Ecology part 4 AQA Triple Biology

Name: _____

Class: _____

Date: _____

Time: **89 minutes**

Marks: **89 marks**

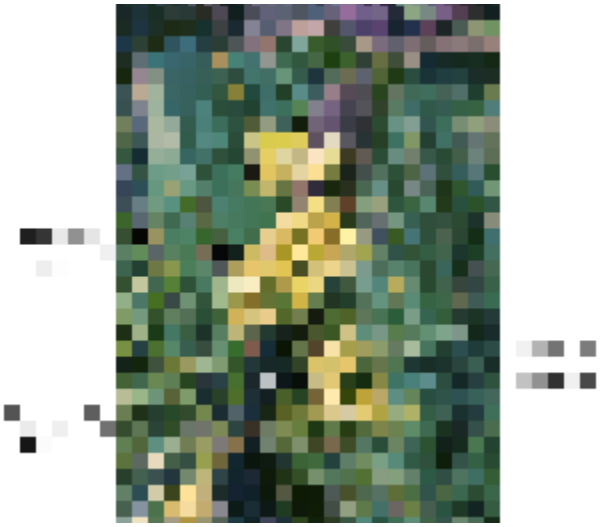
Comments:

1. (a) Dodder is an unusual flowering plant. It is a parasite.

The dodder plant:

- has no chlorophyll
- has no roots
- has no leaves
- grows attached to the stem of a host plant.

The image below shows dodder attached to its host plant.



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(i) Dodder has no chlorophyll. Most plants have leaves containing chlorophyll.

What is the function of chlorophyll in most plants?

_____

_____

_____

_____

(2)

(ii) Parts of the dodder stem grow into the host stem and attach to the host's phloem tissue.

Suggest why it is helpful to the dodder plant to be attached to the host's phloem tissue.

_____

_____

(1)

(iii) Suggest why the dodder will have a harmful effect on the host plant.

_____

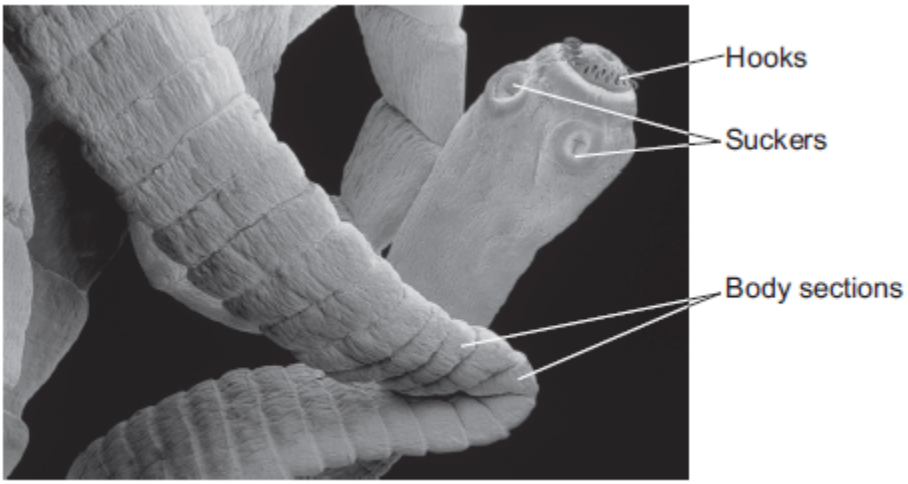
_____

(1)

(b) **In this question you will be assessed on using good English, organising information clearly and using specialist terms where appropriate.**

The tapeworm is another parasite.

The image below shows part of a tapeworm.



The tapeworm lives inside the small intestine of a mammal.

Describe and explain how the tapeworm is adapted for living inside the small intestine of its host.

Extra space

(6)

(Total 10 marks)

2. Food chains show the flow of energy through the organisms in a habitat.

(a) The diagram below shows a food chain.

grass → sheep → human

The biomass in each stage of the food chain changes as food passes along the food chain.

Draw a pyramid of biomass for this food chain.

Label the pyramid.

(2)

(b) The table below shows three food chains, **A, B** and **C**.

	Food chain
A	plants → sheep → human
B	plants → grasshoppers → frogs → trout → human
C	plants → human

(i) In which food chain, **A**, **B** or **C**, will the greatest proportion of biomass and energy of the plants be passed to humans? ☐

(1)

(ii) Give reasons why the food chain that you chose in part **(b)(i)** passes on the greatest proportion of biomass and energy to humans.

_____

_____

_____

_____

_____

_____

(3)

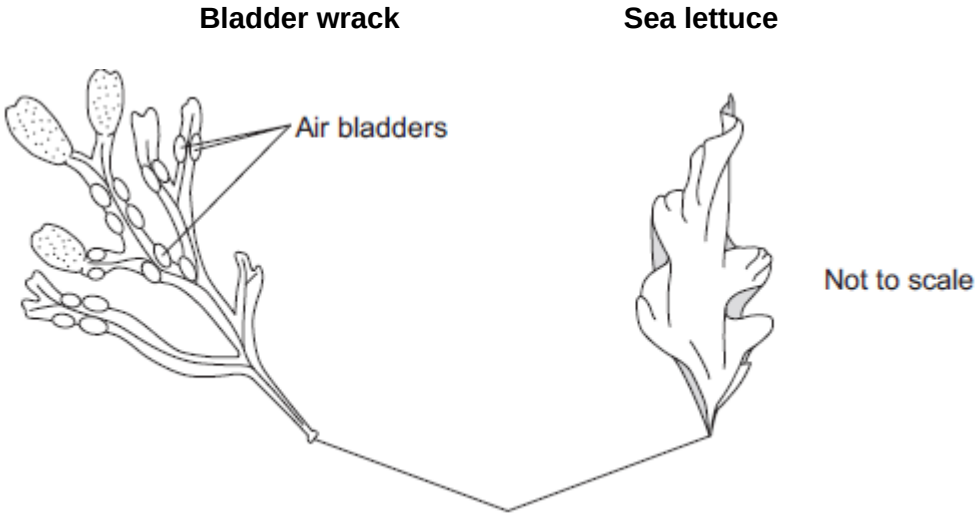
(Total 6 marks)

3. At the seashore, the tide comes in and goes out twice each day.

Some students investigated whether two different species of seaweed could live only at certain positions on a rocky shore.
Seaweeds are plant-like organisms that make their food by photosynthesis.

