

OCR GCSE GATEWAY BIOLOGY A • J247

BIOLOGY



EXAM QUESTION PACK

B6.1 MONITORING AND MAINTAINING THE ENVIRONMENT

SCORE

/149

PERCENTAGE

%

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Gateway Biology A (9-1)

Monitoring and maintaining the environment

Please note that you may see slight differences between this paper and the original.

Candidates answer on the Question paper.

OCR supplied materials:

Additional resources may be supplied with this paper.

Other materials required:

- Pencil
- Ruler (cm/mm)

Duration: Not set

Candidate forename		Candidate surname								
Centre number						Candidate number				

INSTRUCTIONS TO CANDIDATES

- Write your name, centre number and candidate number in the boxes above. Please write clearly and in capital letters.
- Use black ink. HB pencil may be used for graphs and diagrams only.
- Answer **all** the questions, unless your teacher tells you otherwise.
- Read each question carefully. Make sure you know what you have to do before starting your answer.
- Where space is provided below the question, please write your answer there.
- You may use additional paper, or a specific Answer sheet if one is provided, but you must clearly show your candidate number, centre number and question number(s).

INFORMATION FOR CANDIDATES

- The quality of written communication is assessed in questions marked with either a pencil or an asterisk. In History and Geography a *Quality of extended response* question is marked with an asterisk, while a pencil is used for questions in which *Spelling, punctuation and grammar and the use of specialist terminology* is assessed.
- The number of marks is given in brackets [] at the end of each question or part question.
- The total number of marks for this paper is **149**.
- The total number of marks may take into account some 'either/or' question choices.

- 1 Many habitats are being destroyed.

Why is it important that we stop habitats from being destroyed?

- A to maintain biodiversity
- B to maintain homeostasis
- C to maintain active transport
- D to maintain differentiation

Your answer

[1]

- 2 The rock pocket mouse is a small grey coloured mouse that lives in Mexico.



These mice are the main food for owls.

Rattlesnakes also feed on these mice.

The mice get most of their food from grass plants.

Scientists want to construct a pyramid of biomass for this food web.

They first need to estimate how many organisms there are in the area.

They decide to do this using sampling.

- (i) Describe how the scientists would sample an area and ensure that the sample was not biased

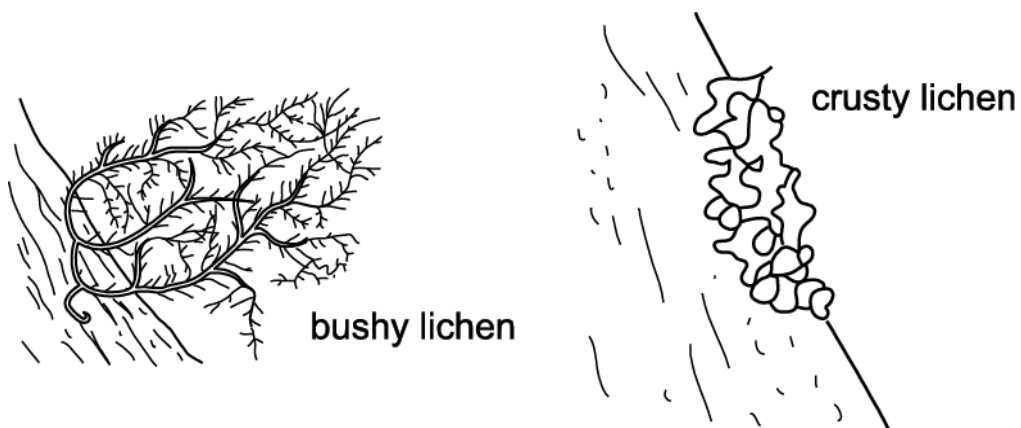
- (ii) * To estimate grass cover and the number of animals, they use a quadrat.

Why do scientists use sampling when studying the organisms living in a habitat?

Identify the limitations of this method and potential improvements that could be made to ensure that the estimated population size of plants and animals closely matches the actual value.

3(a) Lichens are sensitive to pollution because they take up chemicals from the air.

The diagram shows a 'bushy' species of lichen and a 'crusty' species of lichen.



Bushy lichens are usually more sensitive to pollution than crusty lichens.

Use the diagrams to suggest why.

----- [1]

(b) The students decide to use lichens to try and work out how polluted their school grounds are.

They read about a scale called the Lichen Diversity Value (LDV).

It is worked out in this way:

- choose four trees in the area
- hold a quadrat on the north side of the trunk of one tree
- count the total number of all the lichens in the quadrat
- then do this on the east, south and west side of the tree
- repeat this for each tree.

(i) Suggest how the students could choose four trees.

-----[1]

(ii) The students put their results into a table.

	Number of individual lichens found in each quadrat			
Tree number	North	East	South	West
1	3	11	18	7
2	4	12	17	8
3	5	10	15	12
4	4	15	12	9
mean	4.0	12.0	15.5	

The LDV is found by adding together the four mean values.

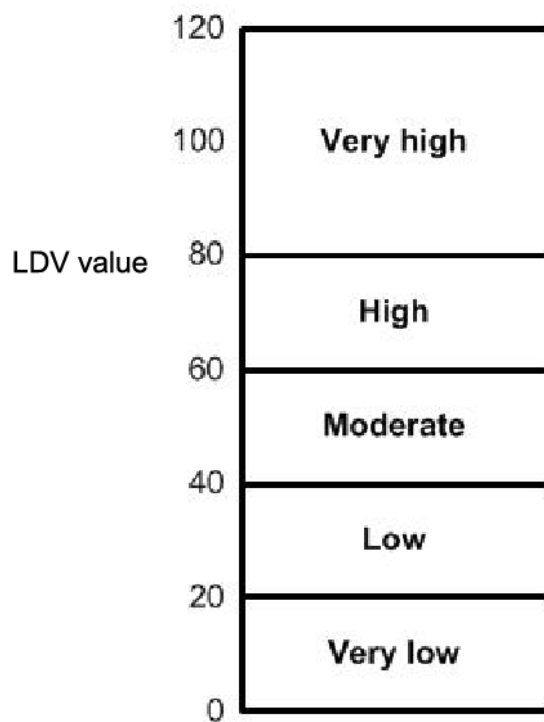
The students calculate the mean number of lichens on the north, east and south sides of the trees.

Calculate the mean for the west side and use this to calculate the LDV.

LDV = -----

[2]

(iii) This scale shows the type of diversity shown by the LDV.



What does the LDV show about the amount of diversity in the school grounds?

----- [2]

(iv) LDV is calculated by counting all the lichens present.

What else about the lichens could the students look for to make a better assessment of pollution?

----- [3]

4 Eva investigates the number of daisy plants growing on the school playing field.

She uses a quadrat to count the number of daisy plants growing in different areas of the field.

The table shows her results.

quadrat	number of daisy plants
1	8
2	2
3	7
4	5

Each quadrat has an area of 0.25 m^2 .

The school playing field has an area of 15000 m^2 .

Estimate the population of daisy plants growing on the school field.

- A 682
- B 82500
- C 330000
- D 1320000

Your answer

[1]

5 Palm oil is used in the manufacture of biscuits, crisps, cereals and many other processed foods.

Palm oil production has a negative effect on the environment.

Which statement identifies a **negative** effect of palm oil production?

- A Palm oil plantations are found in countries with tropical rainforest.
- B Palm oil production has increased due to the demand for more processed food.
- C Palm oil plantations support a low biodiversity.
- D Palm oil production provides jobs for the local community.

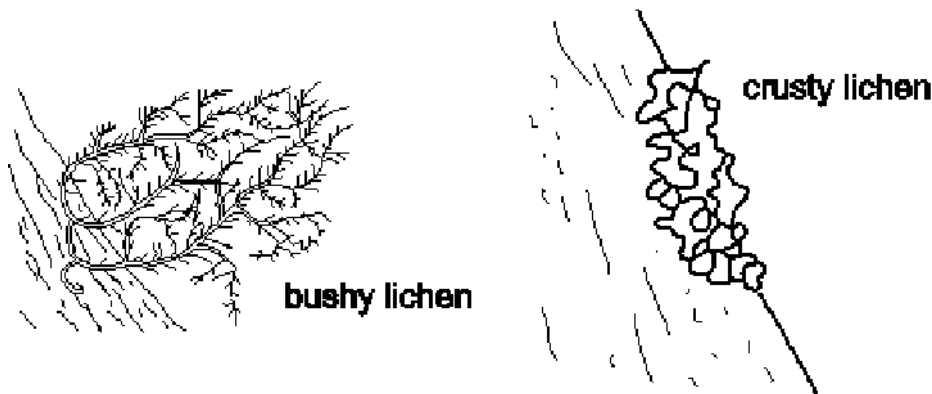
Your answer

[1]

6 Some students are investigating lichens.

Lichens are often studied because they are sensitive to pollution.

Lichens are sensitive to pollution because they take up chemicals from the air.



Students decide to use lichens to try and work out how polluted their school grounds are.

They read about a scale called the Lichen Diversity Value (LDV).

It is worked out in this way:

- choose four trees in the area
- hold a quadrat on the north side of the trunk of one tree
- count the total number of all the lichens in the quadrat
- then do this on the east, south and west side of the tree.
- repeat this for each tree.

(i) Suggest how the students could choose four trees.

[1]

(ii) The students put their results into a table.

	Number of individual lichens found in each quadrat			
Tree number	North	East	South	West
1	3	11	18	7

2	4	12	17	8
3	5	10	15	12
4	4	15	12	9
mean	4.0	12.0	15.5	

The LDV is found by adding together the four mean values.

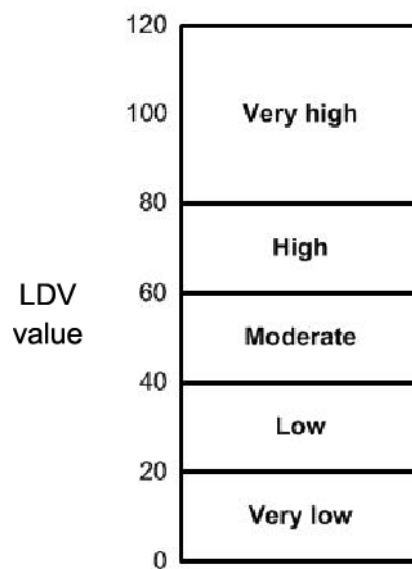
The students calculate the mean number of lichens on the north, east and south sides of the trees.

