

Questions

Q1.

Answer the question with a cross in the box you think is correct . If you change your mind about an answer, put a line through the box and then mark your new answer with a cross .

Figure 1 shows the sources of pollution and different levels of water pollution in a river.

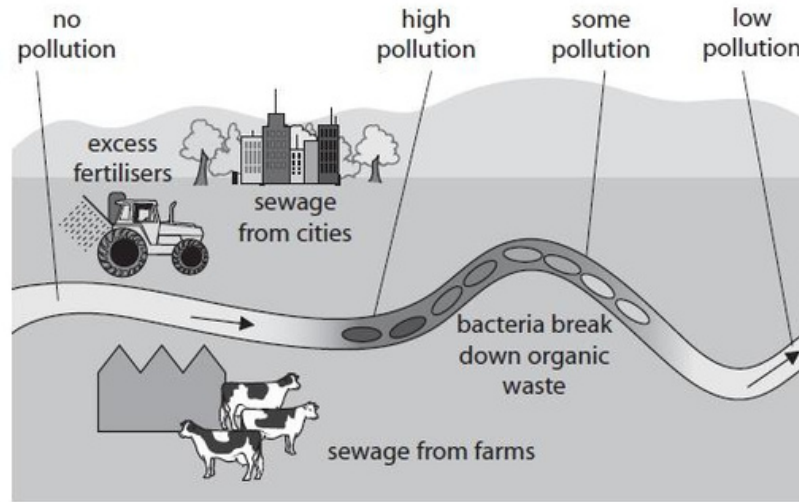


Figure 1

(i) Which part of the river will have the largest number of bloodworms?

(1)

- A no pollution
- B high pollution
- C some pollution
- D low pollution

(ii) Give the names of the two indicator species from the box which provide evidence for clean water.

blackspot fungus	lichen
freshwater shrimp	sludgeworm
	stonefly

(2)

- 1
- 2

(Total for question = 3 marks)

Q2.

Figure 7 shows fungus growing on strawberries.

The fungus is decomposing the strawberries.



© Catherine Eckert/Shutterstock

Figure 7

A scientist investigated the effect of temperature on the decomposition of strawberries.

The scientist spread fresh strawberries on six trays.

Each tray was kept at a different temperature.

After five days the scientist measured the area of fungus that had grown on each tray of strawberries.

The results are shown in Figure 8.

temperature in °C	area of fungus after 5 days in cm ²
5	8
10	25
15	36
20	48
25	60
30	72

Figure 8

(i) The mean rate of growth of fungus at 25°C was 12 cm² per day.

Calculate the mean rate of growth of fungus at 30°C.

(2)

..... cm² per day

(ii) State the effect of temperature on the growth of fungus on strawberries from 5°C to 30°C.

(1)

.....

.....

(Total for question = 3 marks)

Q3.

Figure 12 shows the global movement of carbon into or out of the atmosphere.

process	movement of carbon into or out of the atmosphere in gigatonnes per year
photosynthesis	120.1
respiration	119.6
ocean uptake	92.8
ocean loss	90.0
combustion of fossil fuels	6.4

Figure 12

Calculate the net mass of carbon added to the atmosphere each year.

(2)

..... gigatonnes

(Total for question = 2 marks)

Q4.

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.

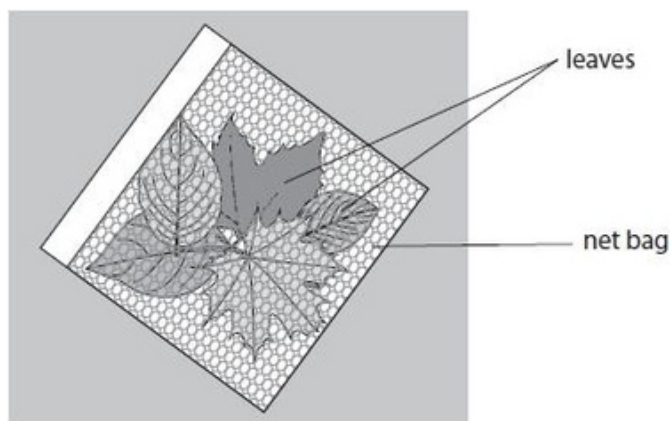


Figure 5

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

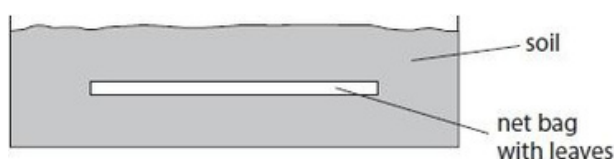


Figure 6

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

Edexcel Biology GCSE - Cycles within Ecosystems

- (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)

.....
.....
.....
.....

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

(2)

1

.....

2

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(Total for question = 6 marks)

Q5.

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.

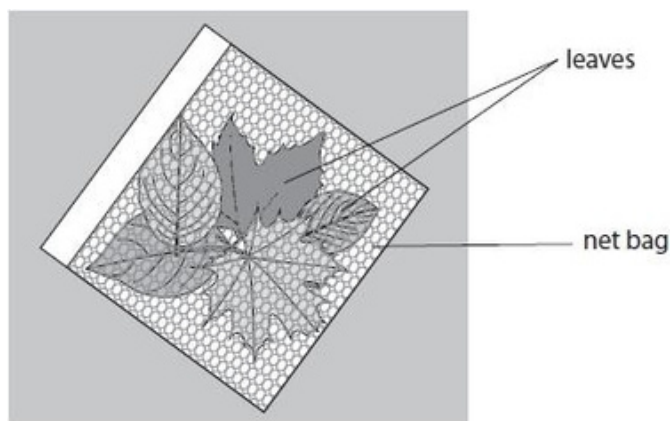


Figure 5

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

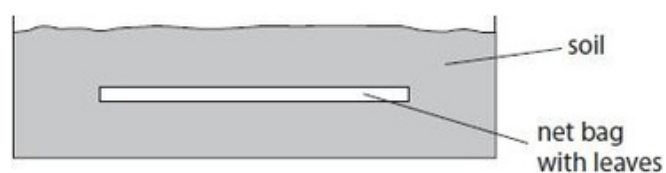


Figure 6

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

- 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)

(Total for question = 1 mark)

Q6.

