



GuideMyGrades

— YOUR GOALS. OUR EXPERTISE. —

EDEXCEL GCSE BIOLOGY: QUESTIONS BY TOPIC

Ecosystems and Material Cycles (9)

GCSE Biology (Foundation) Topic 9

19 questions · 176 marks · Mark schemes included

Pearson Edexcel GCSE (9-1) Biology 1BI0, Foundation Tier, June 2018 - June 2025

 guidemygrades.com

 [@Guidemygrades](https://www.instagram.com/Guidemygrades)

 [@Guidemygrades](https://twitter.com/Guidemygrades)

 [@Guidemygrades](https://www.youtube.com/Guidemygrades)

 info@guidemygrades.com

 Piccadilly Business Centre, Unit C, Aldow Enterprise Park
Blackett Street, Manchester, M12 6AE

HOW TO USE THIS BOOKLET

Questions run from the lowest mark tariff to the highest, so similar questions sit together.

Click any row below to jump straight to that question.

On every question page, click ANSWER in the top-right corner to jump to its mark scheme.

Diagrams, graphs, tables and data are printed exactly as they appeared in the original papers.

QUESTION	SOURCE	MARKS	PAGE
1. Q3	Paper 2 June 2018	7	4
2. Q3	Paper 2 November 2021	7	7
3. Q1	Paper 2 June 2022	7	9
4. Q1	Paper 2 June 2023	7	11
5. Q2	Paper 2 November 2021	8	14
6. Q2	Paper 2 June 2023	8	17
7. Q3	Paper 2 June 2024	8	19
8. Q4 <i>also Topic 6</i>	Paper 2 June 2018	9	22
9. Q2 <i>also Topic 8</i>	Paper 2 November 2020	9	25
10. Q4	Paper 2 November 2020	9	28
11. Q5	Paper 2 June 2022	9	31
12. Q5	Paper 2 June 2018	10	35
13. Q4	Paper 2 June 2025	10	38
14. Q10	Paper 2 June 2018	11	43
15. Q10	Paper 2 November 2020	11	46
16. Q10	Paper 2 June 2022	11	49
17. Q6	Paper 2 June 2023	11	53
18. Q10	Paper 2 June 2024	11	56
19. Q9	Paper 2 June 2025	13	60



QUESTIONS

19 questions · 176 marks · lowest tariff first



7-MARK QUESTIONS

4 questions in this booklet



DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

3 The effect of temperature on decomposition was investigated.

30 leaves were collected.

The mass of five leaves was recorded and the leaves were placed into a net bag.

This was repeated five more times.

Figure 5 shows one of these bags.

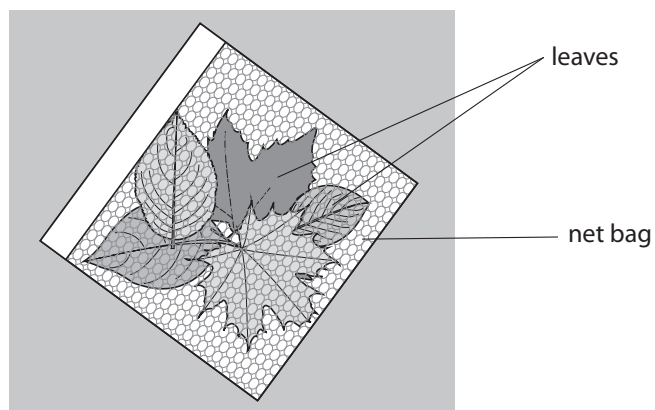


Figure 5

The net bags were then put in trays and covered in soil as shown in Figure 6.

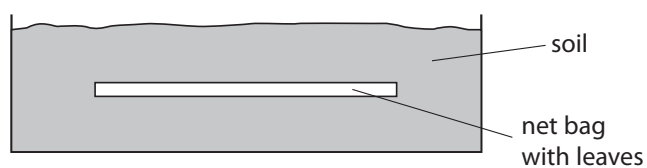


Figure 6

(a) Which type of tray should be used so that the leaves are in the best conditions for decomposition?

(1)

- ☒ **A** tray with air holes and dry soil
- ☒ **B** airtight tray with dry soil
- ☒ **C** tray with air holes and moist soil
- ☒ **D** airtight tray with moist soil

—
—
—
—

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 53 54 55 56 57 58 59 60 61 62 63 64 65 66 67 68 69 70 71 72 73 74 75 76 77 78 79 80 81 82 83 84 85 86 87 88 89 90 91 92 93 94 95 96 97 98 99 100

—

(b) Each tray was kept at a different temperature.

The mass of the leaves was recorded again after 25 days.

Figure 7 shows the results of this investigation.

temperature in °C	mass of leaves in g		decrease in mass in g	percentage decrease in mass (%)
	at start	after 25 days		
10	5.3	4.9	0.4	7.5
25	4.9	4.2	0.7	14
40	5.2	4.0	1.2	23
55	4.8	3.2	1.6	33
70	5.0	3.7	1.3	26
85	5.4	5.2	0.2	?

Figure 7

(i) Calculate the percentage decrease in mass for the leaves at 85 °C.

Give your answer to two significant figures.

(2)

.....%

(ii) Explain which temperature was the best for the decomposition of the leaves.

(2)

.....

.....

.....

.....

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA



DO NOT WRITE IN THIS AREA

(iii) State **two** improvements to the method for this investigation.

(2)

1

.....

2

.....

(Total for Question 3 = 7 marks)



3 A student investigated fish food.

(a) The student added some fish food to a blue liquid in a test tube.

The solution turned from blue to purple.

(i) Use words from the box to complete the sentences.

(2)

ethanol	Biuret	fat
iodine	protein	starch

The blue liquid was solution.

The purple colour showed that the fish food contained

(ii) The blue solution may be harmful if swallowed.

Which procedure is a health and safety precaution needed for this investigation?

(1)

- ☐ **A** use a new test tube
- ☐ **B** wipe up any spilt liquids
- ☐ **C** measure the volume of the solutions
- ☐ **D** use a heat proof mat



(b) 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.

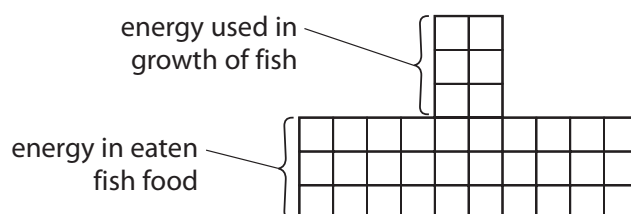


Figure 6

- (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 3 = 7 marks)

- 1 (a) Figure 1 shows part of the carbon cycle.

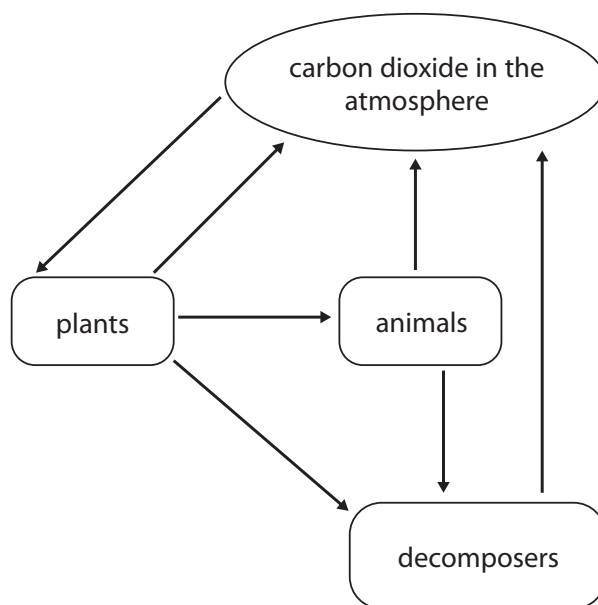


Figure 1

- (i) Name the process that transfers carbon from plants to animals.

(1)

- (ii) Use words from the box to complete the sentences.

(2)

digestion	translocation	osmosis
photosynthesis	respiration	transpiration

Plants use carbon dioxide from the atmosphere for

Animals release carbon dioxide and energy during

(iii) Which of these can be a decomposer?

(1)

- ☐ **A** mammal
- ☐ **B** producer
- ☐ **C** microorganism
- ☐ **D** tree

(b) The water cycle is the movement of water through an ecosystem.

Which process is used to obtain freshwater from seawater?

(1)

- ☐ **A** excretion
- ☐ **B** precipitation
- ☐ **C** sterilisation
- ☐ **D** desalination

(c) Water from rivers can be filtered and then treated with chemicals to make it suitable for drinking.

(i) Give **one** reason why water is filtered.

(1)

(ii) Give **one** reason why water is treated with chemicals.

(1)

(Total for Question 1 = 7 marks)



- 1 Figure 1 shows a bird called an egret on the back of a buffalo.



(Source: © Jaromir Chalabala/Shutterstock)

Figure 1

- (a) (i) The egret eats parasites that live on the skin of the buffalo.

Which term describes this relationship, where the buffalo and the egret both benefit?

(1)

- ☐ **A** eutrophication
- ☐ **B** mutualism
- ☐ **C** indigenous
- ☐ **D** biodiverse

- (ii) The buffalo is part of the carbon cycle.

Use words from the box to complete the sentences.

clean	decompose	energy
fertilise	glucose	water

(2)

The buffalo gains carbon from the in the plants that it eats.

Bacteria will the waste from the buffalo.

(iii) Figure 2 shows part of the carbon cycle.

Draw and label an arrow on Figure 2 to show the process plants use to make glucose from carbon dioxide.