Figure 1 shows the two species of seaweed that the students investigated.

Figure 1



(a) The students:

1 placed a 50-metre tape measure on the rocks at right angles to the sea

2 placed a quadrat next to the tape measure

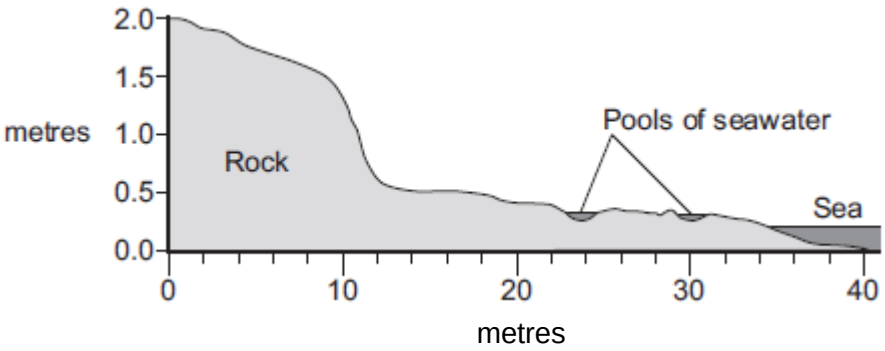
3 recorded whether each species was present or not.

The students repeated steps 2 and 3 every metre down the shore.

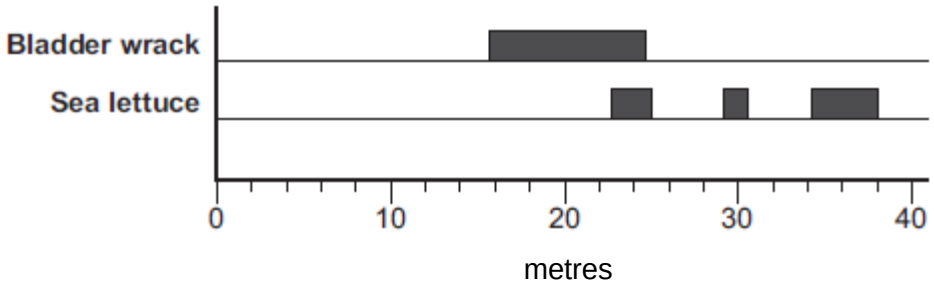
Figure 2 shows a section of the seashore and the students' results.

Figure 2

Section of the seashore



Students' results



(i) The students placed the quadrat at regular intervals along a transect line rather than placing the quadrat at random positions anywhere on the rocky shore.

Explain why.

_____

_____

_____

_____

(2)

(ii) How could the students have improved their investigation to ensure that they produced valid data?

_____

_____

_____

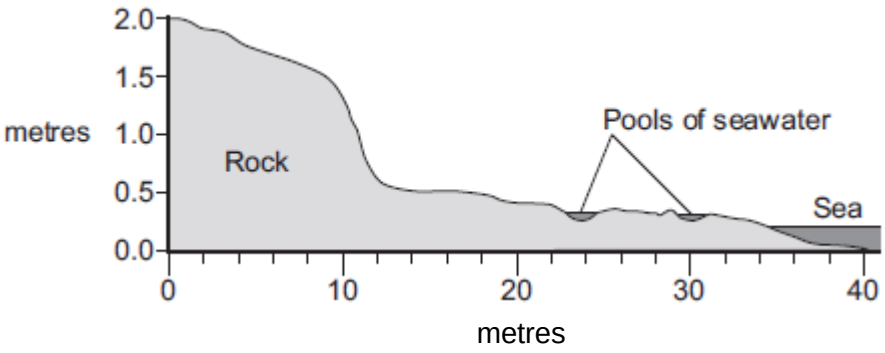
_____

(2)

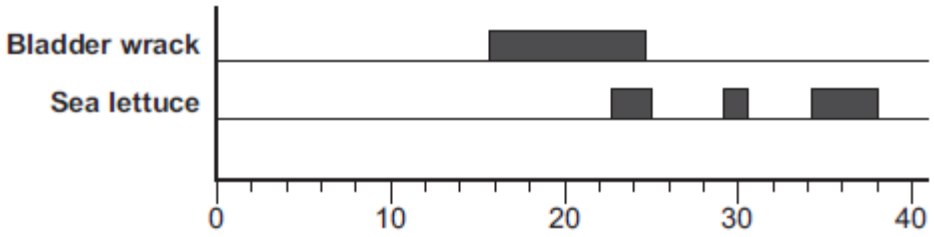
(iii) **Figure 2** is repeated here to help you answer this question.

Figure 2

Section of the seashore



Students' results



The students concluded that bladder wrack is better adapted than sea lettuce to survive in dry conditions.

What is the evidence for this conclusion?

Use information from **Figure 2**.