Water from rivers is treated before it is safe to drink.

Use words from the box to complete the sentences.

(2)

filtering	fish	heating
mud	pathogens	stirring

During water treatment, the solids in river water are removed by

.....

Chlorine is then added to the water to kill

(Total for question = 2 marks)

Q7.

Figure 2 shows the Canary Islands.

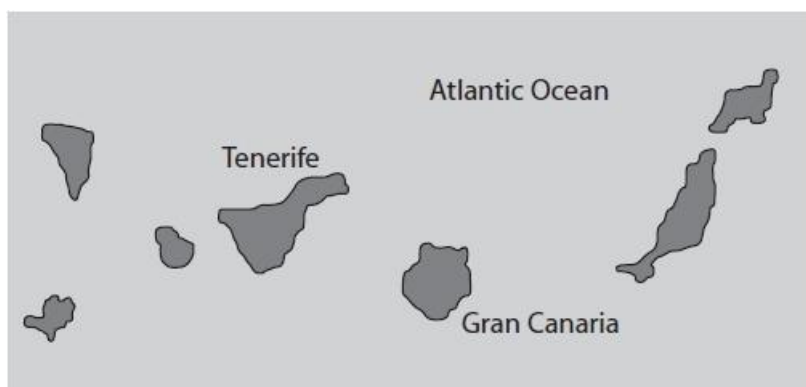


Figure 2

The Canary Islands do not have enough fresh water.

Describe how seawater can be turned into drinking water.

(2)

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(Total for question = 2 marks)

Q8.

Nitrogen is cycled through the environment.

Describe the roles of bacteria in the nitrogen cycle.

(4)

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(Total for question = 4 marks)

Q9.

(i) Strawberries can be preserved by freezing them.
State how freezing helps to preserve strawberries.

(1)

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.....

When the strawberries are frozen they become soft.

(ii) Describe the features of a plant cell that help to maintain its structure.

(2)

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.....
.....
.....

Figure 17 shows a photomicrograph of a root cell.

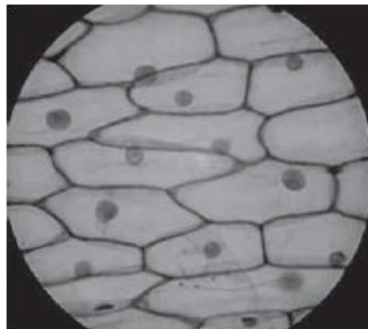


Figure 17

(iii) Draw and label a single plant cell from this photomicrograph.

(3)

A large empty rectangular box with a black border, intended for drawing and labeling a single plant cell based on the photomicrograph in Figure 17.

(Total for question = 6 marks)

Q10.

(a) A group of students investigated the level of pollution in two different streams, A and B.

Figure 14 shows the student's results.

indicator species	total number in	
	stream A	stream B
Mayfly nymph	4	0
Caddis fly larva	29	0
Stonefly larvae	74	1
Water louse	34	4
Bloodworm	10	45
Sludge worm	2	100

Figure 14

Mayfly nymphs, caddis fly larvae and stonefly larvae are indicators of clean water.

(i) Calculate the percentage of organisms in stream A that are clean water indicators. Give your answer to two significant figures.

(2)

.....

(ii) Use the results to explain which stream is more polluted.

(2)

.....

The students investigated a third stream, which is very slow flowing and runs through an area where intensive farming methods are used.

Figure 15 shows the thick layer of algae formed on top of this stream.



Figure 15

(b) Explain the effect of this algal growth on the organisms in the stream.

(4)

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(Total for question = 8 marks)

Q11.

Answer the question with a cross in the box you think is correct . If you change your mind about an answer, put a line through the box and then mark your new answer with a cross .

A group of pupils investigated the effect of temperature on mould growth on bread. Figure 8 shows the bread after being kept at different temperatures for seven days.

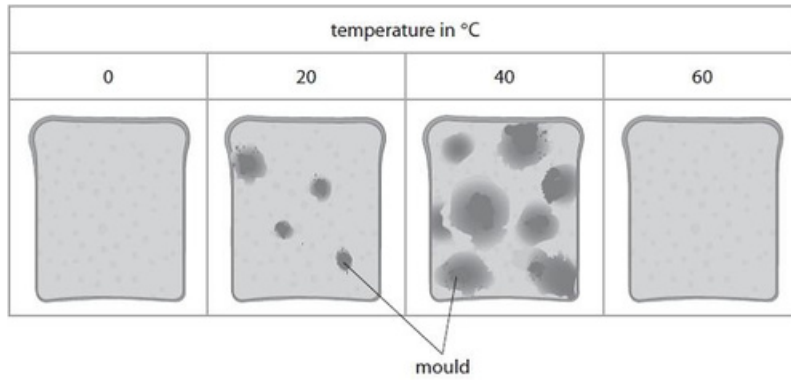


Figure 8

(i) Which is the best estimate of the percentage cover of mould on the bread at 40 °C?

(1)

- A 0%
- B 25%
- C 50%
- D 75%

(ii) State two conclusions that can be made about the growth of mould on the bread from 0 °C to 40 °C shown in Figure 8.

(2)

1

.....

.....

2

.....

.....

(iii) Explain why there was no mould growing on the bread kept at 60 °C.

(2)

.....

.....

.....

(Total for question = 5 marks)

Q12.

Decomposition of strawberries can be prevented by boiling the strawberries with sugar to make jam.

(i) Enzymes in the fungus caused decomposition.

Explain how boiling stops the enzymes from working.

(2)

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(ii) Cells from a fungus can land on jam.

The sugar solution inside the jam is more concentrated than the sugar solution inside the fungus cells.

State how osmosis causes the fungus cells to die.

(1)

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(Total for question = 3 marks)

Q13.

Explain how cabbages, earthworms and squirrels contribute to the carbon cycle.

(3)

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(Total for question = 3 marks)

Q14.

Explain how the concentration of oxygen in a compost bin would affect the rate of decomposition.

(2)

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(Total for question = 2 marks)

Q15.

One method of preserving strawberries is by using them to make jam.

Figure 7 shows a method for making strawberry jam.