(2)

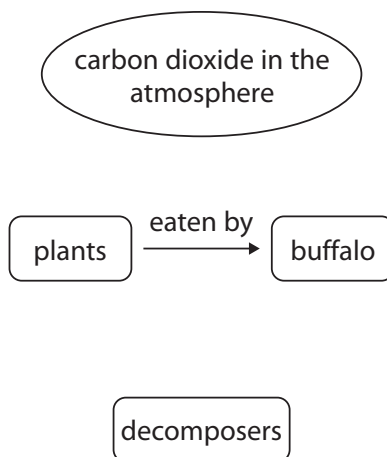


Figure 2

(b) Enzymes are used to digest proteins.

Figure 3 shows an enzyme and a protein.

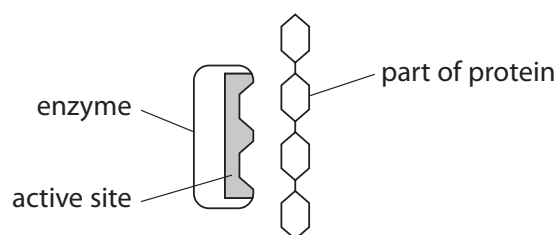


Figure 3

Explain how boiling the enzyme stops the protein being digested.

(2)

.....

.....

.....

.....

(Total for Question 1 = 7 marks)

8-MARK QUESTIONS

3 questions in this booklet



2 (a) 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

(b) 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.

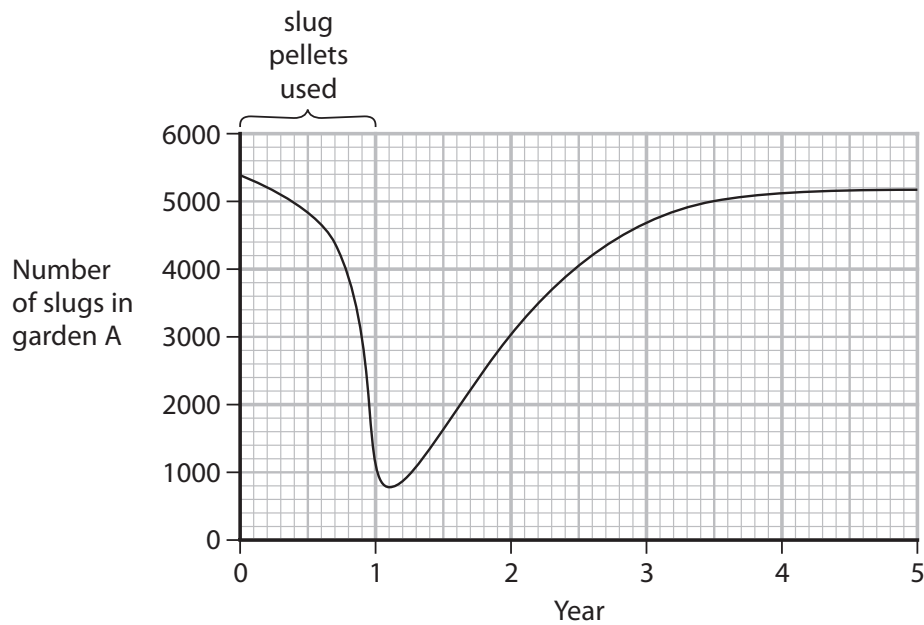


Figure 4

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

(2)

.....

.....

.....

.....

(c) (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.

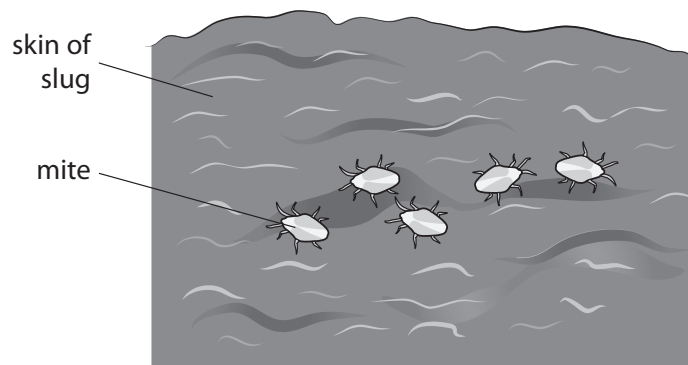


Figure 5

Explain why these mites are classed as parasites.

(2)

.....

.....

.....

.....

(Total for Question 2 = 8 marks)

2 In 2022, temperatures in England were higher than average.

The increase in temperature is linked to global warming.

(a) Which human activity is most likely to cause an increase in global warming?

(1)

- ☐ A burning fossil fuels
- ☐ B insulating houses
- ☐ C using more solar panels
- ☐ D using nuclear power stations

(b) Figure 4 shows the rainfall for one area in England for part of 2022.

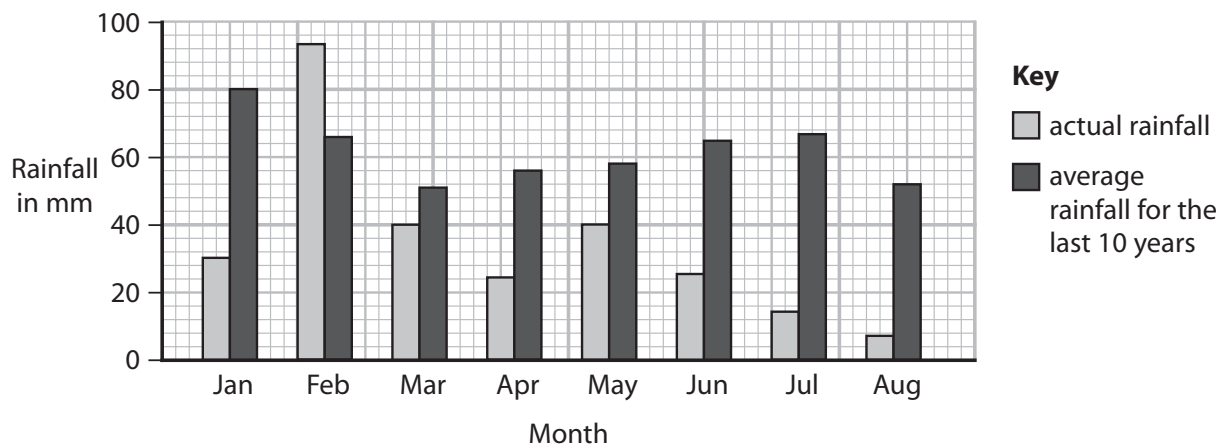


Figure 4

(i) State **two** conclusions about the actual rainfall compared with the average rainfall shown in Figure 4.

(2)

1

2



- (ii) The average potato yield for a field is 44 tonnes.

The weather in 2022 meant that the actual yield for this field was one quarter lower than this average.

Calculate the actual yield of potatoes for this field in 2022.

(2)

..... tonnes

- (iii) Food security occurs when all people are able to access enough safe and nutritious food to meet their requirements for a healthy life.

Explain how lower yields of potatoes and other crops could affect food security.

(3)

.....

.....

.....

.....

.....

.....

.....

.....

(Total for Question 2 = 8 marks)



3 Figure 4 shows a food chain in an oak woodland.

oak tree → aphids → ladybirds → robins

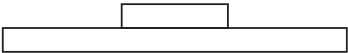
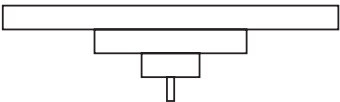
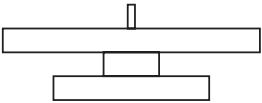
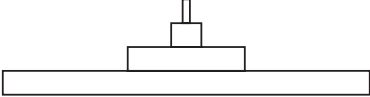
Figure 4

(a) State what the arrows in the food chain represent.

(1)

(b) Which diagram represents the pyramid of biomass for this food chain?

(1)

- ☐ **A** 
- ☐ **B** 
- ☐ **C** 
- ☐ **D** 

(c) A robin in this woodland eats 6 g of food in a day.

The robin uses 15% of this food for growth.

Calculate the mass of food that is used for growth.

(2)

..... g

(d) Temperatures in England have increased over the last 20 years.

(i) State **two** human activities that have caused this temperature increase.

(2)

1

.....

.....

2

.....

.....

(ii) One new species of moth is now able to live in England because of the increased temperatures.

This moth feeds on oak leaves.

Explain how these moths may affect the number of aphids in the food chain shown in Figure 4.

(2)

.....

.....

.....

.....

(Total for Question 3 = 8 marks)

9-MARK QUESTIONS

4 questions in this booklet



4 (a) Plants use nitrate ions to make proteins and chlorophyll.

(i) What effects will a low nitrate ion concentration in soils have on plants?

(1)

- ☐ A reduced growth and darker green leaves
- ☐ B reduced growth and lighter green leaves
- ☐ C increased growth and darker green leaves
- ☐ D increased growth and lighter green leaves

(ii) Which organisms convert nitrogen to nitrate ions during the nitrogen cycle?

(1)

- ☐ A bacteria
- ☐ B mammals
- ☐ C fungi
- ☐ D worms

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA



DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

(b) Figure 8 shows part of a root as seen using a light microscope.

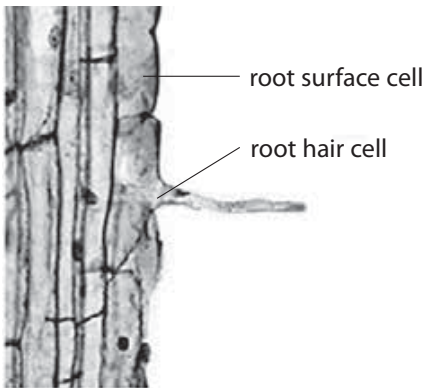


Figure 8

Figure 9 shows information about the two types of cell labelled in Figure 8.

type of cell	surface area in μm^2	volume in μm^3	surface area to volume ratio
root surface cell	5 000	250 000	1 : 50
root hair cell	36 000	288 000	?

Figure 9

(i) Calculate the surface area to volume ratio of the root hair cell.