_____

_____

_____

_____

(2)

(b) The bladder wrack has many air bladders.
The air bladders help the bladder wrack to float upwards when the sea covers it.

Suggest how this helps the bladder wrack to survive.

_____

_____

_____

_____

(2)

(Total 8 marks)

4. Some students investigated the distribution of dandelion plants in a grassy field. The grassy field was between two areas of woodland.

Figure 1 shows two students recording how many dandelion plants there are in a 1 metre x 1 metre quadrat.

Figure 1

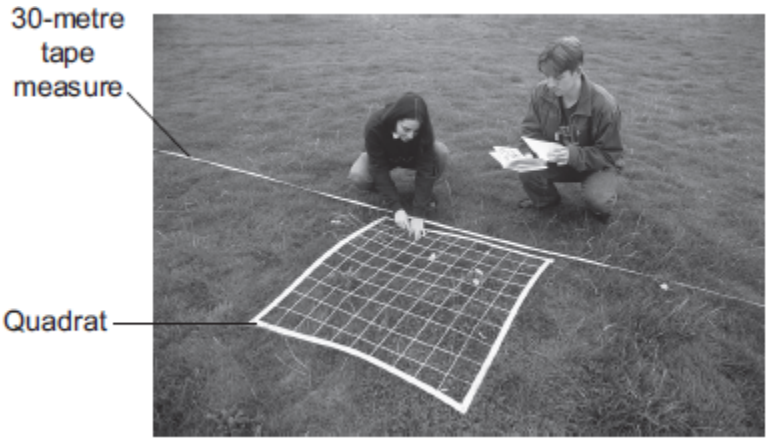
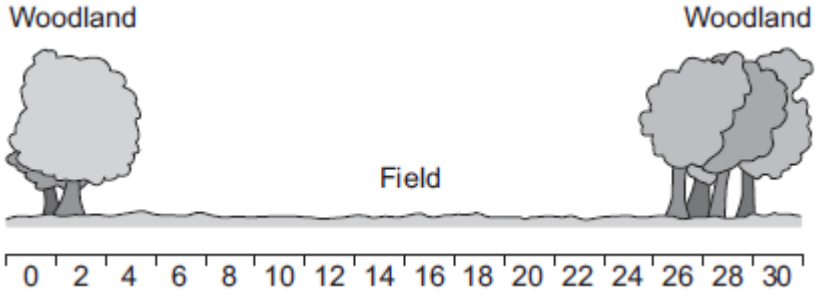


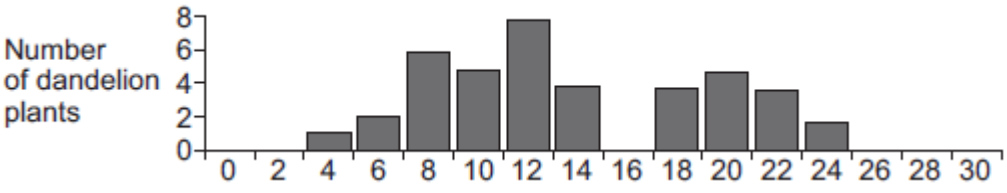
Figure 2 shows a section across the area studied and **Figure 3** shows a bar chart of the students' results.

Figure 2



Distance in m

Figure 3



Distance in m

(a) How did the students use the quadrat and the 30-metre tape measure to get the results in **Figure 3**?

Use information from **Figure 1**.

_____

_____

_____

_____

_____

_____

(3)

(b) (i) Suggest **one** reason why the students found no dandelion plants under the trees.

_____

_____

(1)

(ii) Suggest **one** reason why the students found no dandelion plants at 16 metres.

_____

_____

(1)

(c) The teacher suggested that it was **not** possible to make a valid conclusion from these results.

Describe how the students could improve the investigation so that they could make a valid conclusion.

_____

_____

_____

_____

(2)

(Total 7 marks)

5. Gardeners often collect fallen leaves in autumn and place them on compost heaps.

(a) Over the next year the leaves decay.

Which living things cause decay?

_____

(1)

(b) The leaves decay more quickly in summer than in winter.

Give **one** reason why.

_____

_____

(1)

(c) The compost heap has holes in its sides to let gases enter.

Which gas is needed for decay?

Tick (✓) **one** box.

Carbon dioxide ☐

Nitrogen ☐

Oxygen ☐

(1)

(Total 3 marks)

6. The drawings show two different species of butterfly.

Amauris

Hypolimnas

- Both species can be eaten by most birds.
- *Amauris* has an unpleasant taste which birds do **not** like, so birds have learned **not** to prey on it.
- *Hypolimnas* does **not** have an unpleasant taste but most birds do **not** prey on it.

(a) Suggest why most birds do **not** prey on *Hypolimnas*.

_____

_____

_____

_____

(2)

(b) Suggest an explanation, in terms of natural selection, for the markings on the wings of *Hypolimnas*.

_____

_____

_____

_____

_____

_____

(3)

(Total 5 marks)

7. Some students wanted to find the number of thistle plants growing on a lawn.
The students placed 10 quadrats at different positions on the lawn.
Each quadrat measured 1 metre × 1 metre.
The students counted the number of thistle plants in each quadrat.

(a) Which method should the students use to decide where to place the 10 quadrats?

Tick (✓) **one** box.