Procedure:
Measure 2 kg of crushed strawberries. Place in a bowl.
Add sugar, mix well, and allow to stand for 10 minutes.
Transfer to a saucepan and heat until boiling.
Stir apple pectin into fruit and continue stirring over a high temperature until the gel point is reached and there is a reduction in the water content.
Pour jam into sterilised jars, leaving 1 cm of space at the top and cover.

Figure 7

(i) Explain why reducing the water content of the strawberries will help to preserve them.

(2)

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.....

.....

(ii) Give a reason for sterilising the jars before adding the jam.

(1)

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.....

(Total for question = 3 marks)

Q16.

Explain why keeping food in a fridge slows down the growth of mould.

(2)

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(Total for question = 2 marks)

Q17.

Figure 9 shows some part-baked bread in a sealed bag.

The gas in the bag is nitrogen, which prevents the bread from going mouldy.



Figure 9

If the bag is opened, the bread goes mouldy within days.

State why the bread goes mouldy.

(1)

.....

.....

(Total for question = 1 mark)

Q18.

Figure 15 shows the results of this investigation.

seedling in test tube	length at the start in mm	length after 7 days in mm
1	4	11
2	6	17
3	5	26

Figure 15

(i) Explain why there are differences in the change in the lengths of the seedlings.

(2)

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(ii) Explain how nitrate ions were absorbed by the seedling in test tube 3.

(3)

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(Total for question = 5 marks)

Q19.

Figure 1 shows part of a diseased rose plant from a garden.



(Source: © Manfred Ruckszio/Shutterstock)

Figure 1

Explain what Figure 1 indicates about the air quality in the garden.

(2)

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.....

.....

.....

(Total for question = 2 marks)

Q20.

Farmers use crop rotation to reduce the need to add nitrate fertilisers to the soil.

Plants such as peas and beans have a mutualistic relationship with nitrogen-fixing bacteria.

Explain why farmers use these plants in their crop rotation cycle.

(3)

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(Total for question = 3 marks)

Q21.

Figure 1 shows the sources of pollution and different levels of water pollution in a river.

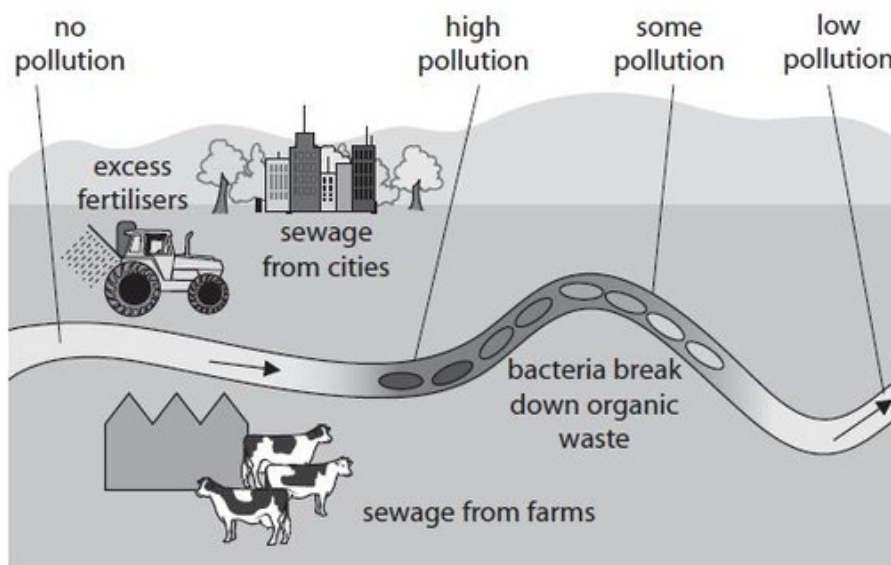


Figure 1

Explain why sewage pollution in the river can decrease the oxygen levels in the water.

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.....

.....

(Total for question = 2 marks)

Q22.

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)

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.....

.....

(Total for question = 3 marks)

Q23.

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

$$\text{rate of decomposition} = \frac{\text{change in mass}}{\text{time taken}}$$

(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)

.....
.....
.....
.....

(Total for question = 6 marks)

Q24.

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 = 2 marks)

Q25.

Answer the question with a cross in the box you think is correct . If you change your mind about an answer, put a line through the box and then mark your new answer with a cross .

A student investigated the decomposition of leaves from different types of tree.

Decomposers in the soil convert

(1)

- A nitrogen into nitrates
- B nitrates into nitrogen
- C urea into ammonia
- D ammonia into urea

(Total for question = 1 mark)

Q26.

Answer the question with a cross in the box you think is correct . If you change your mind about an answer, put a line through the box and then mark your new answer with a cross .

Figure 12 shows the mean rate of decomposition for this investigation.

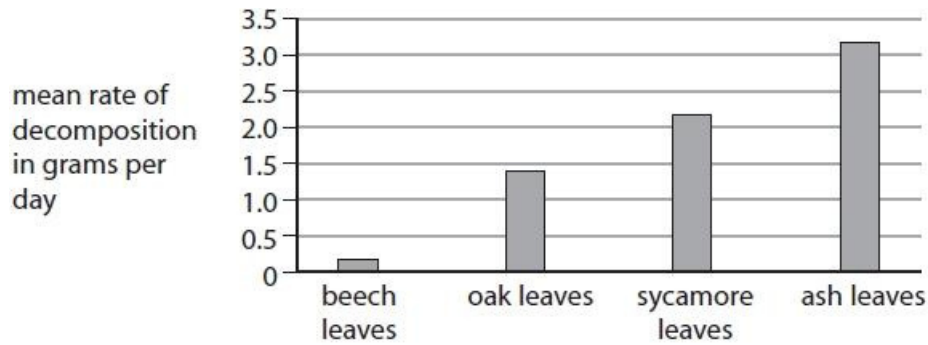


Figure 12

(i) Which leaves would produce compost in the least time?

(1)

- A beech leaves
- B oak leaves
- C sycamore leaves
- D ash leaves

(ii) The same investigation was extended to include the leaves of a silver birch tree.