Calculate the mean for the west side and use this to calculate the LDV.

LDV = _____

[2]

(iii) This scale shows the diversity of the lichens shown by the LDV.



What does the LDV show about the diversity of lichens in the school grounds?

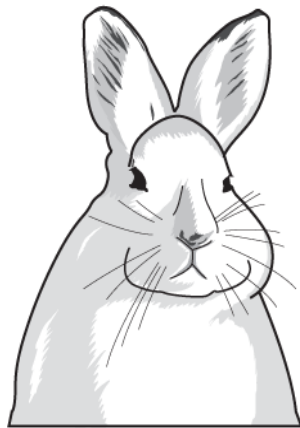
----- [2]

(iv) LDV is calculated by counting all the lichens present.

What else about the lichens could the students look for to make a better assessment of pollution?

7 Snowshoe hares live in parts of Canada.

They are preyed on by animals called lynx.



snowshoe hare



lynx

Where the lynx and hares live there is snow on the ground for long periods of time.

Scientists think that increasing levels of carbon dioxide pollution may make the weather in Canada warmer.

Warmer weather might affect the survival of snowshoe hares.

In 2015 the scientists collected data about the survival of the hares.

They also predicted how the hares will survive in the future if the weather gets warmer.

Their results are shown in the table.

Year	2015	2050	2080
percentage	9.3	8.2	7.0

10 Harry has been looking at the ladybirds on a bush in his garden.

He knows that there are three main types of ladybird living in the area.

The three main types of ladybird can have different numbers of spots on their body.

Type of ladybird	Number of spots on the body
harlequin	15–21
eyed	15
7 spotted	7

Harry is talking to two of his friends.

Harry

The mean (average) on the bush is 15 spots per ladybird so they must all be eyed ladybirds.

Tom

If that mean is correct then there could still be an equal spread of all three types of ladybird on the bush.

Sam

That mean shows that there could be some 7 spotted ladybirds on the bush but not many of them.

Which friend's answer is correct?

Explain your answer.

[2]

11(a) The photograph shows a great crested newt.



Great crested newts live in ponds.

Scientists monitor the population of newts in a pond over 5 years.

They do this by collecting a sample of newts swimming in the pond.

Which piece of apparatus would they use to collect the newts?

Put a **ring** around the correct answer.

net
pooter
quadrat
pit fall trap

[1]

(b) The scientists use the numbers of newts they collect to estimate the population.

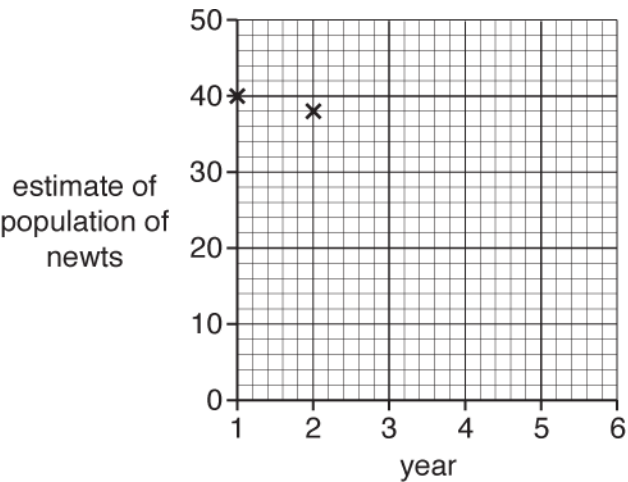
The table shows their estimates.

year	Estimate of population in pond
1	40
2	38
3	36
4	26
5	16

(i) Plot the estimates onto the graph.

The first two points have been done for you.

[1]



(ii) Use a line of best fit to predict a population estimate for year 6.

estimate = ... newts.

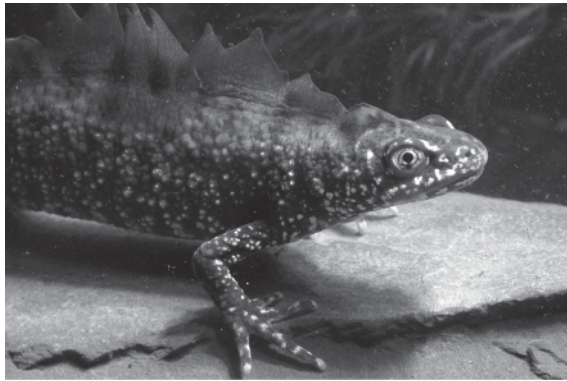
[1]

(iii) The scientists are concerned about the newt population.

Use the data to suggest why they might be concerned.

[2]

12(a) The picture shows a great crested newt.



Great crested newts live in ponds.

Scientists monitor the population of newts in one pond over 5 years.

They use the method of capture - recapture each spring to estimate the population.

The table shows their results.

Year	Number of newts captured and marked in 1st sample	Number of newts captured in 2nd sample	Number of newts in 2nd sample previously marked	Estimate of newt population
1	14	13	3	61
2	21	14	5	59
3	19	12	4	57
4	18	16	5	58
5	17	11	5	

Use this formula to calculate the population estimate for year 5.

Give your answer to the nearest whole number.

$$\text{population size} = \frac{\text{number in 1st sample} \times \text{number in 2nd sample}}{\text{number in 2nd sample previously marked}}$$

answer _____

[2]

(b)

(i) Write down **two** conclusions from the data.

1

2

----- [2]

(ii) Suggest **one** reason why these conclusions may not be valid.

----- [1]

13 Many water companies release treated sewage back into rivers in places called sewage outfall.



Most sewage outfalls are monitored for pollution by the environment agency.

In 1989 there were a number of outfalls not being monitored.

These outfalls were identified and named TDC outfalls.

Water companies have been told to reduce these TDC outfalls by allowing the environment agency to monitor them.

The table shows how the number of TDC outfalls has changed in some areas.

Water company progress in reducing TDCs		
	number of TDCs in 1989	number of TDCs in 2016
Anglian	328	328
Northumbrian	9	9
South West	62	46
Southern	29	29
Thames	1787	400
United Utilities	650	650
Wessex	152	84
Yorkshire	234	234

Why is it important to reduce the number of TDC outlets?

----- [2]

14 A scientist was studying a population of snails.

He caught 60 snails in the first sample. He marked them and released them.

He caught 50 snails in the second sample. 20 of the snails were marked.

Use this equation:
$$\text{estimated population} = \frac{\text{number caught in first sample} \times \text{number caught in second sample}}{\text{number in second sample that are marked}}$$

What is the estimated population?

- A 150
- B 2400
- C 3000
- D 60 000

Your answer

[1]

15 A scientist is estimating the number of rabbits in a field.

He has eight different estimates, 12, 12, 13, 15, 17, 19, 22 and 26.

Which is the median value for his estimates?

- A 8
- B 12
- C 16
- D 17

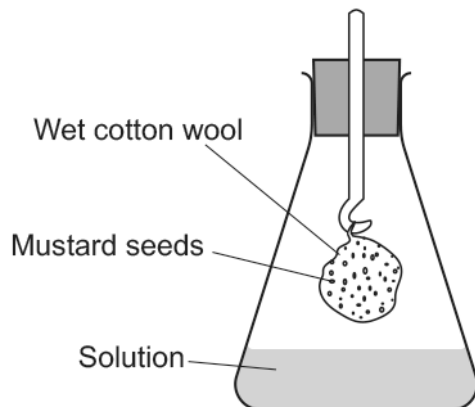
Your answer

[1]

16(a) A student investigates the effect of acid rain on seed growth.

- She soaks cotton wool in a solution with a pH value of 7.0.
- She puts 20 mustard seeds onto the cotton wool and places it inside a flask.
- She adds the same solution to the flask.
- She then repeats this four times using solutions with different pH values.

One of the flasks is shown in the diagram.



After 8 days she counts how many of the seeds are growing.

The table shows her results.

pH of solution	Number of the 20 seeds that are growing after 8 days
7.0	17
6.5	18
6.0	16
5.5	6
5.0	2

The student used 20 seeds in each flask.

Write down **one** other factor that the student should have kept the same in this investigation.

-----[1]

(b) Describe what this investigation shows about the effect of acid rain on seed growth.

----- [2]

(c) One way to compare the growth of seeds is to use a germination index (GI).

Use the formula:
$$GI = \frac{\text{mean root length} \times \text{number of seeds that are growing}}{\text{number of days}}$$

(i) For the seeds at pH 6.0, the mean root length was 5 mm.

Calculate the GI for these seeds.

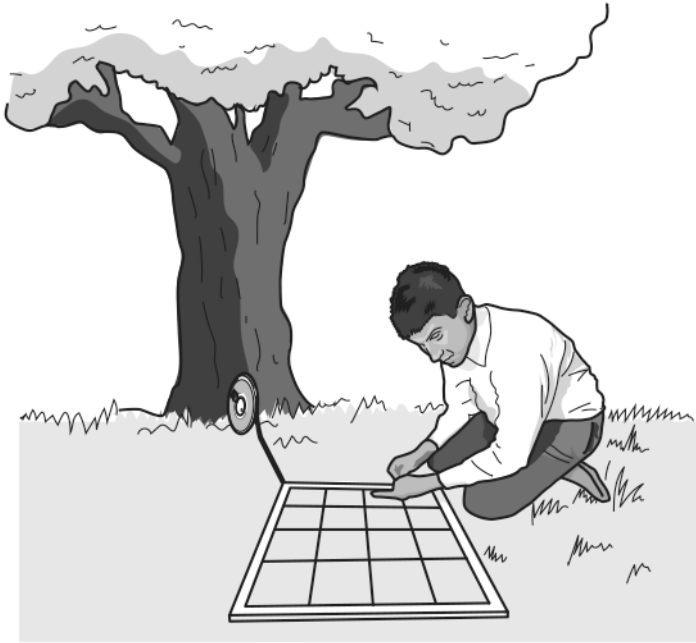
Answer = ----- [2]

(ii) Look at the equation for GI.

This is a better way of measuring the effect of acid rain on seed growth than just counting the number of seeds growing.

Explain why.