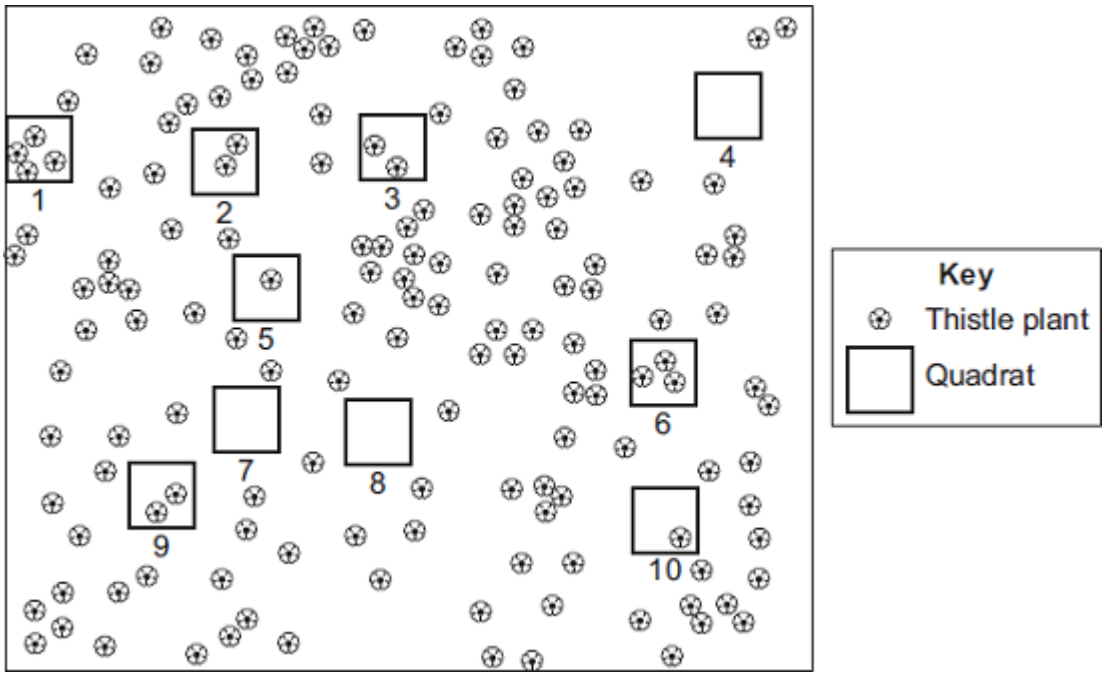
Place the quadrats as evenly as possible around the lawn. ☐

Place 5 quadrats in areas with many thistle plants and 5 quadrats in areas with only a few thistle plants. ☐

Place all the quadrats randomly on the lawn. ☐

(1)

(b) The diagram shows the lawn with the positions of the thistle plants and the students' 10 quadrats.



(i) Complete the table to show:

- how many thistle plants the students found in each of the first four quadrats
- the total number of thistle plants found in all 10 quadrats.

Quadrat number	Number of thistle plants in each quadrat
1	
2	
3	
4	
5	1
6	3
7	0
8	0
9	2
10	1
Total	

(2)

(ii) Calculate the mean number of thistle plants in one quadrat.

_____

Mean = _____

(1)

(iii) The lawn measured 12 metres long and 10 metres wide.

Use your answer from part (b)(ii) to estimate the number of thistle plants on the lawn.

_____

_____

Estimated number of thistle plants = _____

(2)

(c) How could the students make their estimate more accurate?

_____

_____

(1)

(Total 7 marks)

8. The photographs show four different species of bird.

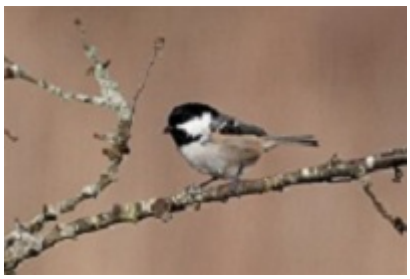
Great tit

© JensGade/iStock

Blue tit

© Marcobarone/iStock

Coal tit



© MikeLane45/iStock

Long-tailed tit

© Andrew Howe/iStock

The table gives information about the four species of bird in winter.

Bird species	Mean body mass in grams	Mean energy needed in kJ per day	Mean percentage of day spent feeding
Great tit	21	84.2	75
Blue tit	12	62.4	81
Coal tit	9	49.5	88
Lond-tailed tit	7	42.0	92

(a) (i) Calculate the energy needed per day per gram of body mass for the blue tit.

_____

_____

_____

Answer = _____ kJ per day per gram of body mass

(2)

(ii) Describe the trend for energy needed per day per gram of body mass for the four species of bird.

_____

_____

_____

(1)

(iii) Suggest an explanation for the trend you have described in part (a)(ii).

_____

_____

_____

_____

(2)

(b) Describe and explain the trend shown by the data for the time spent feeding in winter for the birds.

_____

_____

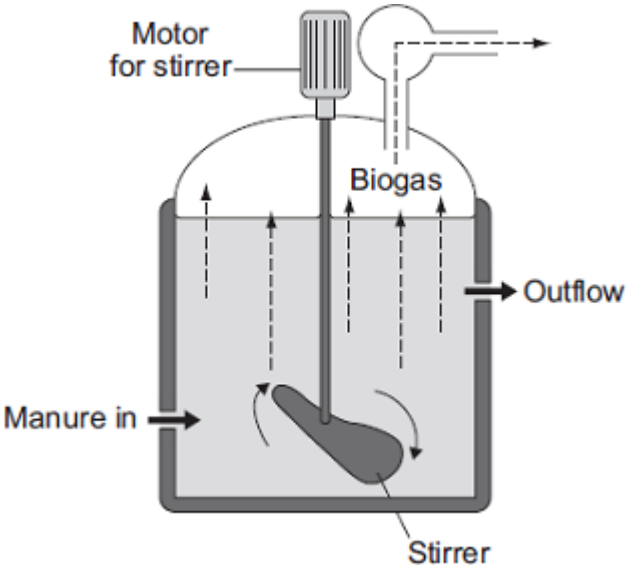
_____

_____

(2)

(Total 7 marks)

9. The diagram shows one type of biogas generator.



(a) With this type of biogas generator, the concentration of solids that are fed into the reactor must be kept very low.