The starting mass of the leaves was 28.2 grams.
 After 40 days the mass of the leaves was 19.7 grams.
 Calculate the rate of decomposition of the leaves of the silver birch tree.
 Give your answer to three significant figures and include the units.

(3)

rate of decomposition

(Total for question = 4 marks)

Q27.

A gardener investigated the ability of four types of compost to hold water.

50cm³ of water was added to each type of compost.

Figure 16 shows the volume of water retained by four different types of compost.

type of compost	A	B	C	D
mass of compost /g	500	500	1000	1000
volume of water retained / cm ³	15	29	45	34
total mass of compost after water was added /g cm ⁻³	515	529	1045	1034

Figure 16

(i) Calculate the percentage change in mass for compost B.

(2)

..... %

(ii) Explain which compost would be best to use in a pot containing strawberry plants to be grown during a hot summer.

(2)

.....

.....

.....

.....

(iii) State one way to improve this investigation in order to compare the results without having to calculate the percentage change in mass.

(1)

.....

.....

(Total for question = 5 marks)

Q28.

A student investigated the effect of nitrate ion concentration on plant growth. She placed barley seedlings in three test tubes containing different concentrations of nitrate fertiliser.

Test tube 1 contained distilled water with 1 pellet of nitrate fertiliser.

Test tube 2 contained distilled water with 2 pellets of nitrate fertiliser.

Test tube 3 contained distilled water with 3 pellets of nitrate fertiliser.

After 7 days, the lengths of the seedlings were measured.

Figure 13 shows an example of the apparatus used.

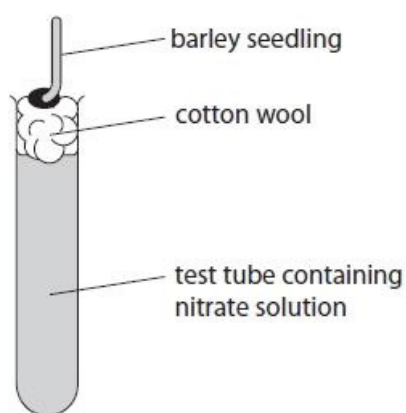


Figure 13

(i) Describe a control for this investigation.

(2)

.....

.....

.....

.....

(ii) The nitrate fertiliser contains the chemical compound potassium nitrate. The hazard symbol on the bag of potassium nitrate fertiliser is shown in Figure 14.



Figure 14

Which hazard does this symbol represent?

(1)

- A flammable
- B oxidising
- C corrosive
- D explosive

(iii) Give a method, other than measuring the change in length, that would show the growth of the seedlings.

(1)

.....

.....

(Total for question = 4 marks)

Q29.

Name a group of organisms that break down the dead leaves and release mineral ions into the soil.

(1)

.....

(Total for question = 1 mark)

Q30.

Figure 1 shows the water cycle.

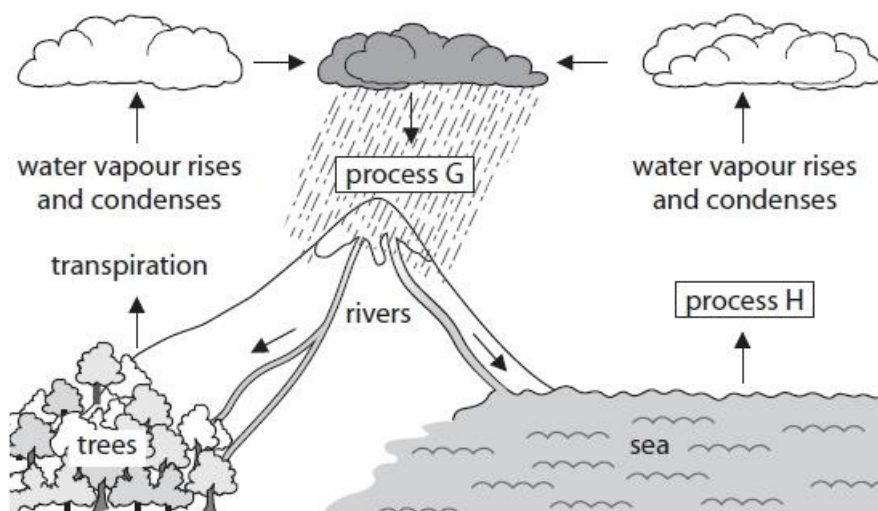


Figure 1

(i) Name process G and process H.

(2)

process G process H

..... (ii) What causes the water

vapour to condense and form clouds?

(1)

- A the water vapour cools down
- B the water vapour heats up
- C the temperature of the water vapour stays the same
- D the trees absorb more water

(Total for question = 3 marks)

Q31.

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

(Total for question = 2 marks)

Q32.

State three ways the concentration of nitrates in soil can be increased.

(3)

- 1
- 2
- 3

(Total for question = 3 marks)

Q33.

Joseph Priestley was a scientist who investigated how green plants and combustion affected the carbon cycle.

Figure 13 shows his first experiment.

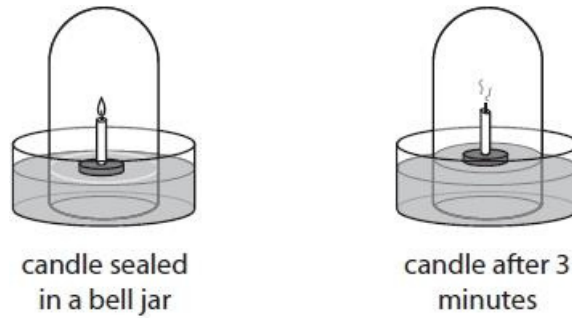


Figure 13

(i) State why the candle was not burning after three minutes.

(1)

.....
.....

(ii) Joseph Priestley continued the investigation but placed a plant inside the bell jar as shown in Figure 14.



Figure 14

He observed that the candle stayed alight for two minutes more than the candle in the bell jar in the first experiment.

Explain his observation.

(2)

.....
.....
.....
.....

(iii) State two variables that would need to be controlled to compare these two experiments.

(2)

1

.....

2

.....

(Total for question = 5 marks)

Q34.

Figure 1 shows part of the carbon cycle.