(2)

(ii) Explain the benefit to the plant of having root hair cells.

(2)

.....

.....

.....



(c) Algae are green plants.

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

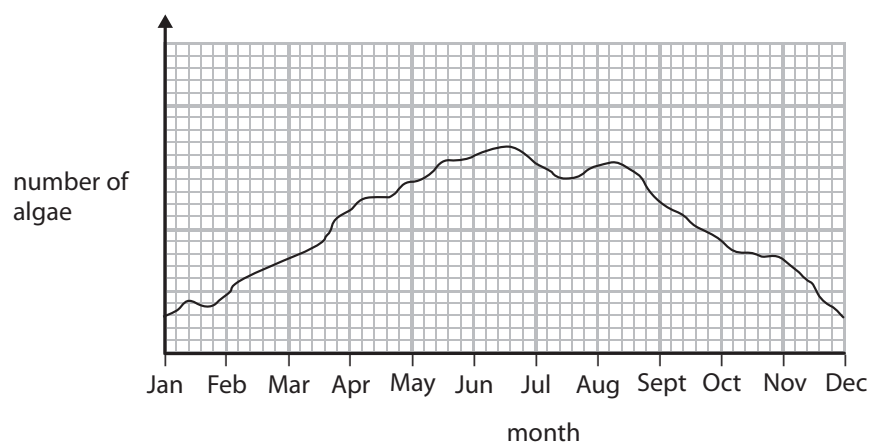


Figure 10

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

(3)

.....

.....

.....

.....

.....

.....

.....

.....

(Total for Question 4 = 9 marks)

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT

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



© IanRedding/Shutterstock

Figure 3

- (a) Use words from the box to complete the sentences.

(2)

enzymes	food	herbivores
parasites	producers	prey

- (i) The tick burrows into the skin to obtain
- (ii) When a tick burrows into human skin the tick benefits but the human is harmed.
- This means that ticks are classed as

- (b) When skin is cut a blood clot forms.

Which part of the blood starts the clotting process?

(1)

- ☒ A red blood cells
- ☒ B water
- ☒ C platelets
- ☒ D white blood cells

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



© MartinMaritz/Shutterstock

Figure 4

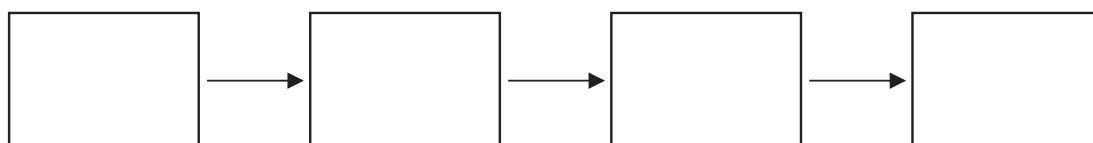
(i) Name the type of relationship where both the oxpecker and the zebra benefit.

(1)

(ii) Zebras eat grass.

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

(2)



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

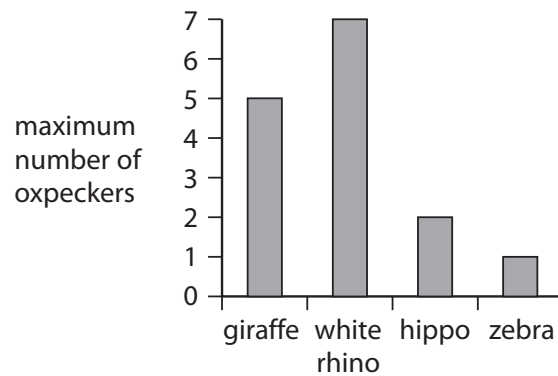


Figure 5

- (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 2 = 9 marks)

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

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

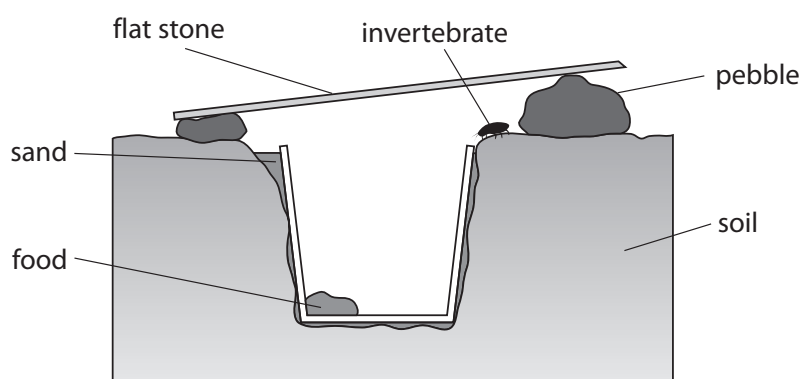


Figure 9

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

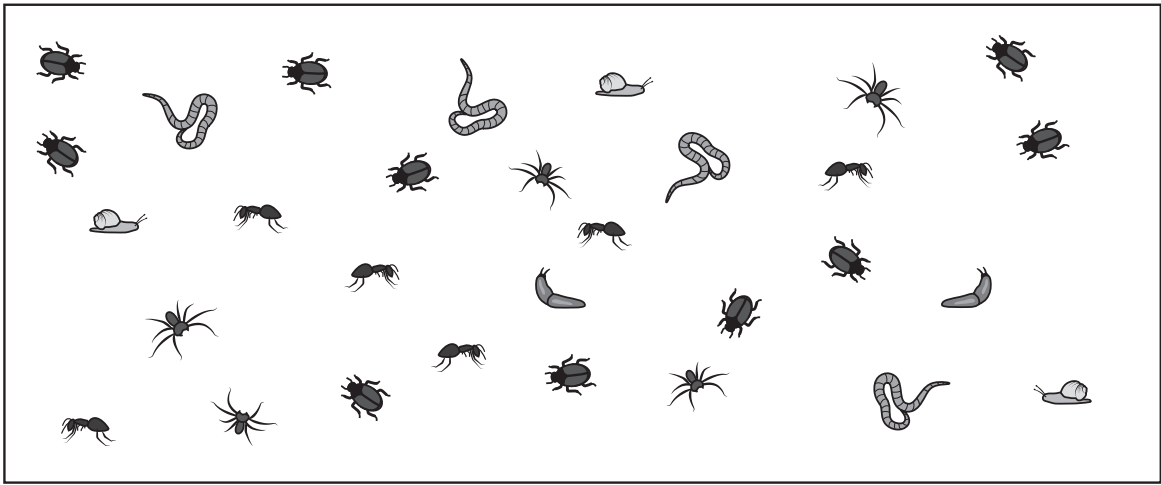
Complete the steps in the correct order, from left to right.

The first number has been written in for you.

(2)

5				
---	--	--	--	--

(b) Figure 10 shows 30 invertebrates that the scientist collected.



key					
beetle	snail	ant	spider	slug	worm

Figure 10

(i) Complete the table by filling in the tally and number for the spiders and worms. (2)

invertebrate	tally	number of invertebrates
ant		6
beetle		10
slug		2
snail		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)

(c) The scientist also counted the number of snails in four 1m^2 areas of the garden.

The garden had a total area of 40m^2 .

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

(2)

(Total for Question 4 = 9 marks)



- 5 (a) Figure 8 shows a compost bin.



(Source: © Evan Lorne/Shutterstock)

Figure 8

- (i) Give **one** reason why the compost bin has gaps at the sides.

(1)

- (ii) A student placed 2.0 kg of vegetable waste in a compost bin.

After 20 days, the student reweighed the vegetable waste and found that its mass was 1.7 kg.

Calculate the rate of decomposition of the vegetable waste.

Use the equation

$$\text{rate of decomposition} = \frac{\text{change in mass}}{\text{time taken}} \quad (3)$$

rate of decomposition = ... kg per day

(iii) The temperature in the compost bin increased from 20 °C to 25 °C.

Explain how this increase in temperature would affect the rate of decomposition in the compost bin.

(2)



(b) Figure 9 shows some preserved food that can be bought in a supermarket.



Dried food



Vacuum packed food

(Source: © Sarah Marchant/Shutterstock © Cultura Motion/Shutterstock)

Figure 9

Explain why these two types of preserved foods do not decompose.

(3)

.....

.....

.....

.....

.....

.....

(Total for Question 5 = 9 marks)

10-MARK QUESTIONS

2 questions in this booklet



DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

- 5 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.

- (a) 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

—

—

—

—

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 53 54 55 56 57 58 59 60 61 62 63 64 65 66 67 68 69 70 71 72 73 74 75 76 77 78 79 80 81 82 83 84 85 86 87 88 89 90 91 92 93 94 95 96 97 98 99 100

15

(b) 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

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA



DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

E IN THIS AREA

(iii) The enzyme luciferase works best at pH8.

Explain why the activity of the enzyme decreases at pH5.

(2)

.....

.....

.....

.....

.....

(c) 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 5 = 10 marks)



4 Figure 5 shows part of the nitrogen cycle.

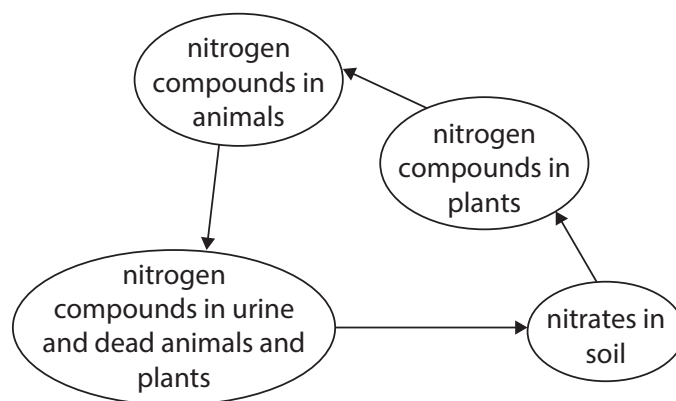


Figure 5

(a) Use words from the box to complete the following sentences about the nitrogen cycle.

