mass / number of leaves (1)		
	• repeat investigation / use more than one nettle in each temperature (1)		

Q15.

Question number	Answer	Additional guidance	Mark
(i)	Pyramid of biomass		(2)
	• pyramid shape with labels (1)	accept names in bars or triangle for this mp	AO 2 1
	• correct proportions: chipmunks must be {equal to/less than} 50% of the acorns, wild dogs must be {equal to/less than} 50% of chipmunks (1)	must be bars: reject triangle against this mp.	

Question number	Answer	Mark
(ii)	An answer that combines **two** of the following points of application and understanding to provide a logical description:	(2)
		AO 2 1
	• few chipmunks are { eaten / killed } (due to the lack of predators) (1)	
	• so the number of chipmunks (in France) will increase (1)	
	• therefore more chipmunks can reproduce (1)	

Question number	Answer	Additional guidance	Mark
(iii)	Substitution 97500 ÷ 100 = 975 (1) Evaluation 975 x 9.5 = 9262.5 (1) Nearest whole number 9263 (kJ) OR 97500 x 0.095 (1) = 9262.5 (kJ) Nearest whole number 9263 (kJ)	award full marks for correct answer with no working	(3) AO 2 2

Q16.

Question number	Answer	Additional guidance	Mark
(i)	An accurately drawn pyramid of biomass: • pyramid shaped with all three stages shown (1) • accurate dimensions for the diagram (1)	6 small squares cod 2 large squares krill 10 large squares plankton	(2)

Question number	Answer	Mark
(ii)	Any two of the following points: • not all the krill is eaten (1) • parts of the krill cannot be digested (1) • the krill has used some biomass to provide energy for movement/heat/respiration (1)	(2)

Q17.

Question Number	Answer	Mark
(i)	The blackbirds will be eating more caterpillars (because there are fewer slugs)	(1) AO3 2a/b

Question Number	Answer	Mark
(ii)	There will be more {food / lettuce} for the caterpillars to eat (because there are fewer slugs eating the lettuce)	(1) AO3 2a/b

Question Number	Answer	Additional guidance	Mark
(iii)	A description including **two** from: The population of slugs: • falls a little (1) • (then) increases (1) • starts to level off between 2.5 and 3 years / levels off after (approximately) 4 years (1)	accept 4000 to 4700 slugs for 2.5 to 3 years accept 5100 to 5200 for 4 years accept population doesn't get as high as the pre slug pellet numbers (1)	(2) AO3.1ab

Q18.

Question number	Answer	Mark
	An explanation that combines identification via a judgment (1 mark) to reach a conclusion via justification/reasoning (2 marks): Judgement: • the number of algae increase (1) Two reasons: • increased {temperature / light intensity} / longer daylight (1) • for (more) photosynthesis (for growth) (1) OR • increased minerals / nitrate ions / eutrophication in the lake (1) • (more) protein / chlorophyll (for growth) (1)	(3) AO 3 2a AO 3 2b

Q19.

Question Number	Answer	Additional guidance	Mark
(i)	An explanation linking: • as light intensity decreases the number of (small) plants (per m²) decreases (1) • because the (small) plants will not be able to photosynthesise enough (1)	accept reverse argument	(2) AO3 1ab

Question Number	Answer	Additional guidance	Mark
(ii)	Any **one** from: • same time of day (1) • same meter (1) • same position(s) in area / measure the same size area (1) • same person makes the readings (1) • meter held vertically each time (1)	accept other valid variables that should be controlled	(1) AO3 1ab

Q20.

Question number	Answer	Additional guidance	Mark
	An explanation linking two from:		(2) AO2.1
	• **outcompeted** (by nettles) (1)	accept (grass) can't compete	
	• by nettles absorbing (most of) the light (1)	accept too dark / shaded / no light accept other resources used by nettles eg water, space or mineral ions	
	• so can't photosynthesise (sufficiently) (1)	accept suitable reasons for lack of water / space / mineral ions	

Q21.

Question number	Answer	Mark
(i)	An explanation that combines identification – application of knowledge (1 mark) and reasoning/justification – application of understanding (1 mark): • number of cod would decrease (1) • due to {smaller amount/limited/no} food supply (1)	(2)

Question number	Answer	Additional guidance	Mark
(ii)	Any one from: • predation (1) • competition (1) • disease (1) • pollution (1)	accept other environmental factors	(1)

Q22.