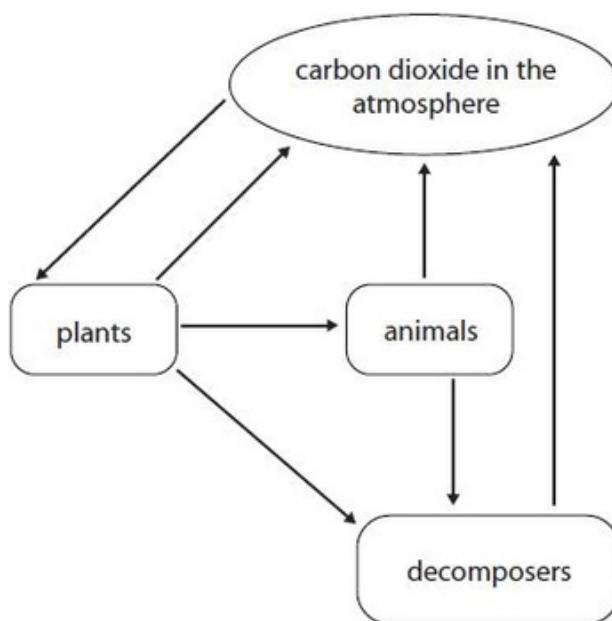


Figure 1

(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

(Total for question = 4 marks)

Q35.

Figure 9 shows part of the nitrogen cycle.

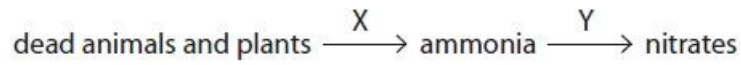


Figure 9

(i) Identify the types of microorganism involved in process X and process Y.

(2)

X

Y

(ii) Explain how crop rotation increases nitrate levels in the soil.

(3)

.....
.....
.....
.....
.....
.....

(iii) Explain why increased nitrate levels in the soil improve crop yield.

(2)

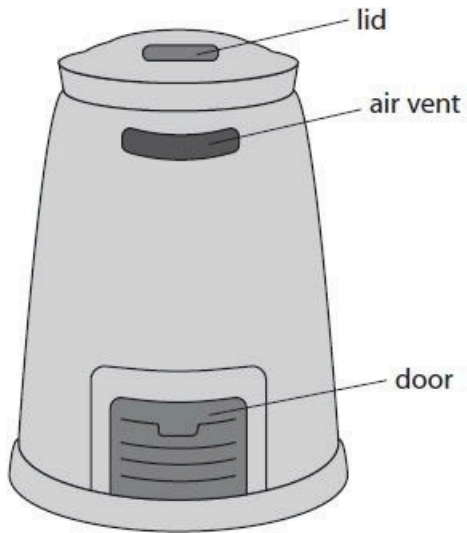
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(Total for question = 7 marks)

Q36.

A gardener read information on a gardening society website about how to use a compost bin.

Figure 11 shows the compost bin and some of the instructions.



- add soil in between layers of vegetation
- mix the contents of the compost bin once a month to add air
- keep the lid on to prevent water entering

Figure 11

(i) Give one reason why the gardener thought the gardening society website was a good source of information.

(1)

.....

..... (ii)

Give reasons why soil is added to the compost bin and why the contents are turned to add air.

(2)

.....
.....
.....
.....
.....
.....

(iii) The gardener noticed the compost bin became warm a few days after vegetation was added.

Why did the contents of the compost bin become warm?

(1)

- A respiration occurred and this is an endothermic reaction
- B respiration occurred and this is an exothermic reaction
- C photosynthesis occurred and this is an endothermic reaction
- D photosynthesis occurred and this is an exothermic reaction

(iv) The mass of the contents of the compost bin at the start was 40 kg.

After 60 days the mass of the contents was 32 kg.
Which is the rate of decay?

(1)

- A 1.8 kg per day
- B 0.66 kg per day
- C 0.53 kg per day
- D 0.13 kg per day

(Total for question = 5 marks)

Q37.

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

(Total for question = 1 mark)

Mark Scheme

Q1.

Question number	Answer	Mark	
(i)	B high pollution The only correct answer is B high pollution A is incorrect because bloodworms are not found in unpolluted water C is incorrect because there are only low levels of bloodworms in areas of some pollution D is incorrect because there are only low levels of bloodworms in areas of low pollution	(1) AO 2.1	
Question number	Answer	Additional guidance	Mark
(ii)	Stone fly (1) Freshwater shrimp (1) Accept phonetic misspellings	answers can be in either order	(2) AO 2.1

Q2.

Question number	Answer	Additional guidance	Mark
(i)	<ul style="list-style-type: none"> substitution $72 \div 5$ (1) evaluation $= 14.4$ (cm² per day) 	accept 14 (cm ² per day) Award full marks for correct answer with no working.	(2) AO2.1
Question number	Answer	Additional guidance	Mark
(ii)	The growth / area of fungus increases	accept it goes up accept manipulated data e.g. the area is 9 times larger accept the higher the temp, the bigger (the area of) the fungus.	(1) AO3.2

Q3.

Question number	Answer	Additional guidance	Mark
	carbon absorbed $120.1 + 92.8$ or 212.9 (1) OR carbon released $119.6 + 90 + 6.4$ or 216.0 (1) Evaluation 3.1 (gigatonnes)	award full marks for correct answer with no workings	(2) AO2 1

Q4.

Question number	Answer	Additional guidance	Mark
(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
(ii)	An explanation that combines identification via a judgement (1 mark) to reach a conclusion via justification/reasoning (1 mark): <ul style="list-style-type: none"> • $55 (^{\circ}\text{C})$ (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

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Question number	Answer	Mark
(iii)	<p>Any two improvements from:</p> <ul style="list-style-type: none"> • 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) 	<p>(2)</p> <p>AO 3 3b</p>

Q5.

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

Q6.

Question number	Answer	Additional guidance	Mark
	<p>filtering (1)</p> <p>pathogens (1)</p> <p>accept phonetic spellings</p>	<p>answers must be in the correct order</p>	<p>(2)</p> <p>AO2.1</p>

Q7.