Suggest **one** reason for this.

Tick (✓) **one** box.

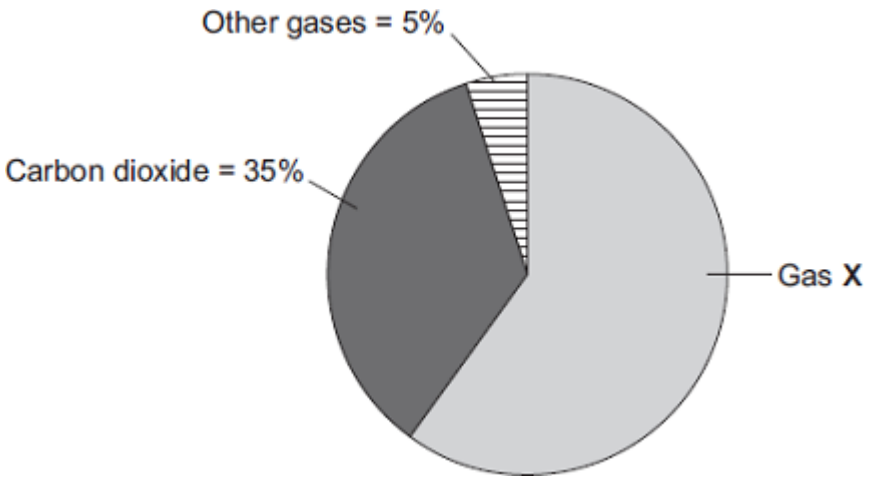
A higher concentration contains too little oxygen. ☐

A higher concentration would be difficult to stir. ☐

A higher concentration contains too much carbon dioxide. ☐

(1)

(b) The pie chart shows the percentages of the different gases found in the biogas.



Gas **X** is the main fuel gas found in the biogas.

(i) What is the name of gas **X**?

Draw a ring around **one** answer.

methane **nitrogen** **oxygen**

(1)

(ii) What is the percentage of gas **X** in the biogas?

Show clearly how you work out your answer.

_____

_____

Percentage of gas **X** = _____

(2)

(c) If the biogas generator is not airtight, the biogas contains a much higher percentage of carbon dioxide.

Draw a ring around **one** answer in each part of this question.

(i) The air that leaks in will increase the rate of

- aerobic respiration.
- anaerobic respiration.
- fermentation.

(1)

(ii) The process in part (c)(i) occurs because the air contains

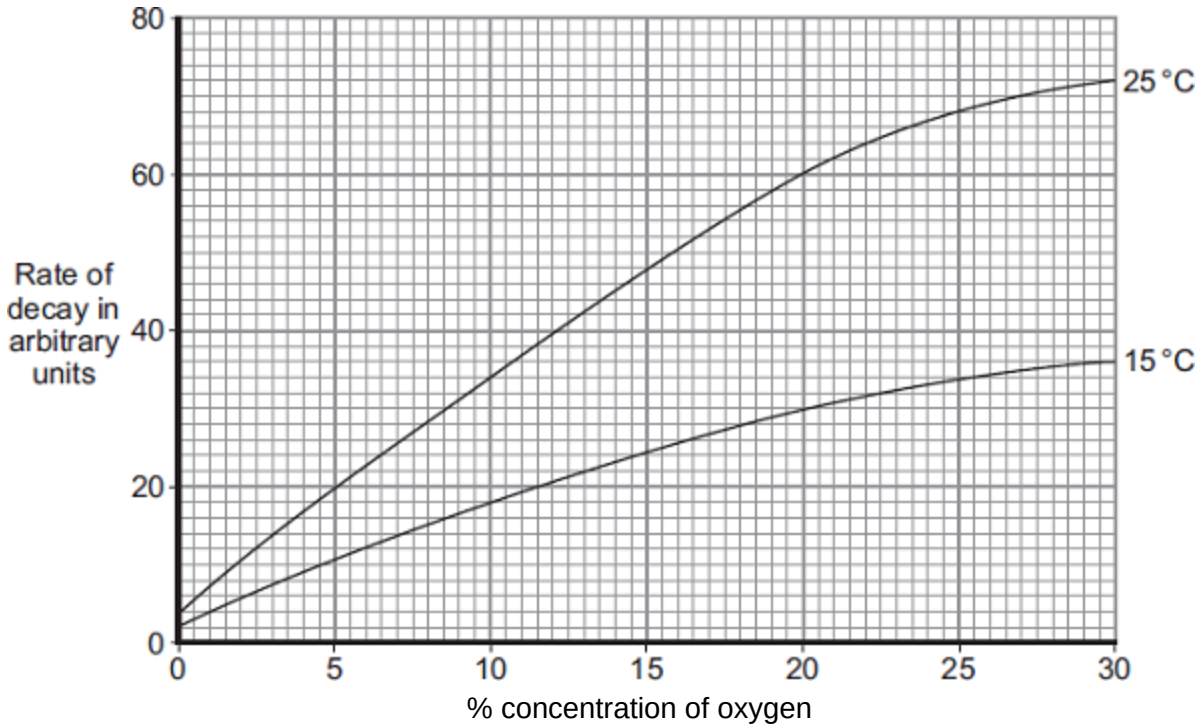
- ammonia.
- nitrogen.
- oxygen.