(2)

animals	lipids	decomposers
sugars	proteins	predators

The nitrogen compounds in plants include

The nitrates from rotting dead plants are released into the soil by

- (b) 180 million tonnes of nitrates were used by crops growing on farms in the UK in 2020.

Figure 6 shows the different sources of nitrates used by the crops.

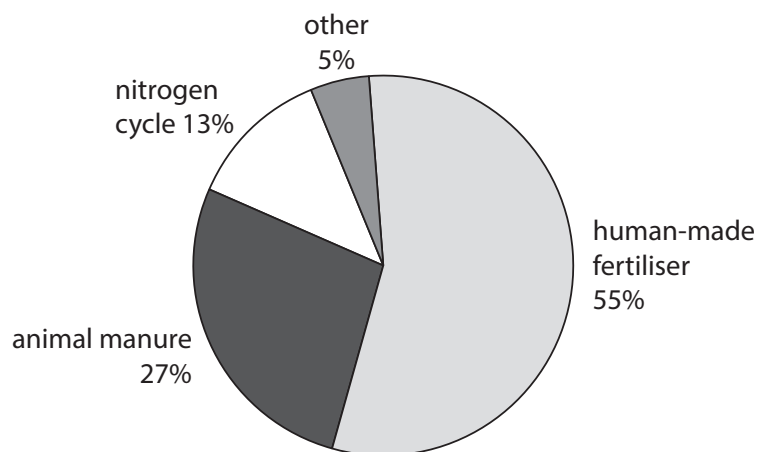


Figure 6

- (i) Calculate the mass of nitrates from human-made fertiliser that was used by crops in 2020.

(2)

..... million tonnes

- (ii) Some of the nitrates spread on fields as fertiliser get into lakes.

Name the type of pollution caused by the build-up of nitrates in lakes.

(1)

.....

.....

(c) A student investigated how the concentration of nitrate affected the types of algae growing in three lakes.

Figure 7 shows microscope images of the algae in 1 mm³ of water, and the concentrations of nitrate ions in each lake.

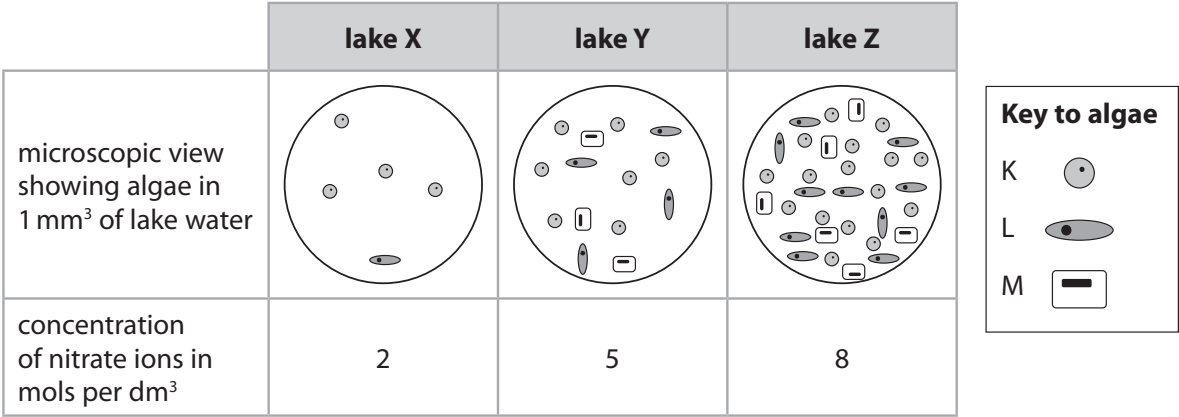


Figure 7

(i) Figure 8 shows a bar chart for the algae in lakes X, Y and Z.

Complete the bar chart for algae L and algae M in lake Z.

(2)

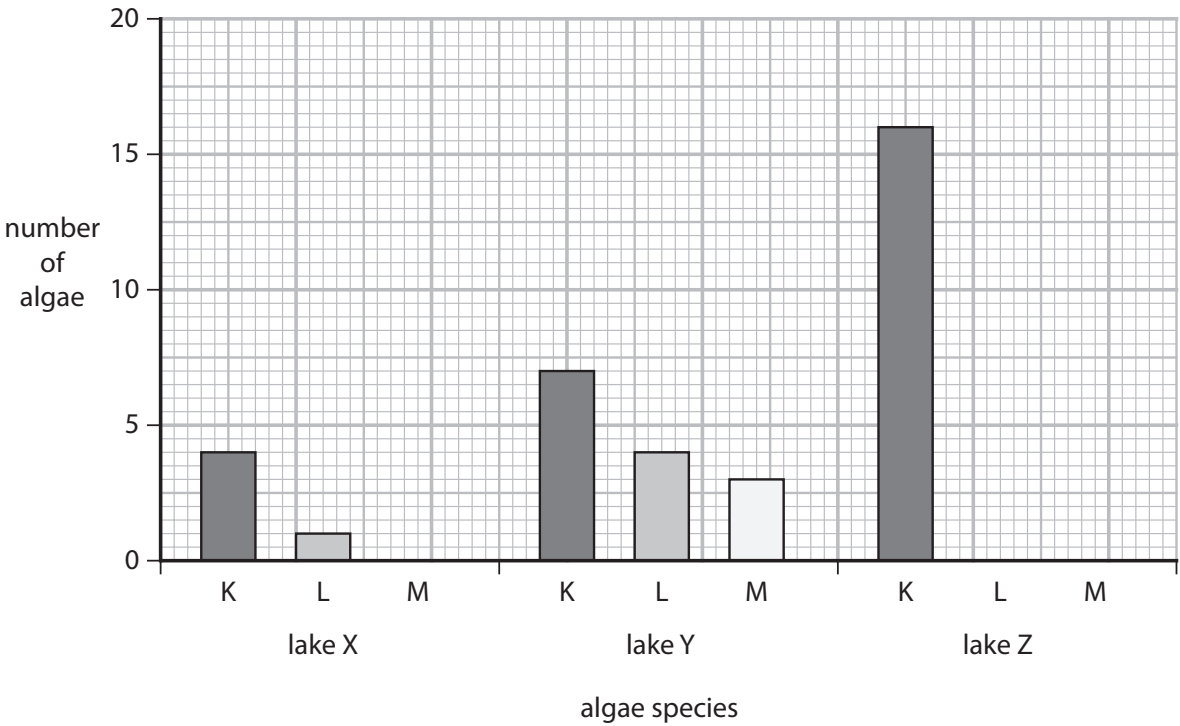


Figure 8

- (ii) State **two** conclusions about the relationship between nitrate concentration and the algae in these lakes.

(2)

1

2

- (iii) A build-up of algae on the surface of the lake can affect plants growing at the bottom of the lake.

Which statement shows how this would affect the plants at the bottom of the lake?

(1)

- ☐ **A** plants grow faster because they are warmer
- ☐ **B** plants can photosynthesise more
- ☐ **C** plants die as they do not receive enough light
- ☐ **D** plants cannot absorb water

(Total for Question 4 = 10 marks)



11-MARK QUESTIONS

5 questions in this booklet



- 10 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

- (a) Siberian chipmunks eat acorns, which are the seeds of oak trees.

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

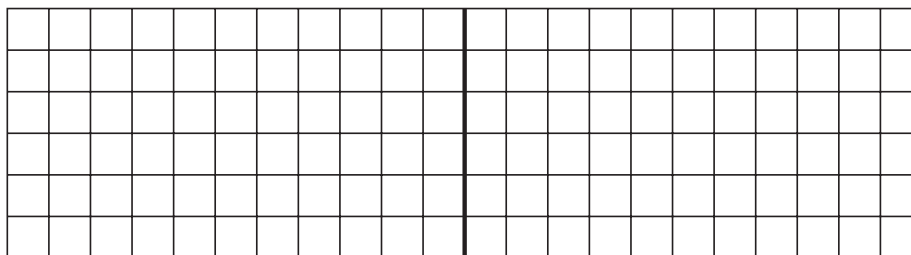
- (i) Figure 26 shows the biomass of three organisms in a food chain from one area of Siberia.

organisms	biomass in kg
acorns	20 650
chipmunks	2 200
wild dogs	230

Figure 26

Draw a pyramid of biomass for this food chain.

(2)



DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

(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



33



(b) The black-legged tick (*Ixodes scapularis*) is a parasite that feeds on the blood of animals including Siberian chipmunks and humans.

The tick transmits the Lyme disease pathogen.

Figure 27 shows the number of cases of Lyme disease in humans in France in 2003 and 2015.

Number of cases of Lyme disease in humans in France	
2003	2015
9 500	27 000

Figure 27

(i) Calculate the percentage increase in the number of cases of Lyme disease in humans in France from 2003 to 2015.

(2)

.....%

(ii) Explain why there has been an increase in the number of cases of Lyme disease in humans in France.

(2)

.....

.....

.....

.....