Question number	Answer	Additional guidance	Mark
	<p>A description including two of the following:</p> <ul style="list-style-type: none"> • desalination/ remove salt from the water (1) • evaporate the water (1) • condense water (vapour and collect it) (1) 	<p>accept alternative methods.</p> <p>accept heat or boil water.</p> <p>accept distillation for both MP2 and 3 (2)</p>	<p>(2)</p> <p>AO2.2</p>

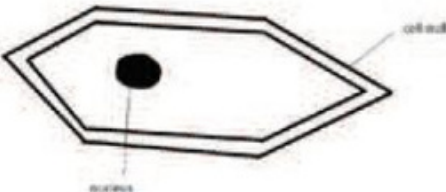
Q8.

Question number	Answer	Additional Guidance	Mark
	<p>A description including:</p> <ul style="list-style-type: none"> • decomposers break down waste matter (into ammonia) (1) • nitrifying bacteria convert ammonia / nitrifying bacteria make {nitrites / nitrates} (1) • nitrogen fixing bacteria convert nitrogen into nitrates (1) • denitrifying bacteria {convert nitrates / release nitrogen} (1) 	<p>accept dead organisms for waste matter</p> <p>accept nitrification for nitrifying bacteria</p> <p>accept ammonia/nitrogen compounds for nitrates</p> <p>accept denitrification releases nitrogen</p>	<p>(4)</p> <p>AO1 1</p>

Q9.

Question number	Answer	Mark
(i)	{Microorganism/pathogen} growth is {very slow/inhibited} (1)	(1)

Question number	Answer	Mark
(ii)	An answer that combines the following points of understanding to provide a logical description: <ul style="list-style-type: none"> the cell wall is made up of cellulose which gives the cell its rigidity (1) and a vacuole for maintaining turgor pressure (1) 	(2)

Question number	Answer	Mark
(iii)	<ul style="list-style-type: none"> nucleus drawn and labelled (1) cell wall drawn and labelled (1) cell drawn with nucleus and cell wall clearly shown as on the photomicrograph (1) 	(3)

Q10.

Question number	Answer	Additional guidance	Mark
(a)(i)	<ul style="list-style-type: none"> $107 \div 153$ (1) $0.699\ 3464 \times 100 = 70\%$ (1) Answer to 2 significant figures	award full marks for correct numerical answer without working	(2)

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Question number	Answer	Additional guidance	Mark
(a) (ii)	<p>An explanation that combines identification via a judgment (1 mark) to reach a conclusion via justification/reasoning (1 mark):</p> <ul style="list-style-type: none"> stream B is more polluted than stream A (1) <p>Plus one from:</p> <ul style="list-style-type: none"> (because) stream A contains stonefly larvae/mayfly larvae/caddis fly larvae (which are indicators of clean water) (1) (because) stream B contains larger numbers of blood worm and sludge worm (which are indicators of polluted water) (1) 	<p>accept other correct indicators from the table.</p> <p>accept higher oxygen levels in place of clean water</p> <p>accept lower oxygen levels in place of polluted water</p>	(2)

Question number	Answer	Mark
(b)	<p>An explanation that combines identification – understanding (1 mark) and reasoning/justification – understanding (3 marks):</p> <ul style="list-style-type: none"> plants growing on the bottom of the stream will be unable to receive sunlight due to the thick layer of algae (1) these plants will not be able to photosynthesise and will die and start to decompose (1) the microorganisms decomposing the plants will respire, removing oxygen from the water (1) the stream will become anoxic/oxygen depleted and other respiring organisms (plants and animals) will not be able to survive so biodiversity will be reduced (1) 	(4)

Q11.

Question Number	Answer	Mark
(i)	<p>C 50%</p> <p>The only correct answer is C</p> <p><i>A is not correct because 0% is too low</i></p> <p><i>B is not correct because 25% is too low</i></p> <p><i>C is not correct because 75% is too high.</i></p>	<p>(1)</p> <p>A01.1</p>

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Question Number	Answer	Additional guidance	Mark
(ii)	<p>An answer including two from</p> <ul style="list-style-type: none"> as the temperature increases (up to 40°C) the % of mould increases (1) no (growth of) mould at {0°C / below 20°C} (1) more growth of mould at 40°C than at 20°C (1) 	accept 40°C is the optimum temperature for mould (growth)	(2) A03.1ab

Question Number	Answer	Additional guidance	Mark
(iii)	<p>An explanation including two from:</p> <ul style="list-style-type: none"> enzymes don't work (at 60°C) / enzymes are denatured (1) active site shape changed so can't fit with substrate (1) so (biochemical) reactions won't {take place / occur quickly enough} (1) 	<p>accept mould is killed (1)</p> <p>accept the bread was too dry (for the mould to grow) (1)</p>	(2) A03.2ab

Q12.

Question number	Answer	Additional guidance	Mark
(i)	<p>An explanation linking two of the following:</p> <ul style="list-style-type: none"> enzymes are heat sensitive (1) the shape of the enzyme / active site changes (1) (enzymes) become denatured (1) substrate(s) will not fit in the active site (1) 	reject kill enzyme.	(2) AO1.2

Question number	Answer	Mark
(ii)	Water moves out (of the fungus cells) / cells become dehydrated	(1) AO2.2

Q13.

Question number	Answer		Mark
	<p>An explanation linking three from</p> <ul style="list-style-type: none"> • {squirrels / earthworms / cabbages} release carbon dioxide (1) • from respiration (1) • cabbages take in carbon dioxide (1) • (cabbages) for photosynthesis (1) • when organisms die decomposers release carbon dioxide (1) • {squirrels/earthworms} eat {cabbages/plants} which contain carbon (1) • egestion releases carbon (into the soil) (1) 	<p>accept CO₂ reject CO²</p> <p>accept decomposers respire</p> <p>accept squirrels eat earthworms which contain carbon</p> <p>accept named methods of egestion</p>	<p>(3) AO2 1</p>

Q14.

Question Number	Answer	Additional guidance	Mark
	<p>An explanation linking:</p> <ul style="list-style-type: none"> increasing oxygen concentration increases the rate of decomposition (1) because there is more respiration (1) 	accept reverse argument	<p>(2)</p> <p>A02 1</p>

Q15.