Question Number	Answer	Mark
	D organism, population, community	(1)
	The only correct answer is D	AO1.1
	A is not correct because community is not the lowest level of organisation in an ecosystem	
	B is not correct because community is not the lowest level of organisation in an ecosystem	
	C is not correct because population is not the highest level of organisation in an ecosystem	

Q23.

Question number	Answer	Additional guidance	Mark
	5 2 1 3 4 • Correct sequence (2)	award one mark if 2 is in the second box or 4 is in the last box.	(2) A02.1

Q24.

Question number	Answer	Mark
	C glow-worm larvae will eat more slugs	(1)
	1. The only correct answer is C	AO 2 1
	A is not correct because fewer snails will not cause the population of glow-worms to increase	
	B is not correct because fewer snails will not cause the adult glow-worms to eat more snails	
	D is not correct because fewer snails will not cause the adult female glow-worms to glow more brightly	

Q25.

Question number	Answer	Mark
(i)	An answer that combines the following points to provide a logical description of the plan:	(2)
		AO 3 3a
	Step 2: add {some / set amount of} enzyme to each of the flasks (1)	
	Step 3: time how long the glow lasts / measure intensity of glow (1)	

Question number	Answer	Mark
(ii)	D keep the volume of each solution the same in each flask.	(1)
		AO 3 3b
	1. The only correct answer is D	
	A is not correct because changing the concentration of the protein solution in each flask will not improve the investigation	
	B is not correct because changing the volume of the protein solution added to each flask will not improve the investigation	
	C is not correct because keeping the concentration of dissolved oxygen the same in each flask will not improve the investigation	

Question number	Answer	Additional guidance	Mark
(iii)	An explanation including any **two** from: • enzymes are pH sensitive / this enzyme has an <u>optimum</u> / <u>optimal</u> pH of 8 (1) • because the {enzyme / active site} will change shape / become denatured (1) • so the enzyme is not able to bind so easily to {substrate / protein / oxygen} (1)	accept pH 8 is alkaline **and** pH 5 is acidic reject kill enzyme	(2) AO 2 1

Q26.

Question number	Answer	Additional guidance	Mark
(i)	mutualism / mutualist / mutualistic	accept mutual accept symbiotic / symbiosis /symbionts	(1) AO2.1

Question number	Answer	Additional guidance	Mark
(ii)	• grass (in first box) (1) • zebra, tick, oxpecker (in correct order in boxes 2,3 and 4) (1)	Award one mark if grass, zebra, tick and oxpecker are in the correct order but written from right to left.	(2) AO1.1

Q27.

Question Number	Answer	Additional guidance	Mark
(i)	Any **two** from: • temperature (1) • water availability (1) • pH of soil (1) • area of leaves in contact with the soil (1) • {mineral ions / nitrates} in the soil (1) • oxygen concentration (1)	accept humidity accept light intensity (1)	(2) AO2 2

Question Number	Answer	Additional guidance	Mark
(ii)	An explanation linking:		(2)
	• repeat the investigation / have more than one tray of each type of leaf (1)	accept so that the data is more reliable	AO3 3b
	• obtain more data / to calculate a mean / identify anomalies (1)		
	OR		
	• a variable that can be controlled (1)	e.g. accept use the same mass for each type of leaf e.g. accept use the same {mass / type} of soil (1)	
	• **linked to why** this would improve the investigation and make the results more comparable (1)	e.g. accept as leaves can be different sizes (1) e.g. accept so that the number of decomposing organisms is the same (1) ignore references to valid / accurate / precise	

Q28.

Question Number	Answer	Mark
(i)	D mutualism **The only correct answer is D** *A* is not correct because it is not parasitism *B* is not correct because it is not indigenous *C* is not correct because it is not biodiversity	(1) AO1

Question Number	Answer	Additional Guidance	Mark
(ii)	7500 (μm)	accept 7.5×10^3 reject 7.5×10^{-3}	(1) AO1 1

Q29.

Question Number	Answer	Additional Guidance	Mark
(i)	nettles → caterpillars → ladybirds → beetles → toads (3)	If food chain is incorrect allow 1 mark for each correct link up to a maximum of 2 marks.	(3) AO2 1

Question Number	Answer	Additional Guidance	Mark
(ii)	substitution 60 ÷ 750 = 0.08 (1) x100 8 (%)	award full marks for the correct answer with no working	(2) AO2 1

Question Number	Answer	Additional Guidance	Mark
(iii)	Any **two** from: • not all the beetle is eaten (1) • not all the beetle can be digested (1) • movement (1) • respiration (1) • (transferred to surroundings) as heat (1)	ignore maintaining body temperature	(2) AO2 1