(1)

(Total 6 marks)

10. Gardeners often put waste material onto compost heaps.

The graph shows how the conditions in a compost heap affect how quickly waste material in the compost heap decays.



(a) (i) Describe the effect of increasing the temperature from 15°C to 25°C on the rate of decay at 20% oxygen concentration.

_____

_____

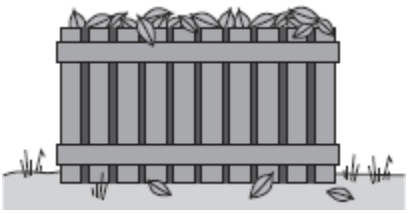
_____

_____

_____

(2)

(ii) Gardeners are advised to put waste materials into special compost bins.
These bins have holes in their sides.



Holes in the sides of the compost bin help the waste materials to decay faster.

Explain why.

_____

_____

_____

_____

_____

(2)

(b) A gardener noticed that some of his plants were growing poorly.

The gardener put some decayed compost onto the soil, around the plants.
One month later the plants were growing well.

Explain why.

_____

_____

(1)

(Total 5 marks)

11. A group of students investigated populations in a food chain in a garden.

The table shows the estimates of the number and biomass of some of the organisms the students found.

Organism	Number in the garden	Mean mass of each one in grams	Biomass of population in grams
Hedgehog	1	200	200
Slug	600	2	1200
Lettuce	60	100	

(a) (i) Calculate the biomass of the lettuce population.

Show clearly how you work out your answer.

_____

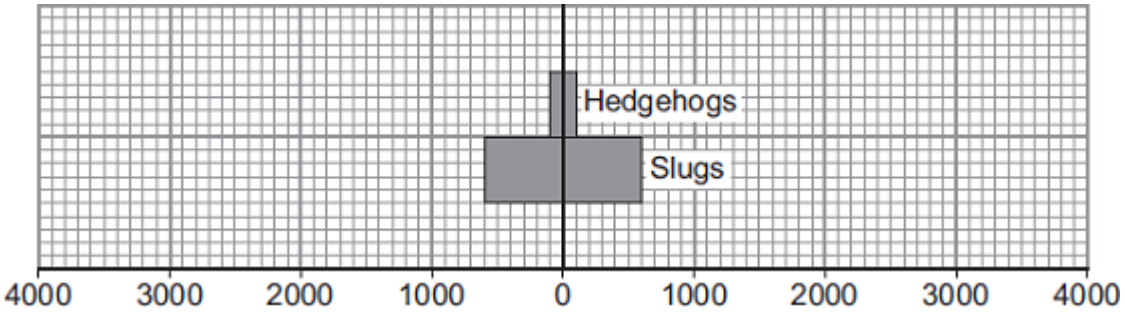
_____

Biomass = _____ grams

(2)

(ii) Use your answer to part (a)(i) to complete the pyramid of biomass.

Show the biomass of the lettuce population in the garden.



Biomass of population in grams

(2)

(b) The energy in the hedgehog population is much less than the energy in the slug population.

Explain why as fully as you can.

_____

_____

_____

_____

_____

_____

_____

_____

(3)

(Total 7 marks)

12. In a woodland, bluebells grow well every year.

Bluebells growing well in woodland

Mick Garratt [CC-BY-SA-2.0], via Wikimedia Commons

Each year the dead flowers and leaves of the bluebells and leaves from the trees fall onto the ground.
The bluebells do not run out of mineral ions.

Explain why the bluebells do **not** run out of mineral ions.

The words in the box may help you.