Question number	Answer	Additional guidance	Mark
(i)	<p>An explanation that combines identification – application of knowledge (1 mark) and reasoning/justification – application of understanding (1 mark):</p> <ul style="list-style-type: none"> by reducing the water content it reduces the number of microorganisms that can reproduce (1) because there is a reduction of microorganisms this reduces the decay process/preserves the food (1) 	accept bacteria/pathogens for microorganisms	(2)
Question number	Answer		Mark
(ii)	to kill unwanted micro-organisms		(1)

Q16.

Question Number	Answer	Additional guidance	Mark
	An explanation including two from: <ul style="list-style-type: none"> • too cold (1) • (for) enzymes to work effectively (1) • (biochemical) reactions occur too slowly (1) 	accept respiration for reactions.	(2) AO1.1

Q17.

Question Number	Answer	Mark
	Oxygen (allows mould to grow) / mould (spores) can enter the bag	(1) AO2.1

Q18.

Question number	Answer		Mark
(i)	An explanation linking: <ul style="list-style-type: none"> • largest amount of growth seen with the highest concentration of nitrates / the higher the concentration of nitrates the more growth /ORA (1) • nitrates are needed to make proteins (1) 	accept faster growth for more growth accept nitrates stimulate growth accept amino acids	(2) AO 3 2a AO 3 2b

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Question number	Answer	Additional guidance	Mark
(ii)	<p>An explanation that links the following:</p> <ul style="list-style-type: none"> by the roots/ root hair cells (1) <p>AND</p> <ul style="list-style-type: none"> by diffusion (1) from a high concentration to a low concentration / down the concentration gradient (1) <p>OR</p> <ul style="list-style-type: none"> by active transport (1) from a low concentration to a high concentration / against the concentration gradient / using energy (1) 	<p>reject osmosis</p> <p>reject osmosis</p>	<p>(3)</p> <p>AO 2 1</p>

Q19.

Question Number	Answer	Additional Guidance	Mark
	<p>An explanation linking:</p> <ul style="list-style-type: none"> blackspot fungus present (1) which indicates clean air / low sulfur dioxide (1) 	<p>accept high / good air quality</p>	<p>(2)</p> <p>A03</p>

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Q20.

Question number	Answer	Additional guidance	Mark
	<p>An explanation linking three of the following:</p> <ul style="list-style-type: none"> to increase nitrate/ammonia levels in the soil (1) because nitrogen fixing bacteria live in {colonies/root nodules} on the roots of pea and bean plants {nitrogen-fixing bacteria} produce {nitrates/ nitrogen compounds / ammonia} (1) from nitrogen {atmospheric/gas} (1) 	ignore live in the roots	<p>(3)</p> <p>AO 1 1</p>

Q21.

Question number	Answer	Additional guidance	Mark
	<p>An explanation linking the following points:</p> <ul style="list-style-type: none"> increased levels of (aerobic) bacteria (1) use oxygen from the water in respiration (1) <p>OR</p> <ul style="list-style-type: none"> prevent plants from getting light/kills plants (1) so no oxygen produced by photosynthesis (1) 	<p>accept microorganisms / bloodworms / sludgeworms / decomposers</p> <p>accept plants broken down by decomposers</p>	<p>(2)</p> <p>AO 2.1</p>

Q22.

Question Number	Answer	Mark
	<p>An explanation including three from:</p> <p>Dried food</p> <ul style="list-style-type: none"> dehydrated / no water in dried food (1) decomposers cannot grow / survive without water (1) <p>Vacuum packed food</p> <ul style="list-style-type: none"> vacuum packed food has no {air/ oxygen} (inside) (1) (which is used for) respiration (1) so {decomposers / microorganisms} are {dormant / dead / cannot survive} (1) 	<p>(3) AO2 1</p>

Q23.

Question Number	Answer	Mark
(i)	To allow {air / oxygen} to enter / water to drain out	<p>(1) AO2 1</p>

Question Number	Answer	Additional guidance	Mark
(ii)	<p>$(2.0 - 1.7 =) 0.3$ (1)</p> <p>$(0.3) \div 20 =$</p> <p>0.015 (kg per day) / (15g per day)</p>	award full marks for correct answer with no working	<p>(3) AO2 1</p>

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Question Number	Answer	Mark
(iii)	<p>An explanation linking:</p> <ul style="list-style-type: none"> increased rate of decomposition (1) <p>with one of</p> <ul style="list-style-type: none"> because particles have more (kinetic) energy (1) because rate of enzyme action increases (1) because more decomposers are present (1) 	(2) AO2 2

Q24.

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

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

Q25.

Question Number	Answer	Mark
	<p>C urea into ammonia</p> <p>The only correct answer is C</p> <p><i>A is incorrect because this is the role of nitrogen fixing bacteria</i></p> <p><i>B is incorrect because this is the role of denitrifying bacteria</i></p> <p><i>D is incorrect because decomposers produce ammonia not urea</i></p>	<p>(1)</p> <p>AO1 1</p>

Q26.

Question Number	Answer	Mark
(i)	<p>D ash leaves</p> <p>The only correct answer is D</p> <p><i>A is incorrect because beech leaves decompose the slowest</i></p> <p><i>B is incorrect because oak leaves decay at a slower rate than ash leaves</i></p> <p><i>C is incorrect because sycamore leaves decay at a slower rate than ash leaves</i></p>	<p>(1)</p> <p>AO3 1a</p>

Question Number	Answer	Additional guidance	Mark
(ii)	<p>selection (28.2 - 19.7 =) 8.5 (1)</p> <p>calculation (8.5 ÷ 40 =) 0.213</p> <p>units grams per day (1)</p>	<p>accept 0.213 for two marks award one mark for 0.2125</p> <p>accept g/day</p>	<p>(3)</p> <p>AO1 2</p>

Q27.

Question number	Answer	Additional guidance	Mark
(i)	$29 \div 500 = 0.058$ (1) $0.058 \times 100 = 5.8$ (1)	award full marks for correct numerical answer without working	(2)

Question number	Answer	Mark
(ii)	<p>An explanation that combines identification via a judgment (1 mark) to reach a conclusion via justification/reasoning (1 mark):</p> <ul style="list-style-type: none"> compost B (1) as it has the highest percentage of water retained and there is a higher amount of water loss in the plants due to higher temperatures causing a {larger rate of evaporation of water/higher transpiration rates} (1) 	(2)

Question number	Answer	Additional Guidance	Mark
(iii)	Use the same starting mass of compost (1)	accept any other relevant improvement	(1)

Q28.