----- [1]



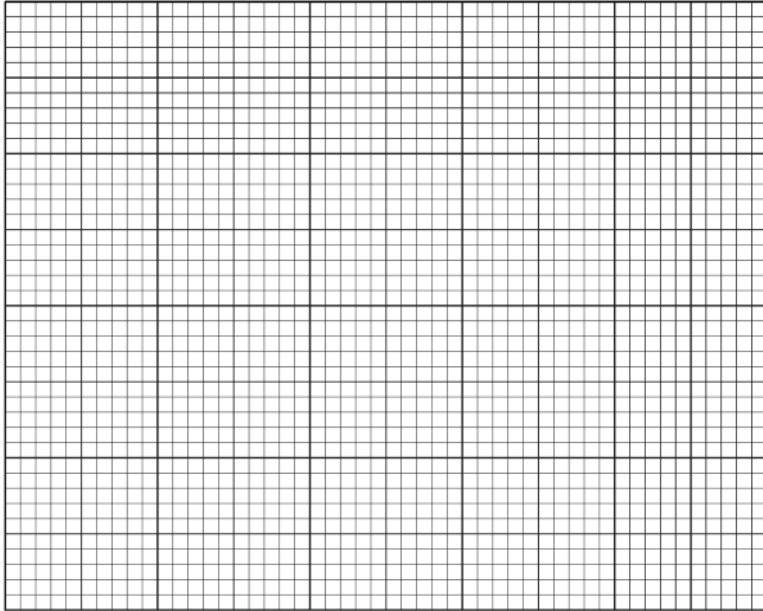
He lays out a tape measure on the ground, starting at the tree. He then places a quadrat on the ground.

He measures the percentage of the ground in the quadrat that is covered by plants. He repeats this every metre away from the tree.

The table shows his results.

Distance from the tree (m)	Percentage of ground covered by plants (%)
1	10
2	15
3	18
4	22
5	50
6	58
7	62
8	64

Plot a graph of the student's results and draw a line of best fit.



[5]

18 The table shows changes in the forest cover in some continents of the world.

Continent	Total forest cover (millions of hectares)		
	1990	2000	2005
Africa	699	656	635
Asia	574	567	572
Europe	989	998	1001
South America	891	853	832

What is the approximate percentage decrease in the area of South America covered by forest between 1990 and 2005?

- A 0.9%
- B 1.1%
- C 6.6%
- D 7.1%

Your answer

[1]

19 A scientist is estimating the number of rabbits in a field.

He has eight different estimates, 12, 12, 13, 15, 17, 19, 22 and 26.

Which is the median value for his estimates?

- A 8
- B 12
- C 16
- D 17

Your answer

[1]

20 A student investigates the plants growing underneath a tree.



He lays out a tape measure on the ground, starting at the tree. He then places a quadrat on the ground.

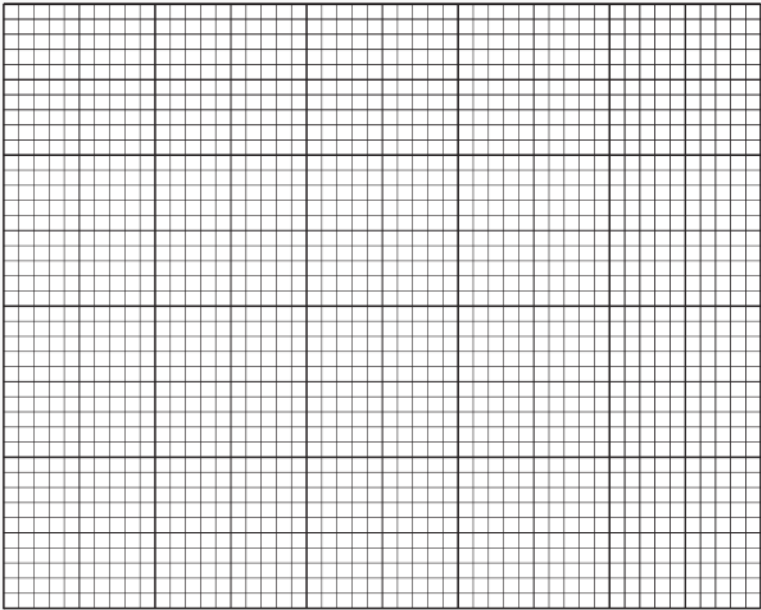
He measures the percentage of the ground in the quadrat that is covered by plants. He repeats this every metre away from the tree.

The table shows his results.

Distance from the tree (m)	Percentage of ground covered by plants (%)
1	10

2	15
3	18
4	22
5	50
6	58
7	62
8	64

Plot a graph of the student's results and draw a line of best fit.



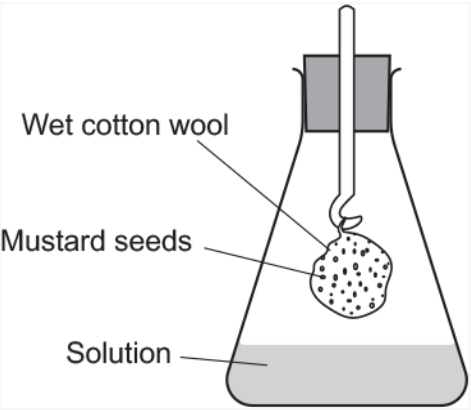
[5]

21(a) A student investigates the effect of acid rain on seed growth.

She dips some cotton wool in 20 cm³ of water. She then puts 20 mustard seeds onto the cotton wool and places it inside a flask. The student puts the remaining water into the flask with the cotton wool.

She repeats this four more times, each time using different solutions of water and dilute sulfuric acid.

One of the flasks is shown in the diagram.



After 8 days she counts how many of the seeds have germinated.

The table shows her results.

Volume of water in flask (cm ³)	Volume of dilute sulfuric acid in flask (cm ³)	Number of seeds that germinated
20	0	18
16	4	15
8	12	13
4	16	6
0	20	2

What is the dependent variable in this investigation?

-----[1]

(b) State why the student changed the volume of water in each flask.

-----[1]

- (c) The student kept each flask at the same temperature during the experiment to make it a fair test.
Explain **one** other reason why she kept each flask at the same temperature.

-----[1]

- (d) Explain what this experiment shows about the effect of acid rain on seed germination.

-----[2]

(e) The student used a formula to describe the germination of seeds called the viability index (VI).

- (i) For the seeds in 20 cm³ of sulfuric acid, the mean root length was 5 mm and the mean shoot length was 2 mm.

Calculate VI for these seeds.

Use the equation:

$$VI = \text{mean root length} \times \text{mean shoot length} \times \text{percentage of seeds that germinated}$$

Answer = ... [2]

- (ii) Using VI is a better way of comparing the effects of acid rain than just using the number of seeds germinated.

Explain why.

.....

.....

.....

..... [2]

- 22 A student estimates the number of snails in a pond. Part of his method involves collecting snails and marking them.

What is the name of the method he is using?

- A Aseptic technique
- B Capture-recapture
- C Percentage increase
- D Scaling-up

Your answer

[1]

23(a) A salt marsh is a large, muddy area of land where a river joins the sea.

Student A and student B study the plants growing on a salt marsh.

They both sample the plants present by laying out two tape measures at right angles across the salt marsh.

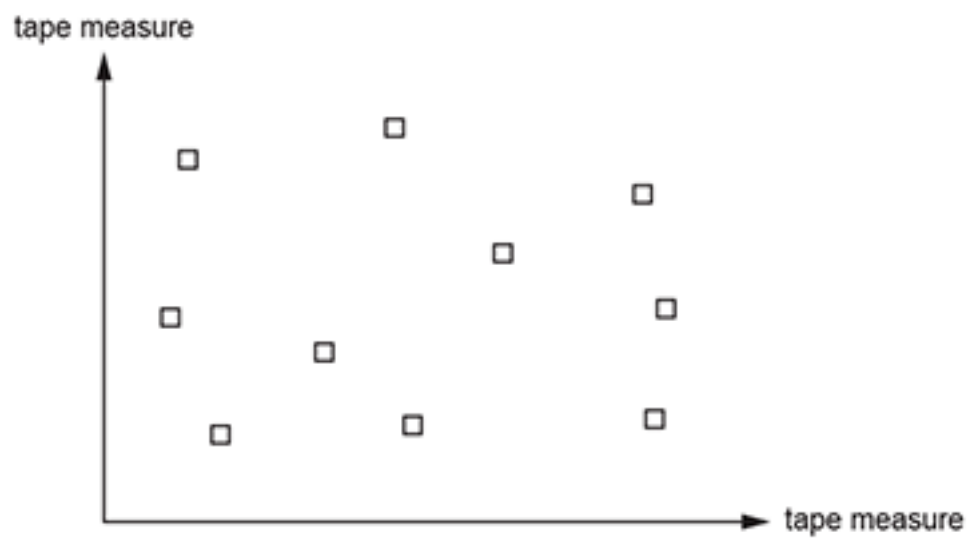
They then place a square frame on the ground in different places and count the number of plants in the square, as shown below.



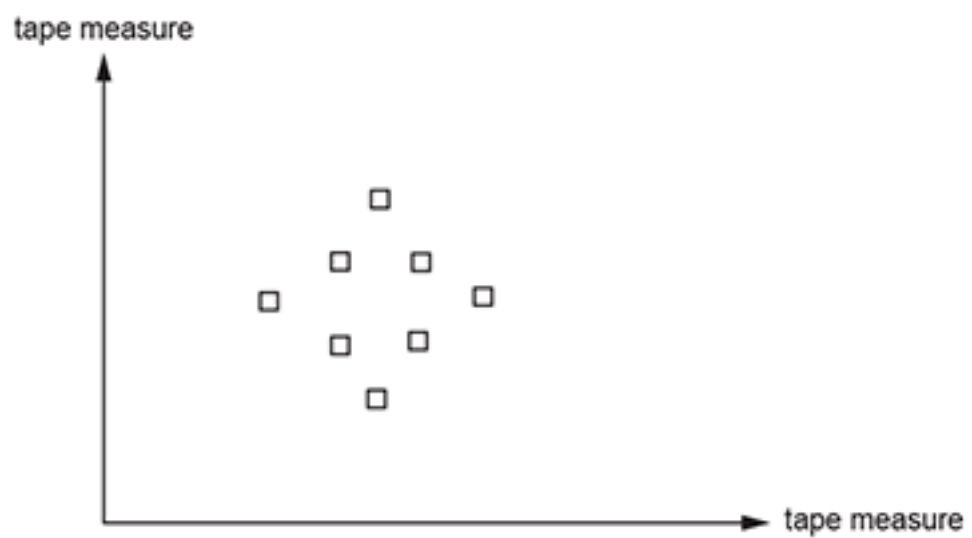
What is the name of the square frame that they use to sample the plants?