(Total for Question 10 = 11 marks)

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

DO NOT WRITE IN THIS AREA

10 Figure 24 shows the world human population from 1800 to 2015.

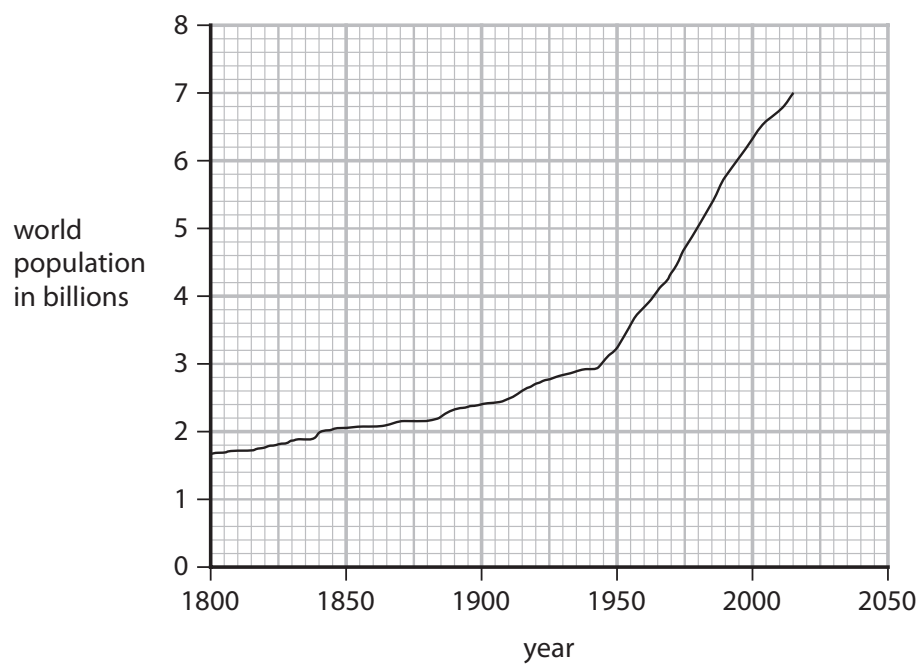


Figure 24

(a) In 2015, 13% of the world human population were classified as malnourished.

Calculate, using Figure 24, how many people were classified as malnourished in 2015.

(2)

..... billion

(b) Protein is an important nutrient in meat.

Describe the laboratory test for protein.

(2)

.....

.....

.....

.....

.....

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

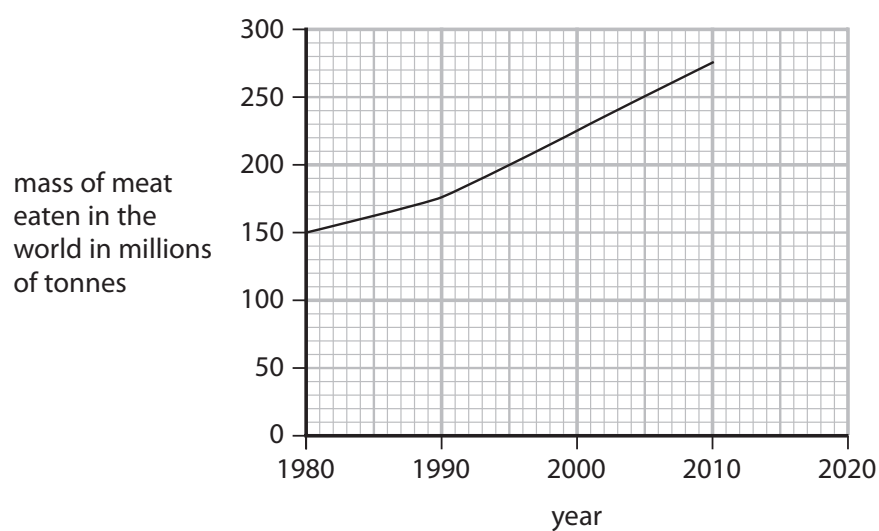


Figure 25

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

(2)

..... millions of tonnes per year

(d) Figure 26 shows an energy pyramid.

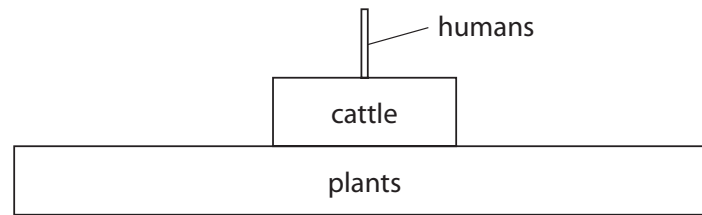


Figure 26

(i) Explain why the area labelled cattle is smaller than the area labelled plants.

(2)

.....

.....

.....

.....

.....

(ii) The World Health Organisation uses this definition of food security.

'When all people at all times have access to sufficient, safe, nutritious food to maintain a healthy and active life'

Explain how a large increase in the mass of meat eaten will decrease food security in the future.

(3)

.....

.....

.....

.....

.....

.....

.....

.....

.....

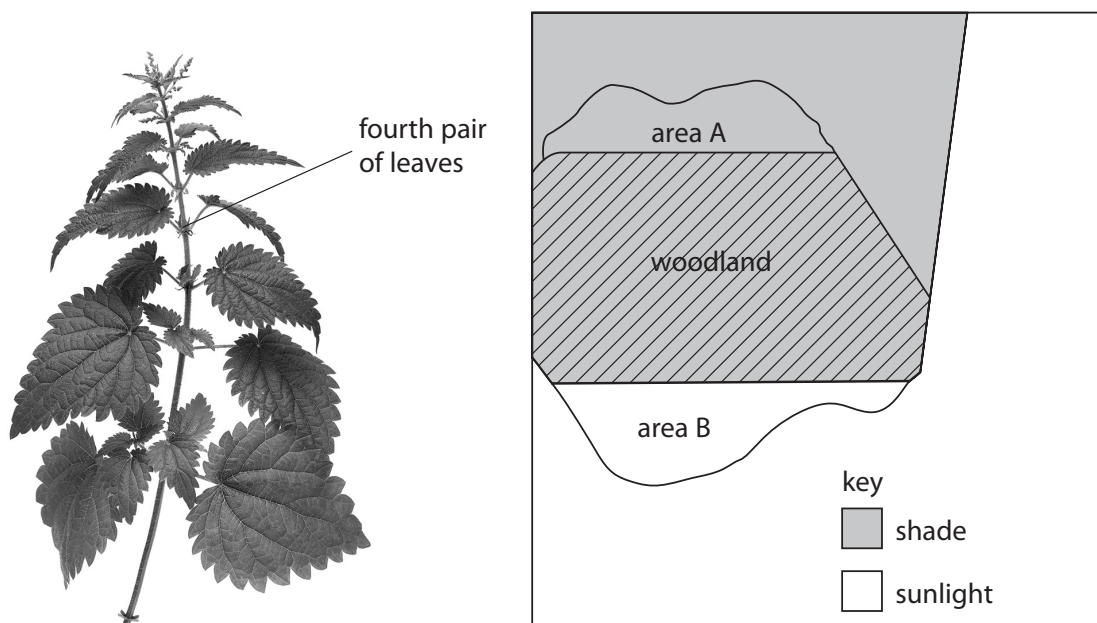
.....

(Total for Question 10 = 11 marks)

- 10** A student investigated the width of leaves on nettle plants growing in two areas next to a woodland.

Figure 19a shows a nettle plant and Figure 19b 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 19a

Figure 19b

The student measured the maximum width of leaves on five plants from each area.

The student always measured one leaf from the fourth pair of leaves.

- (a) Give **one** reason why the student always measured a leaf from the fourth pair of leaves.

(1)

(b) Figure 20 shows the results.

nettle plant	width of the leaf in millimetres (mm)	
	area A	area B
1	45	33
2	50	25
3	48	27
4	52	48
5	47	28
mean	48	28

Figure 20

- (i) Why did the student **not** include the circled width when calculating the mean for area B?

(1)

- ☐ **A** it has not been measured in millimetres
- ☐ **B** it is an anomalous result
- ☐ **C** it is a repeat result
- ☐ **D** it is the mode value

- (ii) Explain the difference in the mean width of leaves in the shade and those in the sunlight.

(2)

.....

.....

.....

.....

(c) 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 21 shows the energy transferred between these animals.

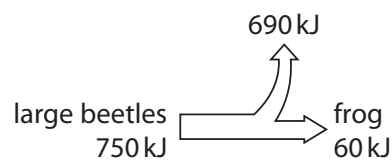


Figure 21

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 10 = 11 marks)



6 In 2000, a council planted indigenous trees as part of a reforestation programme.

(a) Why were indigenous trees used instead of non-indigenous trees?

(1)

- ☒ **A** indigenous trees will bring in more pests
- ☒ **B** indigenous trees are less likely to survive
- ☒ **C** indigenous trees will support more native wildlife
- ☒ **D** indigenous trees will cause more damage to the soil

(b) The animal biodiversity in this reforested area was measured from 2004 to 2017.

Biodiversity is measured on a scale from 0 to 1.

0 = low biodiversity

1 = maximum biodiversity

Figure 12 shows the results.

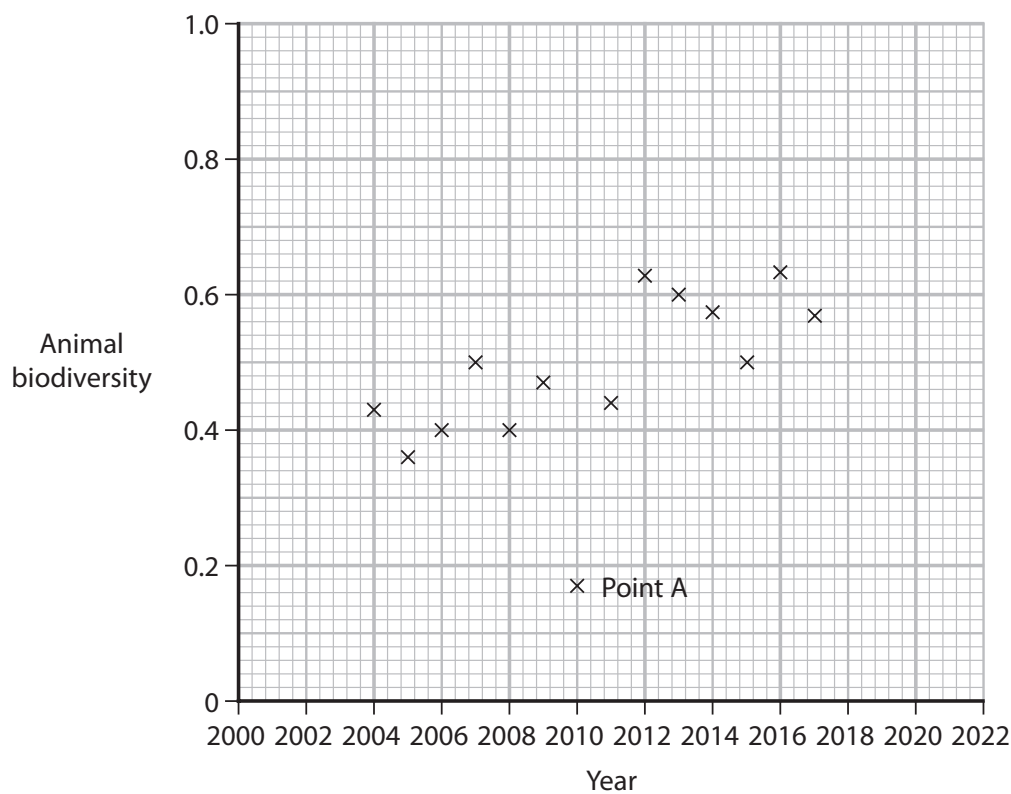


Figure 12

- (i) Draw a straight line of best fit on Figure 12 to show the main trend in this data.