Question number	Answer		Mark
(i)	<ul style="list-style-type: none"> set up the apparatus as shown in figure 13 (1) replace the nitrate solution with (distilled) water / do not add nitrate pellet (1) 	<p>accept set up with a seedling on the cotton wool</p> <p>ignore just idea of controlling the volume of solution</p>	(2) AO 2 2

Question number	Answer	Mark
(ii)	<p>B oxidising</p> <p>1. The only correct answer is B</p> <p><i>A is not correct because this is not the symbol for flammable</i></p> <p><i>C is not correct because the symbol for corrosive is a hand with acid</i></p> <p><i>D is not correct because the symbol for explosive has an explosion on it</i></p>	(1) AO 1 1

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Question number	Answer	Additional guidance	Mark
(iii)	measure the (change in) mass (1)	accept idea of looking at the number/size of leaves accept the width of the seedling	(1) AO 3 3b

Q29.

Question Number	Answer	Additional guidance	Mark
	Any one from bacteria / fungi / decomposers / prokaryotes	accept microorganisms accept named decomposing organisms e.g. worms	(1) AO1 1

Q30.

Question Number	Answer	Mark
(i)	<p>Process G = Precipitation / type of precipitation eg rain (1)</p> <p>Process H = Evaporation / vaporisation (1)</p>	<p>(2)</p> <p>AO1.1</p>

Question number	Answer	Mark
(ii)	<p>A the water vapour cools down</p> <p>The only correct answer is A</p> <p><i>B is not correct because the water vapour does not heat up to form clouds.</i></p> <p><i>C is not correct because the temperature of the water vapour does not stay the same to form clouds</i></p> <p><i>D is not correct because the trees do not absorb more water to form clouds</i></p>	<p>(1)</p> <p>AO1.1</p>

Q31.

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

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

Q32.

Question number	Answer	Additional Guidance	Mark
	<p>Any three from:</p> <ul style="list-style-type: none"> • (add) artificial fertilisers (1) • (add) manure / slurry / (use) green manuring (1) • use crop rotation (1) • nitrogen fixing bacteria (1) • nitrifying bacteria (1) 	<p>accept add fertiliser / add nitrates / named nitrate compound.</p> <p>accept description of green manuring / add faeces /compost /decomposing matter.</p> <p>accept nitrification</p> <p>accept lightning (1)</p>	<p>(3)</p> <p>A01.1</p>

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Q33.

Question number	Answer	Mark
(i)	all the oxygen had been used up / no oxygen left	(1) AO2 2

Question number	Answer	Additional guidance	Mark
(ii)	An explanation linking: <ul style="list-style-type: none"> • the plant produced oxygen (1) • through photosynthesis (1) 	ignore plant removes carbon dioxide	(2) AO2 1

Question number	Answer	Additional guidance	Mark
(iii)	Any two from: <ul style="list-style-type: none"> • light intensity (1) • temperature (1) • size of bell jar / same volume of air (1) • {size/type} of candle /length of the wick (1) • level of liquid/water in the container (1) 	accept same volume of gas in bell jar	(2) AO2 2

Q34.

Question Number	Answer	Additional guidance	Mark
(i)	feeding / eating	accept digestion / absorption / nutrition	(1) AO3 1a

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Question Number	Answer	Additional guidance	Mark
(ii)	photosynthesis (1) respiration (1)	answers must be in the correct order	(2) AO2 1

Question Number	Answer	Mark
(iii)	<p>C microorganism</p> <p>The only correct answer is C</p> <p><i>A is not correct because mammals are not decomposers</i></p> <p><i>B is not correct because producers are not decomposers</i></p> <p><i>D is not correct because trees are not decomposers</i></p>	(1) AO1 1

Q35.

Question Number	Answer	Additional Guidance	Mark
(i)	X – decomposers Y – nitrifying (bacteria)	<p>accept fungi / decomposing bacteria</p> <p>accept named nitrifying bacteria reject denitrifying bacteria / nitrogen-fixing bacteria</p>	(2) AO1 1

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Question Number	Answer	Additional guidance	Mark
(ii)	<p>An explanation linking three from:</p> <ul style="list-style-type: none"> leguminous crops planted (1) that have nitrogen-fixing bacteria (1) in root (nodules) (1) which fix nitrogen (gas) (1) 	<p>accept named leguminous crops</p> <p>accept use nitrogen from the air / use atmospheric nitrogen / make ammonia</p> <p>ignore produce nitrates</p>	(3) AO1

Question Number	Answer	Additional Guidance	Mark
(iii)	<p>An explanation linking:</p> <ul style="list-style-type: none"> nitrates are needed to make {protein / amino acids} (1) which are needed for growth (1) 	accept for DNA / genetic material	(2) AO1

Q36.

Question Number	Answer	Additional Guidance	Mark
(i)	(the gardener thought) they were experts / it was a reliable source	accept the content has been checked / peer review	(1) AO2 1

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Question Number	Answer	Additional guidance	Mark
(ii)	<p>An answer including:</p> <ul style="list-style-type: none"> to introduce microorganisms / decomposers (1) to provide oxygen (1) 	<p>accept bacteria / worms for decomposers</p> <p>accept for respiration</p>	(2) AO2 1

Question Number	Answer	Mark
(iii)	<p>B respiration occurred and this is an exothermic reaction</p> <p>The only correct answer is B</p> <p><i>A is not correct because respiration is not endothermic</i></p> <p><i>C is not correct because it is not photosynthesis</i></p> <p><i>D is not correct because it is not photosynthesis</i></p>	(1) AO2 1

Question Number	Answer	Mark
(iv)	<p>D 0.13 kg per day</p> <p>The only correct answer is D</p> <p><i>A is not correct because 8/60 is not 1.8</i></p> <p><i>B is not correct because 8/60 is not 0.66</i></p> <p><i>C is not correct because 8/60 is not 0.53</i></p>	(1) AO2 1

Q37.

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