-----[1]

- (b) The diagrams show the position of each student's samples across the salt marsh.
Each small square in the diagrams represents one sample.



Student A's sampling



Student B's sampling

(i) The whole salt marsh has an area of 2500 m^2 .

Each square frame has an area of 0.25 m^2 .

Calculate the percentage of the whole salt marsh that was sampled by student A.

Percentage = ... % [3]

(ii) Look at the two students' sampling shown in the diagrams.

Explain which student is likely to get the most accurate estimate for the number of plants in the salt marsh.

student

explanation

.....

.....

.....

.....

[3]

(iii) Their teacher said that they should take care as there may be harmful bacteria in the salt marsh.

State **two** things that the students could do to reduce the risk of infection from the harmful bacteria.

1

.....

2

.....

[2]

- (c) * In some salt marshes large sand banks have been built. These stop tides from entering the salt marsh. The level of soil on the salt marsh builds up and the marsh turns into dry land.

Local farmers want to turn salt marshes into dry land and other people want to leave it as a salt marsh.

Explain why. Use ideas about land use and biodiversity in your answer.

[6]

- 24 Which of these is an example of ecotourism?

- A** Setting up monkey parks in the UK.
- B** Allowing people to sponsor endangered animals.
- C** Encouraging people to view animals in their natural environment.
- D** Educating children about the benefits of conservation.

Your answer

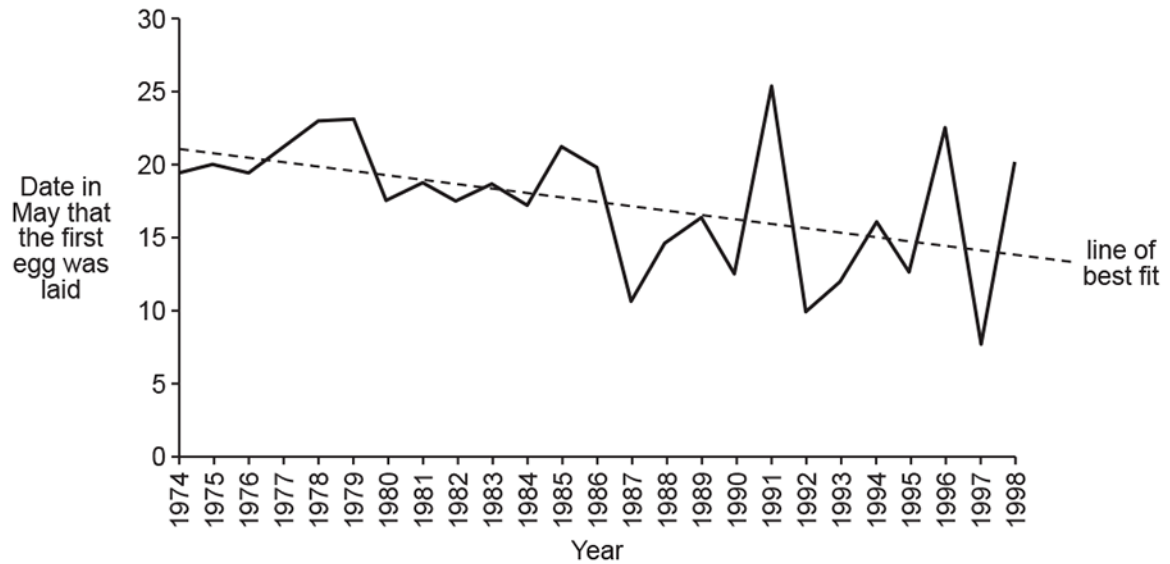
7

- 25 Blue tits are small birds seen in gardens.

Blue tits usually lay their eggs in the month of May.

For many years, the scientists have recorded the first day that an egg was laid.

This data is shown in the graph.



The scientists made this explanation for the results:

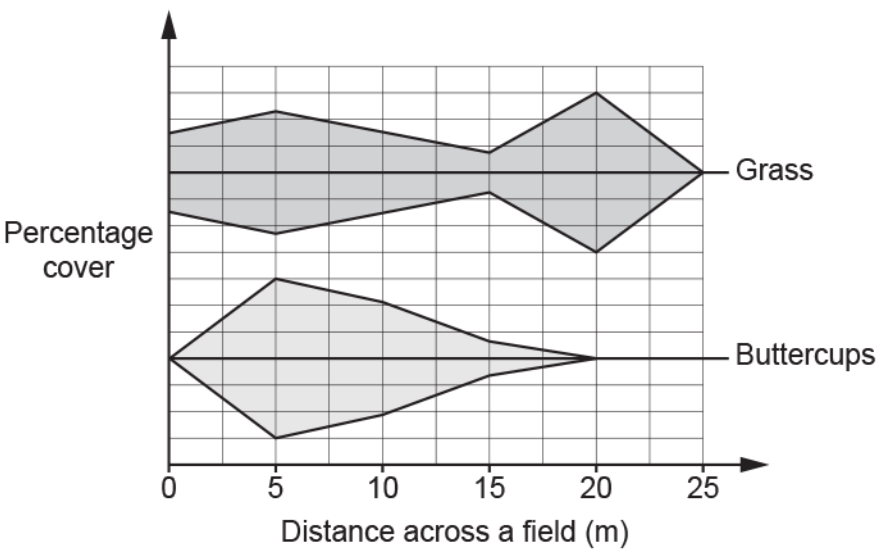
The results are due to climate change.

Suggest arguments **for** and **against** this possible explanation.

Use information from the graph in your answer.

[4]

26 A group of students collected some measurements from a field.
They plotted the measurements on this graph.



Which technique have the students used to collect the data?

- A Capture-recapture
- B Random quadrats
- C Scaling up
- D Transect line with quadrats

Your answer

[1]

27(a) Fig. 18.1 shows a drawing of a very small insect that feeds on the leaves of pine trees.



Fig. 18.1

Give the **name of the equipment** and **explain how** the scientists would use it to collect insects.

Name of equipment _____

How it is used _____

[3]

(b) Scientists can estimate the number of insects on a tree using capture-recapture.

First, they collect some insects from the tree.

Fig. 18.2 shows the equipment they use.

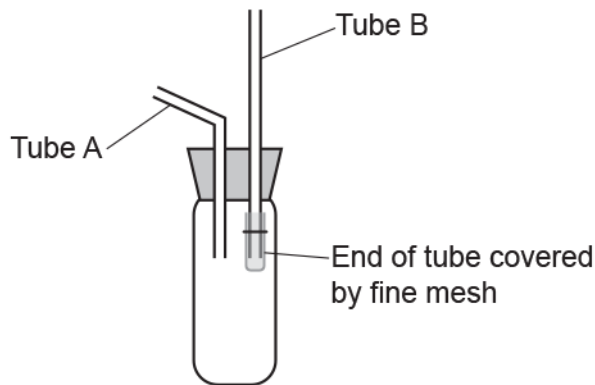


Fig. 18.2

They capture 25 insects from a tree and then mark them. This is their first sample.

They then release the insects and sample the tree again two days later. In this second sample there were 30 insects and 3 had been marked.

- (i) Estimate the population size of insects on the tree.

Use this formula:

$$\text{Estimated population size} = \frac{\text{Number in first sample} \times \text{Number in second sample}}{\text{Number in second sample previously marked}}$$

Estimated population size = ... [2]

- (ii) To mark each insect the scientists put a small spot of paint on the underside of the insect.

Explain why they marked the underside of the insects and not the top.

----- [2]

- (c) Scientists want to see if there is a link between the level of pollution in the air and the number of insects on trees.

They sample trees at different distances from a factory that was releasing sulfur dioxide.

Fig. 18.3 shows their results.

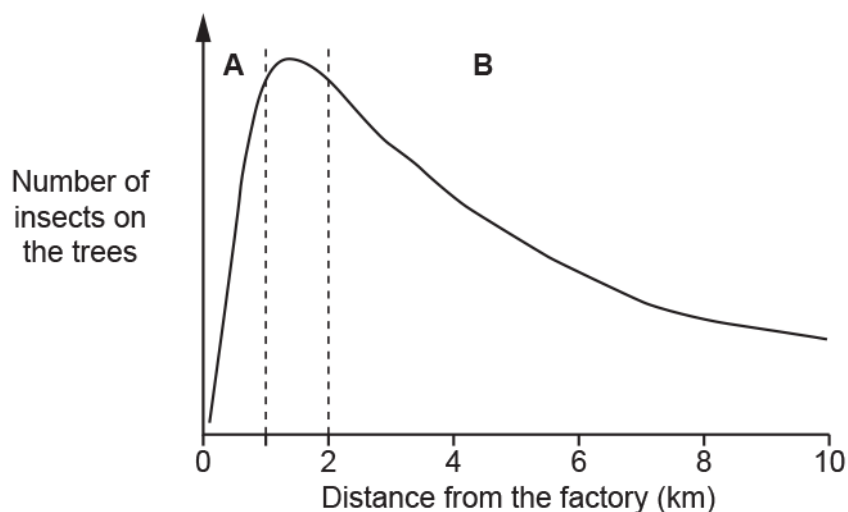


Fig. 18.3

- (i) The scientists found that sulfur dioxide can make the waxy cuticle of leaves thinner.

Suggest how this could explain the number of insects on the trees, further from the factory, in section B of the graph in Fig. 18.3.

[2]

- (ii) Look at section A of the graph in Fig. 18.3. Which is a possible explanation for the shape of the graph nearest the factory, in section A?

Tick (✓) one box.

Low concentrations of sulfur dioxide kill the insects.

☐

Low concentrations of sulfur dioxide make the insects reproduce faster.

☐

Very high concentrations of sulfur dioxide kill the insects.

☐

Very high concentrations of sulfur dioxide make the insects reproduce faster.

☐

[1]

28(a) Gardeners use dead plant material to make compost. They add this compost to soil where they are growing plants.

A new way of making compost is called bokashi. In this process the compost is made **anaerobically** in a different type of composter.

Scientists compare the normal methods of making compost with bokashi.

This is their method:

- Take one large pile of dead plant material
- Divide the material into two samples of equal mass
- Place one sample into the normal composter and place one sample into the bokashi composter
- Measure the temperature in each composter every 10 days
- After 40 days, measure the mass of the compost.