(1)

- (ii) Estimate the animal biodiversity of the reforested area in 2022.

(1)

- (c) (i) The data to calculate animal biodiversity was collected using the following method.

- a 100 m² area was chosen
- three 1 m² quadrats were placed randomly on the ground
- animals inside the quadrat were counted
- the number of each species of animal was recorded

State **two** ways that the quality of the results from this method could be improved.

(2)

1

2

- (ii) State why point A on Figure 12 was ignored when considering the trend in animal biodiversity.

(1)

.....

.....

- (iii) The data shown in Figure 12 was collected during the summer.

Explain why animal biodiversity would be different if the data had been collected in the winter.

(2)

.....

.....

.....

.....



(d) A scientist observes that trees at the edge of a forest shade part of a field.

Describe how a belt transect could be used to see how light intensity affects the biodiversity of plants growing in the field.

(3)

(Total for Question 6 = 11 marks)



10 A student investigated the decomposition of two different types of leaf.

The student placed 200 grams of holly leaves in a net bag.

The student placed 200 grams of oak leaves in another net bag.

The bags were left in a classroom.

The mass of the leaves in each bag was recorded every 10 days for 50 days.

(a) State **two** variables that would need to be controlled in this investigation.

(2)

1

2



(b) The results of this investigation are shown in Figure 16.

time in days	mass of leaves in grams	
	holly	oak
0	200	200
10	191	181
20	176	154
30	159	122
40	147	96
50	120	70

Figure 16

(i) Calculate the rate of decomposition of holly leaves from 0 to 50 days.

(2)

..... grams per day

(ii) Compare the trends shown in the data for holly leaves and oak leaves.

(2)

.....

.....

.....

.....

.....

(c) Explain why it is important for the environment that dead leaves are decomposed. (2)

(d) Name **one** type of organism that decomposes leaves. (1)

(e) Leaves are eaten by snails.

1 600 grams of leaves and 10 snails were kept in a container for one month.

A scientist measured the mass of the leaves and the mass of the snails at the start and end of one month.

Figure 17 shows the results.

	mass in grams	
	at start of month	at end of month
leaves	1 600	400
snails	200	320

Figure 17

Explain why the change in mass of the leaves is not the same as the change in mass of the snails. (2)

(Total for Question 10 = 11 marks)

13-MARK QUESTIONS

1 question in this booklet



9 (a) In 2018, all the plants were removed from the soil in a 1000 m² area.

A wall was built around this area to keep people out.

In 2019, three species of plants were recorded growing in this area.

Two of these species were indigenous.

(i) State what is meant by the term 'indigenous'.

(1)

(ii) Name **one** piece of equipment that could be used to sample the number of indigenous plants in this area.

(1)

(b) The area was surveyed every year and the number of plants of each species (A to H) was estimated.

Figure 20 shows the results.

estimated number of each plant species found in the survey								
year	A	B	C	D	E	F	G	H
2018	—	—	—	—	—	—	—	—
2019	491	23	66	—	—	—	—	—
2020	664	48	186	1	8	—	—	—
2021	470	25	283	3	6	7	1	—
2022	120	41	354	7	4	11	7	—
2023	44	39	421	21	6	11	9	8

Figure 20

- (i) State the trend shown by the data in Figure 20 for plant species C from 2019 to 2023.

(1)

- (ii) A scientist suggested that the decrease in the number of plants of species B in 2021 was caused by competition from one of the other species of plant.

Which species is most likely to have out-competed species B in 2021?

(1)

- ☐ **A** species A
- ☐ **B** species C
- ☐ **C** species D
- ☐ **D** species H

- (iii) Explain **one** way that this species could have out-competed species B.

(2)

- (iv) Give **one** way that species H could have moved into the area.

(1)



MARK SCHEMES

official Pearson Edexcel mark schemes



Question number	Answer	Mark
3(a)	C tray with air holes and moist soil 1. The only correct answer is C <i>A is not correct because dry soil is not the best condition for decomposition</i> <i>B is not correct because neither an airtight tray or dry soil is not the best condition for decomposition</i> <i>D is not correct because an airtight tray is not the best condition for decomposition</i>	(1) AO 1 1

Question number	Answer	Additional guidance	Mark
3(b)(i)	Substitution: $(0.2 \div 5.4) \times 100 = 3.7037(\%)$ (1) Evaluation: 3.7 (%) (1)	accept 3.703 with recurring dots over the 7 and last 3. award full marks for answer without working	(2) AO 2 1

Question number	Answer	Mark
3(b)(ii)	An explanation that combines identification via a judgement (1 mark) to reach a conclusion via justification/reasoning (1 mark): • 55 (°C) (1) • because (55°C) is the largest percentage decrease in mass (1) • because (55°C) is the optimum temperature for the {enzymes / bacteria / fungi / decomposers} (1)	(2) AO 3 2a AO 3 2b

Question number	Answer	Mark
3(b)(iii)	Any two improvements from: • use more leaves / use more bags of leaves / use the same type of leaves / same (tree) species (1) • use same type / amount of soil / bury to same depth (1) • dry leaves before measuring mass / use biomass (1) • increase the length of time / check mass at regular time intervals (1) • increase number of temperatures (between 10 and 85°C) (1)	(2) AO 3 3b

Total for Question 3 = 7 marks



Question Number	Answer	Additional guidance	Mark
3(a) (i)	Biuret (1) protein (1) answers must be in the correct order	(2) AO1.2	

Question Number	Answer	Mark
3(a) (ii)	B wipe up any spilt liquids The only correct answer is B <i>A is not correct because using a new test tube is not a health and safety precaution.</i> <i>C is not correct because measuring the volume of solutions is not a health and safety precaution</i> <i>D is not correct because the Biuret test does not use a Bunsen burner.</i>	(1) AO1.2

Question Number	Answer	Mark
-----------------	--------	------

Question Number	Answer	Additional guidance	Mark
3(b)(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

(Total for question 3 = 7 marks)

Question Number	Answer	Mark
-----------------	--------	------

Question Number	Answer	Additional guidance	Mark
1(a)(i)	feeding / eating	accept digestion / absorption / nutrition	(1) A03 1a

Question Number	Answer	Additional guidance	Mark
1(a)(ii)	photosynthesis (1) respiration (1)	answers must be in the correct order	(2) A02 1

Question Number	Answer	Mark
1(a)(iii)	C microorganism The only correct answer is C <i>A is not correct because mammals are not decomposers</i> <i>B is not correct because producers are not decomposers</i> <i>D is not correct because trees are not decomposers</i>	(1) A01 1

Question Number	Answer	Mark
1(b)	D desalination The only correct answer is D <i>A is not correct because excretion is not used to obtain fresh water from sea water</i> <i>B is not correct because precipitation is not used to obtain fresh water from sea water</i> <i>C is not correct because sterilisation is not used to obtain fresh water from sea water</i>	(1) AO1 1

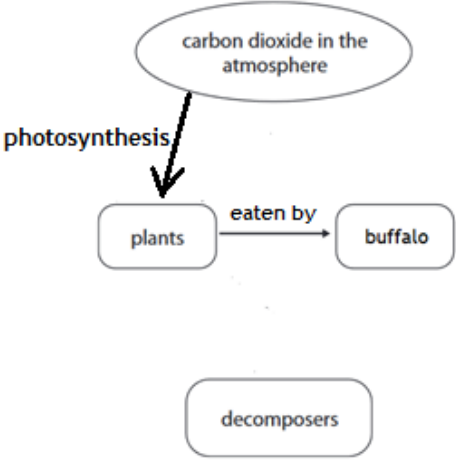
Question Number	Answer	Mark
1(ci)	to remove objects / debris / named objects	(1) AO1 1

Question Number	Answer	Additional guidance	Mark
1(cii)	to destroy pathogens / remove {other chemicals / named chemicals / ions / named ions}	Accept to make it taste better	(1) AO1 1

(Total for Question 1 = 7 marks)

Question number	Answer	Mark
1(a)(i)	The only correct answer is B mutualism A is incorrect because eutrophication is not about feeding relationships. C is incorrect because indigenous is not a feeding relationship D is incorrect because biodiverse is not a feeding relationship	(1)

Question number	Answer	Mark
1(a)(ii)	• glucose (1) • decompose (1) answers must be in the correct order	(2)

Question number	Answer	Additional guidance	Mark
1(a)(iii)	- an arrow drawn from 'carbon dioxide in the atmosphere' to 'plants' (1) - arrow labelled photosynthesis (1) 	photosynthesis label mark can be awarded if arrow is drawn in the wrong direction.	(2)