roots	**dead leaves**	**mineral ions**
microorganisms	**decay**	

_____

_____

_____

_____

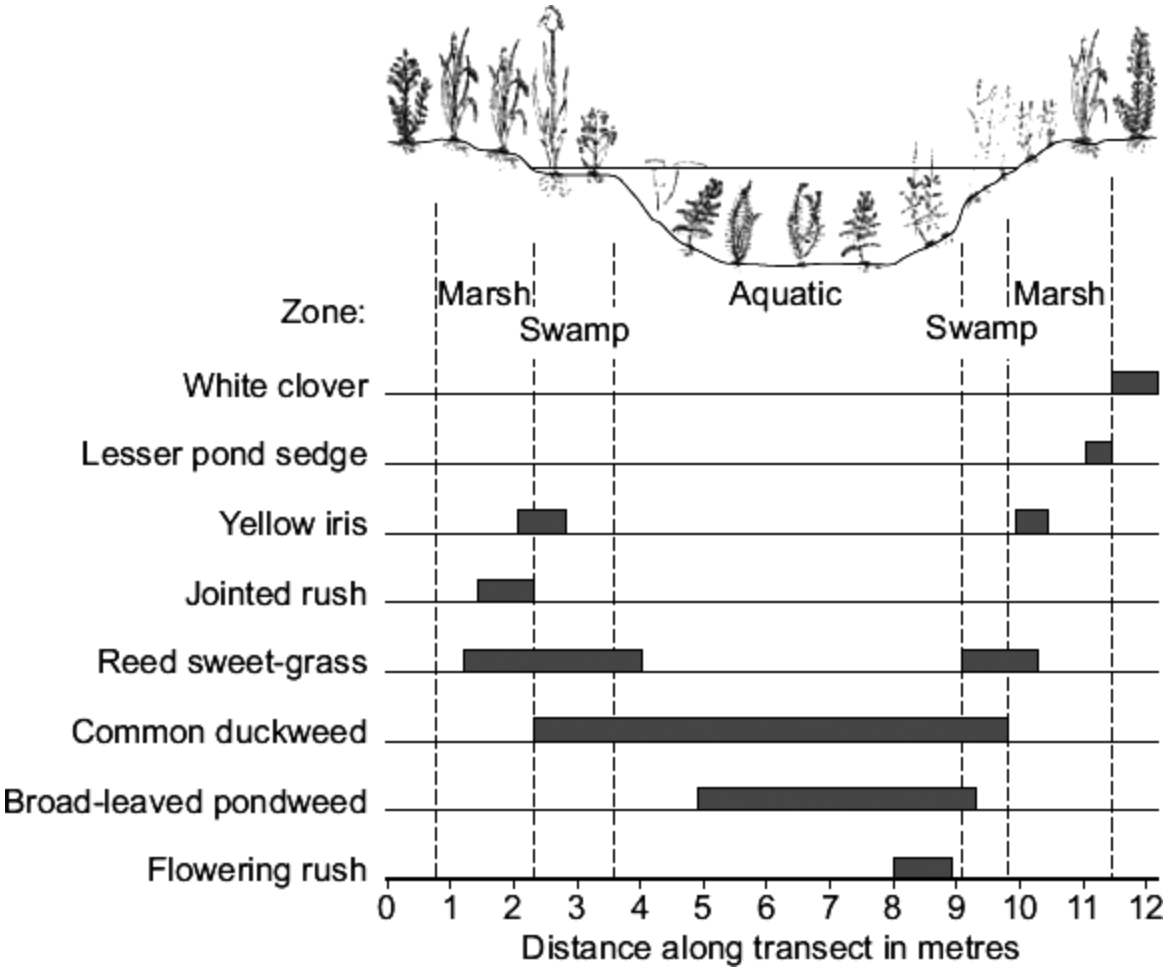
_____

_____

(Total 3 marks)

13. Some students investigated the distribution of some of the plants growing in and around a shallow stream. They sampled along a transect line.

The diagram shows their results.



(a) (i) Name the **one** species that grew only in the driest conditions.

_____

(1)

(ii) Only **one** species grew in the marsh, the swamp and in the aquatic zones.

Which species?

_____

(1)

(iii) Duckweed grows floating in water. What evidence is there for this in the students' results?

_____

_____

(1)

(b) *In this question you will be assessed on using good English, organising information clearly and using specialist terms where appropriate.*

Describe how you would use a $\frac{1}{2}$-metre × $\frac{1}{2}$-metre quadrat frame and a 30-metre tape measure to obtain data similar to the data shown in the diagram.

You should include details of how you would make sure that you would obtain valid results.

(6)

(Total 9 marks)

14. Many animals and plants are adapted to stop other organisms eating them.

(a) The photograph shows part of a plant stem.

By Forest & Kim Starr [CC BY 3.0], via Wikimedia Commons

Suggest how this plant is adapted to stop animals eating it.

Adaptation

_____

Describe how the adaptation helps to stop animals eating the plant.

_____

_____

(2)

(b) The photograph shows an insect on a plant twig.

By Fir0002 [CC BY-SA 3.0], via Wikimedia Commons

Suggest how this insect is adapted to stop animals eating it.

Adaptation

_____

Describe how the adaptation helps to stop animals eating the insect.

_____

_____

(2)

(c) The photograph shows some insects.

These insects are bright red.

By Greg Hume (Greg5030) [CC BY 3.0], via Wikimedia Commons

Suggest how these insects are adapted to stop animals eating them.

Adaptation

_____

Describe how the adaptation helps to stop animals eating the insect.

_____

_____

(2)

(Total 6 marks)

1. (a) (i) traps light (energy)

allow uses light / converts light energy to chemical energy

1

for photosynthesis / for making sugar / starch / carbohydrates

ignore food

allow organic molecules

1

(ii) dodder takes sugar / glucose / sucrose from phloem / dodder cannot make its own glucose / carbohydrate

or

phloem has sugar / glucose / sucrose

accept amino acids / fatty acids / other small organic molecule

ignore takes food / minerals / water / nutrients

1

(iii) any **one** from:

- not enough sugar / nutrients to grow / respire

  accept not enough food to grow / respire
- might strangle / restrict growth by squeezing stem tightly
- may damage stem tissues by growing into it
- may smother leaves / block light **so** less photosynthesis / less growth

1

(b) Marks awarded for this answer will be determined by the Quality of Communication (QC) as well as the standard of the scientific response. Examiners should also refer to the information on page 5, and apply a 'best-fit' approach to the marking.

0 marks
No relevant content.

Level 1 (1 – 2 marks)
Description and explanation of an adaptation which only involves hooks **and / or** suckers.

Level 2 (3 – 4 marks)
Description and explanation of adaptations including hooks **and / or** suckers with any other adaptation **or** explanation.

Level 3 (5 – 6 marks)
Description of most correct adaptations **and** explanations.