Why did the scientists put the same mass of compost in each composter?

Tick (✓) **one** box.

To allow valid comparisons of the results.

☐

To decrease the temperature.

☐

To make the measurements more accurate.

☐

To make the results repeatable.

☐

[1]

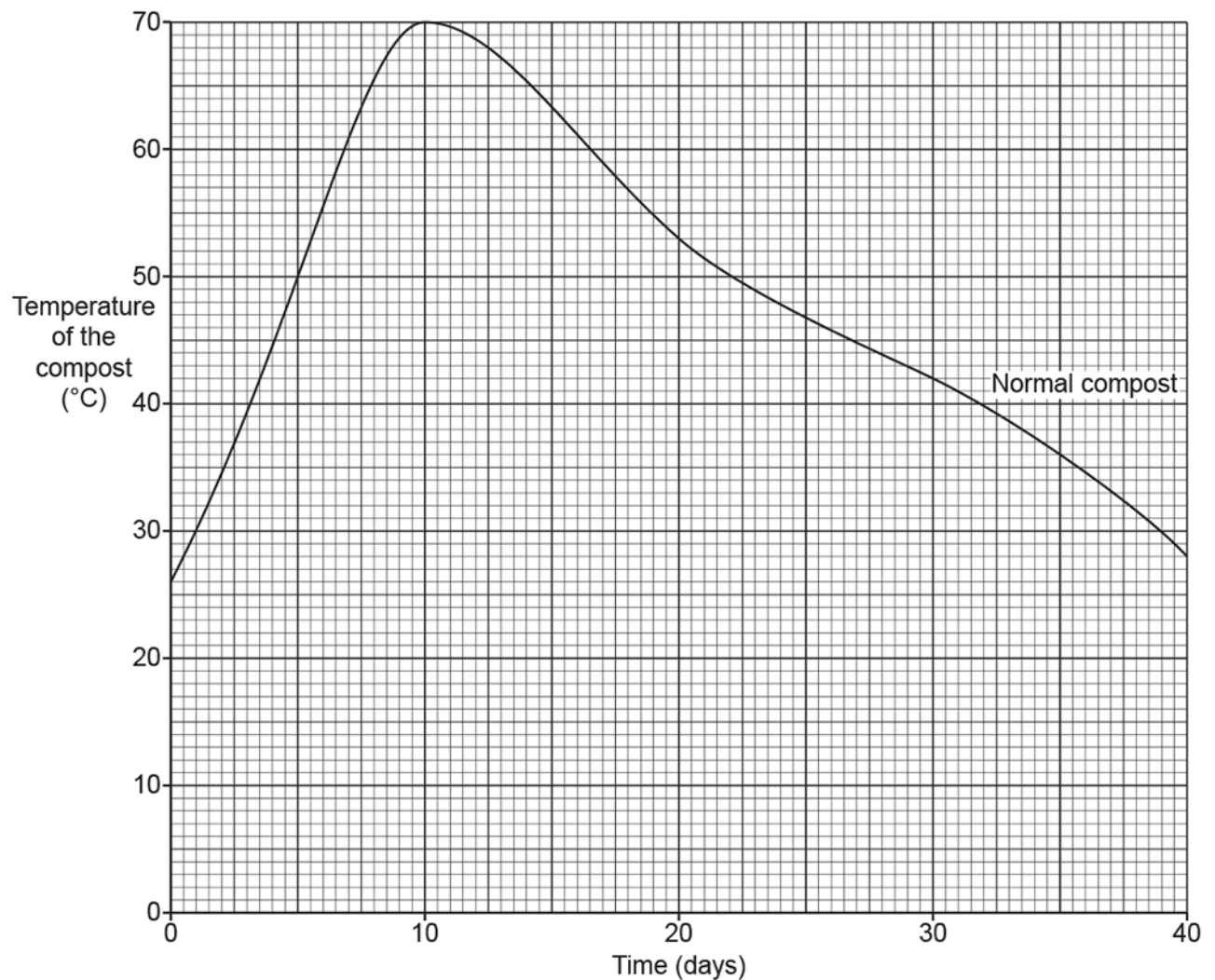
(b) **Table 20.1** shows the scientists' temperature measurements.

Time (days)	Temperature of the compost (°C)	
	Normal compost	Bokashi compost
0	26	26
10	70	27
20	53	29
30	42	31
40	28	28

Table 20.1

- (i) The scientists' results for the normal compost are plotted on the grid.

Complete the graph by plotting the results for the **bokashi** compost and draw a curve of best fit.



[3]

- (ii) Describe the change in the temperature of the **normal** compost during the investigation.

- (iii) Use data from **Table 20.1** to calculate the difference between the maximum temperature of the normal compost and the maximum temperature of the bokashi compost.

Difference = ... °C [2]

- (iv) Which **two** statements explain this difference in temperature between the two types of compost?

Tick (✓) **two** boxes.

Both types of compost are made by aerobic respiration.

☐

Normal compost is made by aerobic respiration.

☐

Normal compost is made by anaerobic respiration.

☐

Aerobic respiration and anaerobic respiration release the same amount of energy.

☐

Aerobic respiration releases more energy than anaerobic respiration.

☐

Aerobic respiration releases less energy than anaerobic respiration.

☐

(c) Table 20.2 shows the scientists' results for the mass of the compost.

	Normal compost	Bokashi compost
Mass at start (kg)	1500	1500
Mass after 40 days (kg)	760	1200

Table 20.2

(i) The mass of the normal compost has decreased by 19 kg per day.

Calculate the decrease in mass of the bokashi compost per day.

Give your answer to the nearest **whole** number.

Decrease = ...kg per day [3]

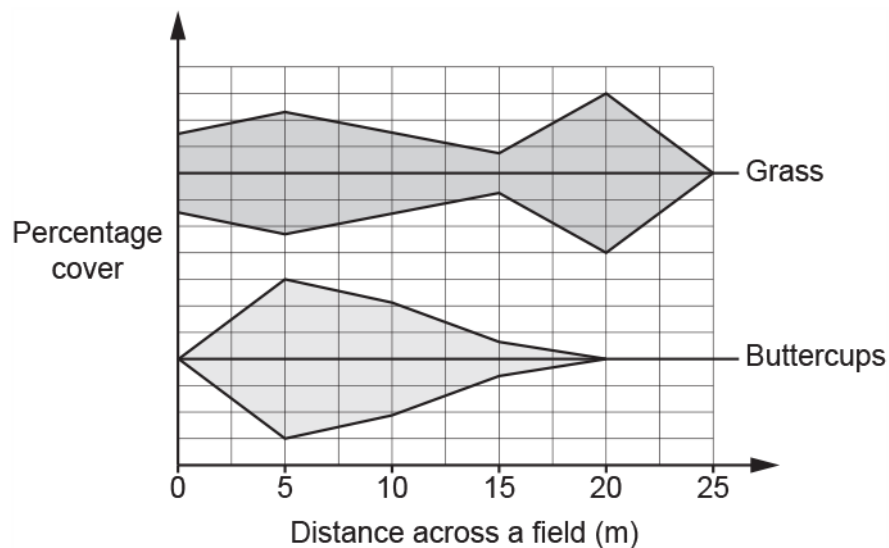
(ii) Carbon dioxide is given off in the making of the compost. This causes most of the decrease in mass.

Scientists think that the bokashi method of composting might be better for the environment.

Use your answer from part (i) to justify the scientists' conclusion.

-----[1]

- 29 A group of students collected some measurements from a field.
They plotted the measurements on this graph.



Which technique have the students used to collect the data?

- A Capture-recapture
- B Random quadrats
- C Scaling up
- D Transect line with quadrats

Your answer

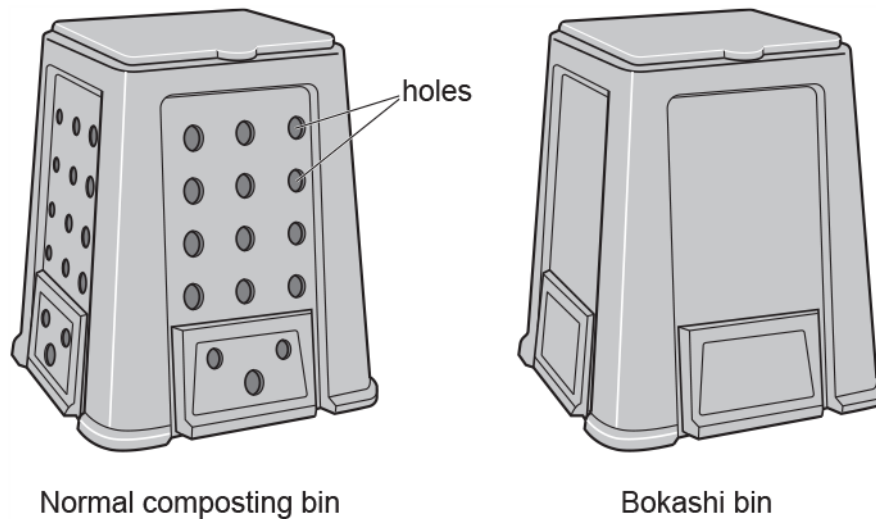
[1]

30(a) Gardeners often turn dead plant material from their garden into compost. They then add this compost to the soil where they are growing plants.

Compost can be made in a composting bin. In the bin **aerobic bacteria** turn dead plant material into compost.

Some people use a different way of making compost, called bokashi. In this process the compost is made **anaerobically**.

The drawings show a normal composting bin and a bokashi bin.



Explain the difference in the design of the two composting bins.

[2]

(b) Scientists investigate the two methods of making compost.

This is their method:

- Take one large pile of dead plant material
- Divide the material into two samples of equal mass
- Place one sample into the normal composter and place one sample into the bokashi composter
- Measure the temperature in each composter every 10 days
- After 40 days, measure the mass of the compost.

Write down **one** way that the scientists make sure that they can draw valid conclusions.