Question number	Answer	Additional guidance	Mark
1(b)	An explanation linking: (the enzyme is) denatured (1) - the active site will change shape (1) - so the protein / substrate will not fit into the active site (1)	accept enzyme changes shape ignore references to the protein changing shape	(2)

Total marks for question 1 = 7 marks

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

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

Question Number	Answer	Mark
2(b)(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
2(b)(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

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

Question Number	Answer	Additional guidance	Mark
2(c)(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

(Total for question 2 = 8 marks)

Question Number	Answer	Mark
-----------------	--------	------

Question number	Answer	Mark
2(a)	The only correct answer is A burning fossil fuels B is incorrect because insulating houses will not increase global warming C is incorrect because more solar panels will not increase global warming D is incorrect because nuclear power will not increase global warming	(1)

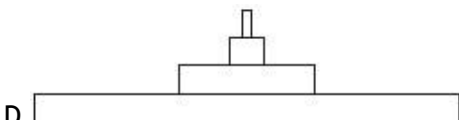
Question number	Answer	Additional guidance	Mark
2(b)(i)	Two conclusions from: - there was less rain in 2022 than average (1) - seven of the eight months (in 2022) had less rainfall than the average / {February was the only month / there was only one month} when more rain fell (than average in 2022) (1) - a specific comparison shown in the graph, e.g. {July had the largest difference / March had the least difference} in rainfall (1)	accept 2022 was a very dry year	(2)

Question number	Answer	Additional guidance	Mark
2(b)(ii)	$(\frac{1}{4} \text{ of } 44 \text{ or } 44 \div 4) = 11 \text{ (1)}$ $44 - 11 = 33 \text{ (tonnes)}$	award full marks for the correct answer with no working	(2)

Question number	Answer	Mark
2(b)(iii)	An explanation linking: • food security will be reduced (1) with two from: • as there will be less food (1) • food prices will increase (1) • so poor people can't obtain / afford as much food / people will be malnourished / starving (1) • people may not get enough nutrients / enough of a named nutrient (1)	(3)

Total marks for question 2 = 8 marks

Question Number	Answer	Additional guidance	Mark
3 (a)	Transfer of energy / energy flow / is eaten by		(1)

Question Number	Answer	Mark
3 (b)	 The only correct answer is D A is incorrect because only two trophic levels are shown B is incorrect because the biomass should decrease in size as the food chain progresses C is incorrect because the biomass should decrease in size as the food chain progresses	(1)

Question Number	Answer	Additional guidance	Mark
3 (c)	$6 \div 100 \times 15 / 6 \times 15\%$ (1) $= 0.9$ (g)	Accept correct answer on answer line for 2 marks ecf 15% of any number correctly calculated (1)	(2)

Question number	Answer	Additional guidance	mark
3 (d)(i)	An answer including two from: • (burning / using) fossil fuels / oil / gas / wood (1) • cutting down {trees / hedges} / deforestation (1) • farming animals / cows (for meat) (1) • (organic) waste materials being added to landfill (1)	accept driving cars / planes accept other named fuels accept building houses on fields accept paddy fields / growing rice	(2)

Question Number	Answer	Additional guidance	Mark
3 (d) ii	An explanation including: • the number (of aphids) will decrease (1) • because the moths eat the aphid's food (1)	accept because there is less food for the aphids / the moths outcompete the aphids	(2)

Total for question 3 = 8 marks

Question number	Answer	Mark
4(a)(i)	B reduced growth and lighter green leaves 1. The only correct answer is B <i>A is not correct because low nitrate ion concentration in soils will not cause darker green leaves</i> <i>C is not correct because low ion nitrate concentration in soils will not cause neither increased growth or darker green leaves</i> <i>D is not correct because low nitrate ion concentration in soils will not cause increased growth</i>	(1) AO 2 1

Question number	Answer	Mark
4(a)(ii)	A bacteria 1. The only correct answer is A <i>B is not correct because mammals do not convert nitrogen to nitrate ions</i> <i>C is not correct because fungi do not convert nitrogen to nitrate ions</i> <i>D is not correct because worms do not convert nitrogen to nitrate ions</i>	(1) AO 2 2

Question number	Answer	Additional guidance	Mark
4(b)(i)	Substitution: $288\,000 \div 36\,000 (= 8) (1)$ Evaluation: 1:8	award full marks for correct ratio with no working	(2) AO 2 2

Question number	Answer	Additional guidance	Mark
4 (b)(ii)	An explanation including: • increases the surface area (1) • for absorption of (more) mineral ions / named mineral ions / water (1)	accept increases anchorage (1)	(2) AO 1 1

Question number	Answer	Mark
4(c)	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

Total for Question 4 = 9 marks

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

Question number	Answer	Mark
2a(ii)	parasites reject if more than one word is used from the box	(1)

Question number	Answer	Mark
2(b)	C platelets The only correct answer is C platelets A is incorrect because red blood cells do not start the clotting process. B is incorrect because water does not start the clotting process. D is incorrect because white blood cells do not start the clotting process.	(1)

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

Question number	Answer	Additional guidance	Mark
2(c)(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)

Question number	Answer	Additional guidance	Mark
2(d)(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 $7 \div 2 = 3.5$ times more oxpeckers (2 marks)	(2)

Question number	Answer	Additional guidance	Mark
2(d)(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)

Total for question 2 = 9 marks

Question number	Answer	Additional guidance	Mark
4(a)	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)

Question number	Answer	Mark						
4(b)(i)	<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 33%;">spider</td><td style="width: 33%; text-align: center;">///</td><td style="width: 33%; text-align: center;">5</td></tr> <tr> <td>worm</td><td style="text-align: center;">// //</td><td style="text-align: center;">4</td></tr> </table> - Spider line correct (1) - Worm line correct (1)	spider	///	5	worm	// //	4	(2)
spider	///	5						
worm	// //	4						

Question number	Answer	Additional guidance	Mark
4(b)(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)

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

Question number	Answer	Mark
4(c)	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)

Total for question 4 = 9 marks

Question Number	Answer	Mark
5(a)(i)	To allow {air / oxygen} to enter / water to drain out	(1) A02 1

Question Number	Answer	Additional guidance	Mark
5(a)(ii)	$(2.0 - 1.7 =) 0.3$ (1) $(0.3) \div 20 =$ 0.015 (kg per day) / (15g per day)	award full marks for correct answer with no working	(3) A02 1

Question Number	Answer	Mark
5(a)(iii)	An explanation linking: - increased rate of decomposition (1) with one of - because particles have more (kinetic) energy (1) - because rate of enzyme action increases (1) - because more decomposers are present (1)	(2) A02 2

Question Number	Answer	Mark
5(b)	An explanation including three from: Dried food • dehydrated / no water in dried food (1) • decomposers cannot grow / survive without water (1) Vacuum packed food • vacuum packed food has no {air/ oxygen} (inside) (1) • (which is used for) respiration (1) • so {decomposers / microorganisms} are {dormant / dead / cannot survive} (1)	(3) A02 1

(Total for Question 5 = 9 marks)

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

Question number	Answer	Mark
5(b) (i)	An answer that combines the following points to provide a logical description of the plan: 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)	(2) AO 3 3a

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

Question number	Answer	Additional guidance	Mark
5(b)(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

Question number	Answer	Mark
5(c)(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
5(c)(ii)	4000 / 4 X 10 ³	(1) AO 1 1

Total for Question 5 = 10 marks

Question number	Answer	Mark
4(a)	- proteins (1) - decomposers (1) Answers must be in the correct order	(2)

Question number	Answer	Additional guidance	Mark
4(b)(i)	Substitution: $180 \div 100 \times 55$ (1) Evaluation: 99 (million tonnes)	award full marks for the correct answer with no working accept other ways of working	(2)

Question number	Answer	Additional guidance	Mark
4(b)(ii)	eutrophication		(1)

Question number	Answer	Additional guidance	Mark
4(c)(i)	both columns plotted algae L = 10 (1) algae M = 6 (1)	tolerance = $\frac{1}{2}$ small square	(2)

Question number	Answer	Additional guidance	Mark
10(a)(i)	Pyramid of biomass - pyramid shape with labels (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)	accept names in bars or triangle for this mp must be bars: reject triangle against this mp.	(2) AO 2 1

Question number	Answer	Mark
10(a)(ii)	An answer that combines two of the following points of application and understanding to provide a logical description: • 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)	(2) AO 2 1



Question number	Answer	Additional guidance	Mark
10(a)(iii)	Substitution $9\,7500 \div 100 = 975$ (1) Evaluation $975 \times 9.5 = 9\,262.5$ (1) Nearest whole number 9 263 (kJ) OR 97500×0.095 (1) $= 9\,262.5$ (kJ) Nearest whole number 9 263 (kJ)	award full marks for correct answer with no working	(3) AO 2 2

Question number	Answer	Additional guidance	Mark
10(b)(i)	Substitution $27\,000 - 9\,500 = 17\,500$ (1) Evaluation $(17\,500 \div 9\,500) \times 100 = 184.2 / 184$ (%)	award full marks for correct answer with no working accept answer to any number of decimal places rounded correctly from: 184.2105263158	(2) AO 2 1

Question number	Answer	Mark
10(b)(ii)	An explanation including the following: • (the number chipmunks in the wild have increased) {so the ticks have more food / there are more ticks} (1) • so humans are more likely to be bitten (and contract Lyme disease) (1)	(2) AO 2 1

Total for Question 10 = 11 marks



Question number	Answer		Mark
10(a)	7 (billion) (1) 0.91 (billion)	award full marks for answer without working accept 910 000 000 for 1 mark	(2)

Question number	Answer	Additional guidance	Mark
10(b)	A description including: • add Biuret (reagent / solution) (1) • colour change (from blue) to mauve / purple (1)	accept sodium hydroxide and copper sulfate	(2)