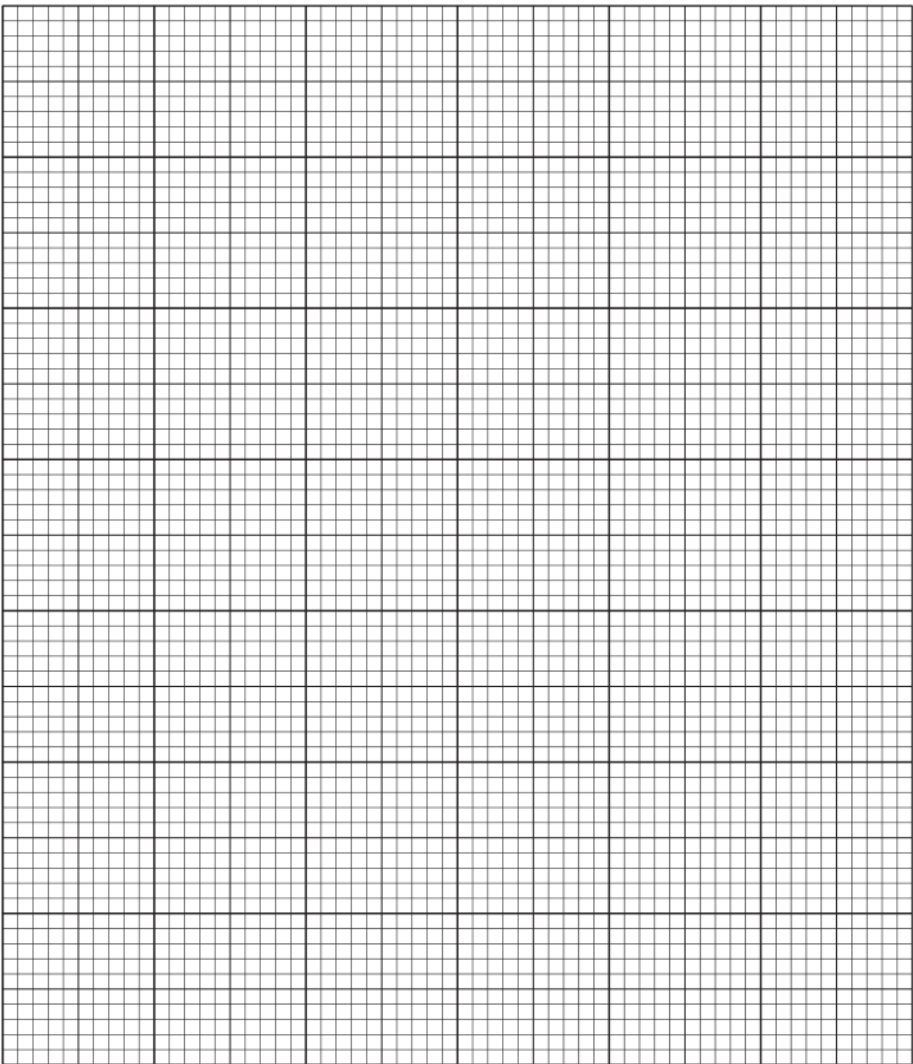
-----[1]

(c) Table 18.1 shows the scientists' temperature readings.

Time (days)	Temperature of the compost (°C)	
	normal compost	bokashi compost
0	26	26
10	70	27
20	53	29
30	42	31
40	28	28

Table 18.1

(i) Plot the scientists' results on the grid for normal and bokashi compost, and draw **two** curves of best fit.



[5]

(ii) Explain why the temperature of the compost in the **normal** bin changed as shown in the graph.

[2]

(iii) Explain the difference in the temperature changes between the aerobic normal compost and the anaerobic bokashi compost.

[2]

(d) **Table 18.2** shows the scientists' results for the mass of the compost.

	Normal compost	Bokashi compost
Mass at start (kg)	1500	1500
Mass after 40 days (kg)	750	1100

Table 18.2

A gas is given off in the formation of the compost. This causes most of the decrease in mass.

- (i) The percentage decrease in the mass of the normal compost is 50%.

Calculate the percentage decrease in the mass of the bokashi compost.

Give your answer to 2 significant figures.

Percentage decrease = ... % **[3]**

- (ii) The scientists concluded that the bokashi method of composting might be better for the environment.

Use your answer from part (i) to justify the scientists' conclusion.

[2]

END OF QUESTION PAPER

Mark Scheme

Question			Answer/Indicative content	Marks	Guidance
1			A	1	
			Total	1	
2		i	set out a grid / sample area (1)	1	
		i	use random sampling within that area (1)	1	
		ii	* Please refer to the marking instruction point 10 for guidance on how to mark this question. Level 3 (5–6 marks) Explains improved animal sampling techniques. <i>There is a well-developed line of reasoning which is clear and logically structured. The information presented is relevant and substantiated.</i> Level 2 (3–4 marks) Explains advantages of plants being sedentary along with the limitations of animal sampling using a quadrat. <i>There is a line of reasoning presented with some structure. The information presented is relevant and supported by some evidence.</i> Level 1 (1–2 marks) Provides a basic description of why sampling has to be used and use of or the limitations of the quadrat. <i>The information is basic and communicated in an unstructured way. The information is supported by limited evidence and the relationship to the evidence may not be clear.</i> 0 marks <i>No response or no response worthy of credit.</i>	6	AO3.3b: Analyse the information to develop the techniques to improve the sampling techniques • use of capture / recapture • use of pitfall traps • use of pooters • plants are sedentary so will not move and as such are easy to count • animals can move away / frightened away • risk of counting animal more than once • missing some animals e.g. burrowing and • further limitations of these methods AO1.2: Demonstrate knowledge of sampling techniques and why sampling is carried out • a basic description of use of capture / recapture pitfall traps and pooters • gives a basic description as to why sampling techniques are used • the habitat is often too large to count everything • saves time / would take too long otherwise
			Total	8	
3	a		larger surface area (to take up pollutants) (1)	1	allow sticks out more from bark

Mark Scheme

Question			Answer/Indicative content	Marks	Guidance
	b	i	use of random numbers (1)	1	
		ii	40.4 (2)	2	allow correct mean ie 9.0 (1)
		iii	moderate pollution (1)	1	allow ECF from (d) (ii)
		iii	only just above low / closer to low than high (1)	1	
		iv	identify the species of lichens present in their sample (1)	1	allow reference to bushy / crusty allow ora
		iv	find out how sensitive to pollution these lichens are (1)	1	
		iv	if the lichens are mostly pollution sensitive species = low pollution levels (1)	1	
			Total	9	
4			C	1	
			Total	1	
5			C	1	
			Total	1	
6		i	use of random numbers (1)	1	
		ii	40.4 (2)	2	allow correct mean i.e. 9.0
		iii	moderate diversity (1)	1	allow ECF from (d) (ii)
		iii	only just above low / closer to low than high (1)	1	
		iv	identify the species of lichens present in their sample (1)	1	allow reference to bushy / crusty allow ora
		iv	find out how sensitive to pollution these lichens are (1)	1	
		iv	if the lichens are mostly pollution sensitive species = low pollution levels (1)	1	
			Total	8	

Mark Scheme

Question			Answer/Indicative content	Marks	Guidance
7			[Level 3] Answer includes a correct description of the greenhouse effect and is able to link this to the decrease in population of hares. Quality of written communication does not impede communication of the science at this level. (5 – 6 marks) [Level 2] Answer includes a correct description of the greenhouse effect or explains why warmer weather results in less hares surviving. Quality of written communication partly impedes communication of the science at this level. (3 – 4 marks) [Level 1] Answer includes reference to the greenhouse effect or global warming or identifies that the predictions are for less hares to survive (1 – 2 marks) [Level 0] Insufficient or irrelevant science. Answer not worthy of credit. (0 marks)	6	This question is targeted up to grade C Indicative scientific points about the warmer weather may include: • The greenhouse effect • Carbon dioxide being a greenhouse gas • Trapping more heat in the Earth's atmosphere • Less radiated out to space Indicative scientific points about the prediction of the hares include: • Warmer weather means less snow • Hares will be less well camouflaged • More eaten by lynx • Increased risk of disease due to warmer conditions • Flooding of habitats due to sea level rising • Lack of food due to inability to grow in the new climate Use the L1, L2, L3 annotations in Scoris; do not use ticks.
			Total	6	

Mark Scheme

Question			Answer/Indicative content	Marks	Guidance
8			Sam (1) (mean is 16 but this means that) there could be some ladybirds with 7 spots (and some with 15 or more) (1)	2	answer must include figure
			Total	2	

Mark Scheme

Question			Answer/Indicative content	Marks	Guidance
9			[Level 3] idea of how carbon dioxide contributes to the greenhouse effect AND effect on snowshoe hares and their habitat AND linked to a reason for numbers dropping / extinction Quality of written communication does not impede communication of the science at this level. (5 – 6 marks) [Level 2] idea of how carbon dioxide contributes to the greenhouse effect AND effect on snowshoe hares and their habitat OR linked to a reason for numbers dropping / extinction Quality of written communication partly impedes communication of the science at this level. (3 – 4 marks) [Level 1] idea of how carbon dioxide contributes to the greenhouse effect OR effect on snowshoe hares and their habitat OR a reason for numbers dropping / extinction OR reference to the prediction by the scientists (1 – 2 marks) [Level 0] Insufficient or irrelevant science. Answer not worthy of credit. (0 marks)	6	This question is targeted up to grade C Indicative scientific points about carbon dioxide in the environment include: • the greenhouse effect • carbon dioxide being a greenhouse gas • trapping more heat in the Earth's atmosphere / less radiated out to space • global warming Indicative scientific points about the hares habitat include: • loss of habitat • not having as much camouflage • numbers may fall below critical level -reduced population Indicative scientific points about the hares extinction include: • this may result in -higher predation -lack of genetic variation -inability to find mates / lower reproduction rate Indicative scientific points about prediction by the scientists at Level 1 • predictions show that less hares will survive Use the L1, L2, L3 annotations in Scoris; do not use ticks.
			Total	6	

Mark Scheme

Question			Answer/Indicative content	Marks	Guidance
10			Sam is correct because: any two from: 7 spotted would decrease the mean (1) an even spread would decrease the mean (1) harlequins would increase the mean (1)	2	no mark for Sam Tom or Harry correct no marks
			Total	2	
11	a		net (1)	1	allow answer ringed, underlined or ticked more than one answer = 0
	b	i	all three points correctly plotted (1) (3,36) (4,26) (5,16)	1	
		ii	answer matching line drawn on graph (1)	1	no line = no mark allow + or – 1
		iii	numbers are falling (1) (so concerned) there will be none left / become extinct (1)	2	
			Total	5	

Mark Scheme

Question			Answer/Indicative content	Marks	Guidance
12	a		37 (2) But if incorrect $\frac{17 \times 11}{5} \quad \text{or} \quad \frac{187}{5}$ (1)	2	allow 37.4 (1)
	b	i	Any two from (overall) decrease in population (1) numbers remained steady for first 4 years / at start (1) population is starting to fall in year 5 or at end / idea that largest decrease is in year 5 or at end (1)	2	
		ii	Any one from: limited set of results (1) idea that there is only one set of data from each year (1) need to sample at different times of the year / population may vary over (a single) year (1) need monitor for more years to see if trend continues (1) idea that populations may change due to migration / immigration / less birth / more death / effects of marking (1)	1	allow small sample size(1)
			Total	5	
13			idea that it will increase monitoring of sewage / pollution idea that sewage / pollution can kill the animals and plants in the water / can spread disease (1)	2	allow to stop pollution / reduces pollution accept high level answer that sewage may cause eutrophication (1)
			Total	2	

Mark Scheme

Question			Answer/Indicative content	Marks	Guidance
14			A ✓	1 (AO2.2)	<u>Examiner's Comments</u> This question was the most accessible question in the multiple choice section A, with most candidates correctly answering A by correctly applying the equation.
			Total	1	
15			C ✓	1 (AO1.2)	
			Total	1	

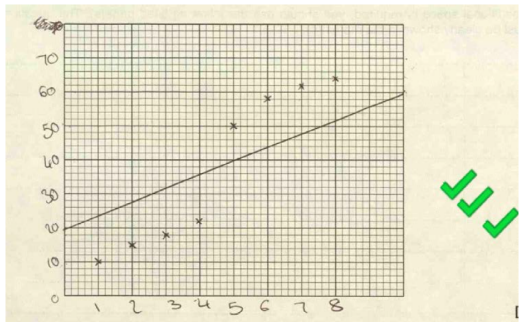
Mark Scheme

Question			Answer/Indicative content	Marks	Guidance
16	a		type of seeds / temperature ✓	1 (AO3.3b)	ALLOW light / volume/amount of solution / size of cotton wool / type of cotton wool / time soaked in solution IGNORE reference to time/ days DO NOT ALLOW pH <u>Examiner's Comments</u> This question differentiated well, the majority of higher ability candidates correctly gained marks here and lower ability candidates did not. Most correct answers referred to the amount of solution, and most incorrect answers referred to the number of seeds and days left.
	b		(acid rain) will lower the number of seeds growing ✓ only affects seeds if the pH is less than 6.0 ✓	2 (AO 2 × 3.2b)	IGNORE references to pH for this marking point IGNORE references to alkalinity IGNORE decrease pH decreases number of seeds growing <u>Examiner's Comments</u> This question challenged many of the candidates and the majority did not apply the experimental results to the effects of acid rain. Many referred to the effect of pH on seed growth. For the second marking point candidates didn't recognise it was only below pH 6 that affected seed growth, and only stated the general trend. An example of an answer that didn't receive any marks is seen in Exemplar 1. Exemplar 1 <i>As lower the pH levels the less the seeds will grow</i>

Mark Scheme

Question			Answer/Indicative content	Marks	Guidance
	c	i	If answer = 10 award 2 marks $\frac{5 \times 16}{8} \checkmark$ = 10 ✓	2 (AO 2 × 2.2)	Examiner's Comments This question differentiated well between higher and lower ability candidates. Most common error in the calculation was replacing the number of seeds that are growing with the total number of seeds used. This gave an incorrect answer of 12.5 instead of 10.
		ii	idea that it takes into account the mean root length / growth rate ✓	1 (AO 3.2b)	IGNORE grows well IGNORE more accurate result Examiner's Comments Most candidates gave general answers referring to accurate results and difficulty in counting / miscounting of the seeds. This is seen in Exemplar 2 which did not gain marks. Exemplar 2 this is because the counter can miss some seed growing and it will not be accurate [1]
			Total	6	

Mark Scheme

Question			Answer/Indicative content	Marks	Guidance
17			correctly chosen axes, labelled with units ✓ suitable scale on both axes ✓ all points correctly plotted ✓✓ line of best fit through most points ✓	5 (AO 5 × 2.2)	place ticks on right hand side of grid minimum 50% of grid used scale must be in ascending order ALLOW +/- half a square 0 to 5 correct points plotted = 0 mark 6 or 7 correct points plotted = 1 mark All 8 correct points plotted = 2 marks DO NOT ALLOW dot to dot line ALLOW line of best fit for their plotting IGNORE any extrapolation of line <u>Examiner's Comments</u> The majority of candidates scored 3 or 4 marks for the graph. Most common errors were choosing the wrong axis labelled with units. A number of candidates didn't give a suitable scale on both axes. Points plotted correctly on the graph were where candidates scored most marks. The construction of a line of best fit going through most points seemed very challenging or not attempted. Others just joined the points. Exemplar 11 shows a graph with no axes labelled with units; suitable scale on both axes; all points correctly plotted but no acceptable line of best fit. This graph achieved 3 marks out of a possible 5 marks. Exemplar 11 
			Total	5	

Mark Scheme

Question			Answer/Indicative content	Marks	Guidance
18			C ✓	1 (AO2.2)	
			Total	1	
19			C ✓	1 (AO1.2)	
			Total	1	
20			correctly chosen axes, labelled with units ✓ suitable scale on both axes ✓ all points correctly plotted ✓ ✓ line of best fit through most points ✓	5 (AO 5 × 2.2)	place ticks on right hand side of grid minimum 50% of grid used scale must be in ascending order ALLOW +/- half a square 0 to 5 correct points plotted = 0 mark 6 or 7 correct points plotted = 1 mark All 8 correct points plotted = 2 marks DO NOT ALLOW dot to dot line ALLOW line of best fit for their plotting IGNORE any extrapolation of line <u>Examiner's Comments</u> This question assessed candidates' ability to apply knowledge and understanding of scientific enquiry, techniques and procedures in graphing skills. Many candidates scored 4 marks and missed out on the mark for the line of best fit as they drew straight lines that did not go through or near any of the points. The mark scheme looked for the line through most of the points and this was best achieved by a curved line. There were a significant number of candidates who plotted the variables on the wrong axes. This did lose them a mark, but they were able to score the other marking points if all points were plotted accurately, to a suitable scale and a suitable line of best fit was drawn.
			Total	5	

Mark Scheme

Question			Answer/Indicative content	Marks	Guidance
21	a		number of seeds that germinated ✓	1 (AO 3.1a)	IGNORE the number of seeds
	b		to keep the total volume constant / to dilute the acid by different amounts ✓	1 (AO 3.1a)	ALLOW so volume adds up to 20cm³ ALLOW change/investigate the concentration of acid ALLOW make it more/less acidic / vary acidity <u>Examiner's Comments</u> In this AO3 question many candidates found difficulty in communicating that the same volume overall was needed, or to change the concentration of acid. Where candidates did gain marks, it was often for stating 'so volume adds up to 20cm³'.
	c		idea that germination is affected by temperature✓	1 (AO 3.1a)	ALLOW higher level answers such as references to rate of diffusion or enzyme action correctly linked to temperature change IGNORE to make it a fair test <u>Examiner's Comments</u> This AO3 interpretation question provided challenge for most candidates. Often responses were seen referencing prevention of evaporation, which did not gain marks. Few candidates correctly linked the temperature to its effect on germination rate. Some higher ability candidates did give correct references to enzyme action.

Mark Scheme

Question			Answer/Indicative content	Marks	Guidance
	d		Any two from: acid rain will reduce the number of seeds that germinate ✓ reference to addition of small volumes of acid having little effect / rapid drop in germination between third and fourth flask ✓ germination at the highest volume of acid is still possible / acid concentration would have to be higher to stop germination ✓	2 (AO 2 × 3.1b)	ALLOW ORA ALLOW indication of correct flasks from table data <u>Examiner's Comments</u> This question assessed AO3 evaluation. Most candidates correctly identified the effect of acid on germination, but none commented on the pattern in the data. On the very rare occasion that a second mark was obtained, it was for identifying that germination still did happen with highest concentration stating that 'the higher acid concentration reduces germination rate, but it doesn't stop it altogether' which got maximum marks.
	e	i	First check answer on answer line If answer = 100 award 2 marks correct calculation of 10% ✓ VI = 100 ✓	2 (AO 2 × 2.2)	<u>Examiner's Comments</u> This AO2 question assessed mathematical skills in a practical context. Many candidates did well and scored both marks. Some had an incorrect answer but scored the working out mark for getting 10%. Again, this emphasises the advantage of candidates ensuring that they show their working out in the space provided for them to put their response.

Mark Scheme

Question			Answer/Indicative content	Marks	Guidance
		ii	takes into account how well the seeds are growing ✓ also better to use percentage germination than number germinated ✓	2 (AO3.3b)	ALLOW shows seeds growing roots/shoots / shows seeds growing above/below soil <u>Examiner's Comments</u> This AO3 question linked to improving experimental procedures was looking for the idea that VI, by measuring length of roots/shoots, looked at growth not just germination. However, candidates simply repeated the question (just referencing about the length of shoot/roots) and used terms such as accurate, precise and reliable to try and cover the improvement aspect of the question. Very few were able to identify that percentage germinated was a better value to use than number of seeds germinated.
			Total	9	
22			B	1 (AO 1.2)	
			Total	1	

Mark Scheme

Question			Answer/Indicative content	Marks	Guidance
23	a		quadrat ✓	1 (AO 1.2)	Examiner's Comments The majority of higher ability candidates gained this mark. Those candidates that didn't score couldn't recall the piece of equipment as a quadrat. Common errors included square frame and Punnett square.
	b	i	FIRST CHECK ANSWER ON THE ANSWER LINE If answer = 0.1 (%) award 3 marks 10x0.25 or 2.5 (m²) ✓ 2.5 ?00 / 0.001 ✓ = 0.1 (%) ✓	3 (AO 2 x 2.2)(AO 1.2)	ALLOW correct conversion of the fraction of the area sampled into a percentage Examiner's Comments Just over half of candidates did not achieve any marks for this mathematical application question and lower ability candidates found having to work out the fraction of the field sampled then convert it into a percentage challenging. The candidates benefited if they showed their working out as there was an error carried forward mark for the correct percentage from an incorrect fraction.
		ii	(student A): has taken more samples/quadrats than B ✓ has sampled all over/spread out/ random over the marsh OR ✓ samples more likely to be representative / not bias / valid ✓	3 (AO 3.1a x2) (AO 3.2a)	If student B chosen = No marks IGNORE A = 10 and B = 8 samples IGNORE plants more spread out Examiner's Comments The majority of higher ability candidates achieved at least one mark here, with the most common credited mark that student A's sample was random. Very few candidates appreciated the sample would be more valid/representative, using the accepted language of measurement.