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

Question number	Answer	Additional guidance	Mark
10(d)(i)	An explanation including two from: • there is less energy in the cattle than in the plants (1) • not all of the energy from the plants is passed on to the cattle (1) • because not all plant material is digested / eaten (1) • and some energy is used for respiration / movement / metabolism (1)	accept plants are eaten by cattle accept excretion	(2)

Question number	Indicative content	Additional guidance	Mark
10(d)(ii)	An explanation linking three of the following: • there will be less food for people to eat (1) • farming meat does not produce as much food (per acre as arable farming) (1) • so more land used for {meat farming / animal feed} (1) • means less {arable land / food (crops) grown for humans} (1)	accept a diet including a large amount of meat has health implications e.g. high cholesterol (1)	(3)

Total for question 10 = 11 marks

Question Number	Answer	Additional Guidance	Mark
10 (a)	Any one from: - so the leaves are the same age (1) - so the results can be compared (1) - to control a variable (1)	accept similar for same accept so the results are valid (1)	(1) AO2 2

Question Number	Answer	Mark
10 (b)(i)	B it is an anomalous result The only correct answer is B <i>A is not correct because it is measured in millimetres</i> <i>C is not correct because it is not a repeat</i> <i>D is not correct because it is not the mode</i>	(1) AO3 1a

Question Number	Answer	Additional Guidance	Mark
10 (b)(ii)	An answer linking: - the leaves in the {shade / area A} are wider (1) - to give a larger surface area / to absorb more light (1)	accept reverse argument	(2) AO3 2a+2b

Question Number	Answer	Additional Guidance	Mark
10 (c)(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) A02 1

Question Number	Answer	Additional Guidance	Mark
10 (c)(ii)	substitution $60 \div 750 = 0.08$ (1) $\times 100$ 8 (%)	award full marks for the correct answer with no working	(2) A02 1

Question Number	Answer	Additional Guidance	Mark
10 (c)(iii)	Any two from: - not all the beetle is eaten (1) - not all the beetle can be digested (1) - movement of the frog (1) - respiration by the frog (1) (transferred to surroundings) as heat (1)	ignore maintaining body temperature	(2) A02 1

(Total for question 10 = 11 marks)

Question number	Answer	Mark
6(a)	The only correct answer is C indigenous trees will support more native wildlife A is incorrect because indigenous trees will bring in less pests than non-indigenous trees. B is incorrect because indigenous trees are more likely to survive than non-indigenous trees D is incorrect because indigenous trees damage soils less than non-indigenous trees.	(1)

Question number	Answer	Additional guidance	Mark
6(b)(i)	a straight line drawn on the graph showing the main trend with roughly equal plots on both sides (ignoring the anomalous point)	accept minimum of 4 crosses above / below their line that shows the general trend.	(1)

Question number	Answer	Mark
6(b)(ii)	the biodiversity at 2022 should be taken from their line of best fit drawn on the graph	(1)

Question number	Answer	Additional guidance	Mark
6(c)(i)	Any two from: - sample other areas of the forest (1) - use more (than 3) quadrats / use larger quadrats (1) - calculate an average / mean (1) - sample animals on the leaves / branches / trunks / trees / in soil (1)	accept increase area sampled (to more than 100m²) accept repeat the investigation on different dates (1)	(2)

Question number	Answer	Additional guidance	Mark
6(c)(ii)	because the data was anomalous / an outlier / doesn't fit in with the trend	accept it was much lower than the other points	(1)

Question number	Answer	Additional guidance	Mark
6(c)(iii)	An explanation to include two from: - the biodiversity will be lower (1) - because there will be less {food / shelter} / fewer leaves / the animals will be hibernating / the animals will have migrated (1)	accept it is colder / wetter	(2)

Question number	Answer	Additional guidance	Mark
6(d)	A description including three from: - place a line (at 90°) from edge of forest (1) - place a quadrat against the line (1) {count / record} the {number of / height} of {species / plants} (in the quadrat) (1) - measure the light (intensity) (1) - move along the line / repeat at different distances (from the forest) (1)	accept types for species accept sample a shaded area and a sunny area	(3)

Total for question 6 = 11 marks

Question number	Answer	Mark
-----------------	--------	------

Question number	Answer	Additional guidance	Mark
10(a)	Any two from: - temperature (1) - humidity / water levels (1) {size / volume / size of holes / material} of bag (1)	accept the bags need to be identical	(2)

Question number	Answer	Additional guidance	Mark
10(b)(i)	correct data selected and subtracted $200 - 120 = 80$ (1) Rate calculated $80 \div 50 = 1.6$ (g per day)	accept correct answer on the answer line for 2 marks ecf accept 2.6 for 1 mark (oak)	(2)

Question number	Answer	Additional guidance	Mark
10(c)	An explanation linking: - decomposition of leaves release minerals / named minerals (1) - which are absorbed / used by other organisms / plants / primary producers (1) OR (if they weren't decomposed) leaves would build up covering small plants - small plants wouldn't {get light / be able to photosynthesise} (1)	accept nutrients for minerals accept recycling of minerals / nutrients for 2 marks accept small plants would die accept supplies energy to decomposers / named decomposers (1)	(2)

Question number	Answer	Additional guidance	Mark
10(d)	bacteria / fungi / detritivores	accept microorganisms / named {decomposers / detritivores}	(1)

Question number	Answer	Mark
10(e)	An explanation including two from: - the change in mass of snails is smaller than the change in mass of the leaves / {not all the mass / only 120 g} of the leaves is transferred to the snails (1) - some of the leaves were not {digested / absorbed} / some of the leaves were {excreted / egested} (1) - some mass was used up in {respiration / providing energy} for the snail (1) - some mass / energy was used up by the snail moving (1) - leaf mass may be digested by decomposers (1)	(2)

Total for question 10 = 11 marks

Question number	Answer	Mark
9(a)(i)	native (species) / (species) from the country of origin	(1)

Question number	Answer	Additional guidance	Mark
9(a)(ii)	quadrat / stated size of square area	accept {belt / line} transect / a grid	(1)

Question number	Answer	Mark
9(b)(i)	increases / goes up / rises	(1)

Question number	Answer	Additional guidance	Mark
9(b)(ii)	The only correct answer is B species C A is incorrect because Species A is decreasing so will not out-compete C is incorrect because species D has only increased by 2 so will not out-compete B D is incorrect because species H is not present so will not out-compete species B		(1)



Question number	Answer	Additional guidance	Mark
9(b)(iii)	An explanation linking: - taller / bigger / had larger leaves / had larger roots (1) (got more) water / minerals / nutrients / light / photosynthesis (1)	ORA accept grows / reproduces / takes up more space / higher population accept named minerals accept disease / eaten by animals (1)	(2)

Question number	Answer	Mark
9(b)(iv)	(seeds) blown in by the wind / (seeds) brought in by animals / {roots / shoots} growing under the wall	(1)

Question number	Indicative content	Mark
9(c)*	A02 / A03 Plan - use a quadrat / description of quadrat - place on ground - randomly - identify plants in quadrat - count the number of each of the types of plants found in each 'quadrat' Calculation - method of scaling up to size of field - calculate a mean (per quadrat / for each species) - multiply mean by area of field / number per m² by 1000 Details - size of quadrat - how to place quadrat randomly - when to count plant as present e.g. more than half in quadrat - repeats (places a quadrat more than once) - multiply by 4 to get number per square metre if a ½ m / ¼ m² quadrat used - don't put quadrat in an area already used	(6)



Level	Mark	Descriptor
	0	No awardable content
Level 1	1–2	- The plan attempts to link and apply knowledge and understanding of scientific enquiry, techniques and procedures, flawed or simplistic connections made between elements in the context of the question. (AO2) - Analyses the scientific information but understanding and connections are flawed. An incomplete plan that provides limited synthesis of understanding. (AO3)
Level 2	3–4	- The plan is mostly supported through linkage and application of knowledge and understanding of scientific enquiry, techniques and procedures, some logical connections made between elements in the context of the question. (AO2) - Analyses the scientific information and provides some logical connections between scientific enquiry, techniques and procedures. A partially completed plan that synthesises mostly relevant understanding, but not entirely coherently. (AO3)
Level 3	5–6	- The plan is supported throughout by linkage and application of knowledge and understanding of scientific enquiry, techniques and procedures, logical connections made between elements in the context of the question. (AO2) - Analyses the scientific information and provide logical connections between scientific concepts throughout. A well-developed plan that synthesises relevant understanding coherently. (AO3)



Level	Mark	Additional guidance	General additional guidance The level is driven by the plan. The mark within the level is determined by the calculation
	0	No rewardable material.	
Level 1	1–2	States a relevant part of a plan States relevant parts of a plan or one part of a plan with some detail	<u>Possible candidate responses</u> - Count the plants in the field / part of the field - Count the plants in the field / part of the field. Place a grid on the ground and count the plants inside.
Level 2	3–4	States aspects of a plan with some detail Includes how to calculate the number of each species in the field but omits detail	<u>Possible candidate responses</u> - Put a ½ metre square on the ground and count how many of each plant are in the square - Put a ½ metre square on the ground and count how many of each type of plant are in the square. Multiply the number of each plant by the size of the field.
Level 3	5–6	Produces a workable, detailed plan that includes placing quadrats randomly and counting the number of each species within the quadrat Calculates the number of (each species of) plant in the field e.g. multiplying the average number of each species in the quadrats / per m ² by the area of the field	<u>Possible candidate responses</u> - Place quadrats randomly 3 times (by using random coordinates). Count the plants of each species that are inside the quadrat. - Place quadrats randomly 3 times (by using random coordinates). Count the plants of each species that are inside the quadrat. Calculate the average for each species per quadrat /m². Multiply the averages per quadrat by 4 and then by the area of the field / by 1000.

Total for Question 9 = 13 marks