Mark Scheme

Question			Answer/Indicative content	Marks	Guidance
		iii	Any two from: wash hands (after sampling) ✓ not to eat / do not put hands to mouth (whilst sampling) ✓ protective clothing (whilst sampling) ✓ Cover cuts with plasters ✓	2 (AO 3.3b)	ALLOW sterilise equipment after use <u>Examiner's Comments</u> Half of candidates achieved one mark on this question. The most common credited response was protective clothing, which was given by candidates analysing the information and making suggestions to improve experimental procedures.
	c		Please refer to the marking instructions on page 4 of this mark scheme for guidance on how to mark this question. Level 3 (5–6 marks) Provides a detailed explanation for the uses for the land. AND Provides a detailed explanation how preserving the salt marsh will maintain biodiversity. <i>There is a well-developed line of reasoning which is clear and logically structured. The information presented is relevant and substantiated.</i> Level 2 (3–4 marks) Provides a detailed explanation for the uses for the land. OR Provides a detailed explanation how preserving the salt marsh will maintain biodiversity. OR Provides a basic explanation for the use for the land. AND Provides a basic explanation how preserving the salt marsh will maintain biodiversity. <i>There is a line of reasoning presented with some structure. The information presented is relevant and supported by some evidence.</i> Level 1 (1–2 marks)	6 (AO 1.1 x2) (AO 2.1 x4)	AO1.1 Demonstrates knowledge and understanding of land use and the need to maintain biodiversity - land may be used for growing crops/biofuels/ grazing animals/renewable energy - protecting the salt marsh will maintain biodiversity/ecosystem/number of species/habitats/food chains ORA AO2.2a Applies knowledge and understanding of land use and the need to maintain biodiversity - increases in population mean that land is needed to supply more food / biofuel/renewable energy - farmers will gain more money from more food production - increased demand for renewable energy resources to reduce climate change - the salt marshes are rare habitats/species - avoid species becoming extinct/endangered ORA - maintaining biodiversity can provide medicines ORA - pollinators are crucial in maintaining biodiversity ORA <u>Examiner's Comments</u> This is the Level of Response question on this paper which required the candidates to

Mark Scheme

Question			Answer/Indicative content	Marks	Guidance
			Provides a basic explanation for the use for the land. OR Provides a basic explanation how preserving the salt marsh will maintain biodiversity. <i>There is an attempt at a logical structure with a line of reasoning. The information is in the most part relevant.</i> 0 marks No response or no response worthy of credit.		demonstrate and apply their knowledge and understanding of land use and biodiversity to salt marshes. This differentiated well between lower and higher ability candidates, whereby there was a spread of marks across the levels given. The majority of higher ability candidate achieved a Level 2. Exemplar 2 shows a Level 2 response, which does not provide a detailed explanation for land use or preserving the salt marsh. Exemplar 2 Explain why. Use ideas about land use and biodiversity in your answer. Local farmers would want to turn the salt marshes into dry land so that it is a sustained environment. Farmers want this as it means plants / crops are more likely to grow under an environment which is constantly the same. However other people would want to leave it how it is as ~~some~~ due to it being a habitat for some species such as small fish and people don't want to take this away from them.
			Total	15	
24			C	1 (AO 1.1)	
			Total	1	

Mark Scheme

Question			Answer/Indicative content	Marks	Guidance
25			shows that over the years the birds are laying eggs earlier (in May) ✓ this could be because temperatures are increasing (year on year) ✓ however, the data shows a lot of variation ✓ there could be other factors involved ✓	4 (AO 3.1a) (AO 3.2b) (AO 3.1a) (AO 3.2b)	ALLOW shows downward trend ALLOW because Earth is getting warmer ALLOW examples of variation in data from the graph ALLOW data shows lots of fluctuations / erratic data / spikes in the data ALLOW examples of factors such as predator/prey relationship may be different <u>Examiner's Comments</u> In this AO3 question, most higher ability candidates scored well. Most candidates were able to appreciate and describe the fluctuations. Some lower ability candidates wrote about climate change without mentioning an increase in temperature, for example, 'due to climate change eggs were laid earlier'. Some referred to the number of eggs laid rather than the timing, and many that didn't lost track that eggs were laid earlier. Some candidates thought climate change might not be the cause but then didn't suggest that another factor could be involved.
			Total	4	
26			D ✓	1 (AO1.2)	
			Total	1	

Mark Scheme

Question			Answer/Indicative content	Marks	Guidance
27	a		pooter ✓ Any two from: place tube A next to/over moth/insect ✓ student sucks ✓ on tube B ✓	3 (AO3 x 1.2)	ALLOW student sucks the moth/insect into tube A = 2 marks ALLOW tube with end covered by fine mesh
	b	i	FIRST CHECK THE ANSWER ON ANSWER LINE If answer = 250 award 2 marks $25 \times 30 / 3$ OR $750 / 3$ ✓ = 250 ✓	2 (AO2 x 2.2)	
		ii	Idea of less visible ORA ✓ otherwise they are more likely to be eaten ORA ✓	2 (AO2 x 2.2)	ALLOW spot not visible to predators = 2 marks ALLOW small spot is less likely to be toxic / poisonous If no other mark scored, credit less likely to be washed off
	c	i	(further from the factory) there is less sulfur dioxide and so thicker cuticle/leaves ORA✓ insects find it harder to feed on the thicker leaves/cuticle ORA✓ the numbers are lower with thicker leaves/cuticle ORA✓	2 (AO2 x 3.1b)	IGNORE any reference to section A If no other mark scored, credit thicker leaves/cuticle further from the factory ORA
		ii	very high concentrations of sulfur dioxide kill the insects✓	1 (AO3.2b)	
			Total	10	

Mark Scheme

Question			Answer/Indicative content	Marks	Guidance
28	a		to allow a valid comparison of the results✓	1 (AO3.1b)	
	b	i	correct plots ✓✓ smooth curved line between points ✓	3 (AO3 x 2.2)	ALLOW +/- half a square All correct = 2 marks 3 or 4 plots correct = 1 mark DO NOT ALLOW sketchy line / line thicker than half a square
		ii	increases up to 10 days/70°C ✓ then decreases ✓	2 (AO3.1a)	ALLOW increases up to 9-11 days ALLOW increases by 44°C
		iii	FIRST CHECK THE ANSWER ON ANSWER LINE If answer = 39 (°C) award 2 marks 70-31 ✓ = 39 (°C)✓	2 (AO2.2) (AO1.2)	
		iv	normal compost is made by aerobic respiration✓ aerobic respiration releases more energy than anaerobic respiration✓	2 (AO2 x 2.1)	2 correct ticks = 2 marks 1 correct ticks = 1 mark 3 ticks two correct = 1 mark 3 ticks one correct = 0 marks 4 or more ticks = 0 marks
	c	i	FIRST CHECK THE ANSWER ON ANSWER LINE If answer = 8 (kg) award 3 marks 1500-1200 OR 300 ✓ 300/40 OR 7.5 ✓ = 8 (kg) ✓	3 (AO3 x 2.2)	 ALLOW one mark for clear evidence of rounding incorrect answer correctly to the nearest whole number
		ii	less carbon dioxide is produced ✓	1 (AO3.1b)	ALLOW less contribution to global warming / greenhouse effect / climate change
			Total	14	
29			D ✓	1 (AO2.2)	
			Total	1	

Mark Scheme

Question			Answer/Indicative content	Marks	Guidance
30	a		normal bin has holes to allow in air / oxygen ✓ (making normal compost) so aerobic respiration occurs ✓	2 (AO2.1) (AO1.1)	ALLOW converse arguments for bokashi bin ALLOW aerobic bacteria carry out respiration IGNORE bacteria work aerobically
	b		used the same pile of dead plant material for both composters / used same plant type / used equal mass in both composters ✓	1 (AO2.2)	ALLOW used the same time interval for both composters ALLOW used the same water/moisture content for both composters ALLOW idea of same external conditions e.g. put both in same place / external temperature kept the same / kept in the same environment IGNORE references to fair testing
	c	i	Axes – both correctly labelled, including units ✓ Axes - even scales occupying more than half of the grid ✓ Plotting - all points correctly plotted ✓ Line - lines labelled or a key ✓ Line - points with curve of best-fit lines ✓	5 (AO5 x 2.2)	Must have time on x-axis and temperature on y-axis ALLOW +/- half a square at least 8 points correctly plotted IGNORE extrapolated lines
		ii	temperature increased as compost decomposed / bacteria released heat by respiration ✓ temperature starts to drop as decomposition slows down/complete / bacterial respiration slows ✓	2 (AO2 x 2.1)	ALLOW rise in temperature due to energy released by respiration ✓ ALLOW bacterial activity slows (if respiration already mentioned) ALLOW temperature starts to drop as enzymes in respiration denature at high temperatures
		iii	idea that decomposition in bokashi (method) bin much slower ✓ anaerobic respiration releases less heat/energy than aerobic respiration ✓	2 (AO2 x 2.1)	Enter text here.

Mark Scheme

Question			Answer/Indicative content	Marks	Guidance
	d	i	FIRST CHECK THE ANSWER ON ANSWER LINE If answer = 27 (%) award 3 marks 400 / 1500 x 100 ✓ 26.6 (%) ✓ = 27 (%) ✓	3 (AO2.2) (AO2.2) (AO1.2)	If answer = 26.6 (%) award 2 marks ALLOW ECF for correct rounding
		ii	idea that the gas given off is carbon dioxide ✓ less greenhouse gas produced / less likely to result in global warming / less contribution to greenhouse effect ✓	2 (AO2.2) (AO3.1b)	ALLOW for 2 marks less carbon dioxide produced which is a greenhouse gas ALLOW correct formula ALLOW explanations of the greenhouse effect IGNORE references to environmental damage/not environmentally friendly/pollution/not good for the environment
			Total	17	