Examples of biology points made in the response:

- hooks – for holding on / not being detached
- suckers – for holding on / not being detached
- flattened / large surface area – absorption of (large amounts of) food
- no gut – not needed as host digests food
- thick cuticle – protection from host's enzymes / so not digested
- large number of eggs – increased chance of infecting new host

allow hermaphrodite and self-fertilising – likely to be just one worm per host

internal fertilisation – gametes not digested

6

[10]

2. (a) 3-layered triangular pyramid

as blocks or layered triangle, ignore (small) gaps between layers

1

(pyramid) labelled in food chain order

all three labels are required

*for **2** marks the pyramid must be fully correct*

1

(b) (i) C

1

(ii) shortest **or** fewest stages / transfers / (trophic) levels

allow only if (b)(i) is C or blank

1

less losses in waste / faeces / urine / CO_2 / excretion

allow smaller amount uneaten

1

less loss in respiration / heat / movement

allow less lost keeping warm

*do **not** allow energy for respiration*

*do **not** allow respiration makes energy*

*allow less loss (of biomass / energy) **or** less transfer (of biomass / energy) to surroundings if neither 2nd nor 3rd point given, for **1** mark*

1

[6]

3. (a) (i) to get data re position of seaweed / of organism

1

in relation to distance from sea / distance down shore / how long each seaweed was exposed

1

(ii) repeat several times

minimum = 2 repeats

1

elsewhere along the shore

1

(iii) bladder wrack is further up the shore (than the sea lettuce) / exposed for longer

ignore found in dry areas / on bare rock

1

sea lettuce (only) in rock pools / in the sea / (only) in water

1

(b) gets more light / closer to light

allow better access to CO_2

1

(so) more photosynthesis

allow 1 mark for light for photosynthesis

allow 1 mark for CO_2 for photosynthesis

ignore reference to oxygen for respiration

'more' only needed once for 2 marks

1

[8]

4. (a) any **three** from:

- place 30-m tape measure across field / from one wood to the other
- place quadrat(s) next to the tape
- count / record the number / amount of dandelions / plants in the quadrat

  ignore 'record the results'

  ignore measures / estimates dandelions
- repeat every 2 metres

  allow every metre / at regular intervals

3

(b) (i) low light / it is shady

allow no light

ignore sun / rays

or

not enough water / ions / nutrients

accept correct named ion

ignore no water / ions / nutrients

or

wrong pH of soil

accept competition with trees for light / water / ions

ignore competition for space and competition unqualified

accept soil too acidic / too alkaline

ignore temperature

1

(ii) sensible suggestion for a small area, eg chance variation / anomaly / poisoned by animal waste / wrong pH of soil / eaten (by animals) / cut down / footpath

1

(c) repeat (transect) / compare with the results of other groups

allow 'do it in two different locations' for 2 marks

1

at different / random location(s) / elsewhere (across the field)

*do **not** allow 'in other fields'*

1

[7]

5. (a) microorganisms / microbes / bacteria / fungi / decomposers

*allow named example **or** mould*

ignore germs / worms / other detritivores

1

(b) (weather / it is) warm(er) / hot(ter)

accept optimum conditions for enzymes

allow cold(er) in winter

ignore wet(ter) / light(er) / sun

*do **not** accept heat dries the leaves out*

1

(c) oxygen

no mark if more than one box is ticked

1

[3]

6. (a) wing pattern similar to *Amauris*

allow looks similar to Amauris

1

birds assume it will have an unpleasant taste

1

(b) mutation / variation produced wing pattern similar to *Amauris*

*do **not** accept breeds with Amauris*

*do **not** accept idea of intentional adaptation*

1

these butterflies not eaten (by birds)

1

these butterflies breed **or** their genes are passed to the next generation

1

[5]

7. (a) place all the quadrats randomly on the lawn

1

(b) (i) 1 4

2 2

3 2

4 0

all 4 counts correct

1

Total = 15

total correct for their figures

1

(ii) 1.5

allow ecf from (b)(i)

1

(iii) 180

correct answer with or without working

*if answer incorrect, allow **1** mark for* $\frac{15}{10}$ *x 120 **or** 15 x 20*

or $\frac{15}{10}$ *x 12 x 10*

***or** 1.5 x 12 x 10 **or** 1.5 x 120*

allow ecf from (b)(ii)

*allow **1** mark if only 1 error*

2

(c) use a larger sample size / more quadrats

ignore repeats but allow repeat in different places

ignore 'count them all'

or

use bigger quadrats

1

[7]

8. (a) (i) 5.2

*award **2** marks for correct answer, irrespective of working or lack of it*

*award **1** mark for 62.4 ÷ 12 only with incorrect or no answer*

2

(ii) the smaller the (mass of the) bird the more energy is needed (per gram of body mass)

allow converse

ignore figures

1

(iii) smaller bird has larger surface area : volume / mass ratio

allow converse

1

so heat / energy lost more quickly

allow lose more heat / energy

*if (a)(ii) describes a trend of more energy with increasing body mass allow **one** mark for idea of more energy needed for flight*

1

(b) larger birds spend less time feeding

accept converse

allow the less energy they need per day the longer they spend feeding

1

since they need less food per gram of body mass (to satisfy energy needs)

1

[7]

9. (a) a higher concentration would be difficult to stir

1

(b) (i) methane

1

(ii) 60

100 - (5 + 35) but incorrect answer allow 1 mark

2

(c) (i) aerobic respiration

1

(ii) oxygen

1

[6]

10. (a) (i) increase / higher / faster / quicker

1

numerical comparison eg from 30 to 60 **or** by 30 **or** it is 30 at 15°C *and* 60 at 25°C

*award **2** marks for doubles / goes twice as fast or 30 units more*

1

(ii) any **two** from:

- oxygen / air (in)
  ignore air out
  *do **not** accept lets oxygen*
  ignore reference to other substances / light passing in or out
- for microorganisms / bacteria / microbes / fungi / decomposers
  ignore microorganisms passing in
  ignore worms / germs / bugs / other detritivores
- (for aerobic) respiration (of microorganisms)
- let excess heat out
  ignore heat in

2

(b) compost contains minerals / nutrients / elements / ions / named

allow improve drainage / moisture
allow contains nitrogen
ignore CO_2 / food / goodness / fertiliser
*do **not** accept vitamins / glucose*

1

[5]

11. (a) (i) 6000

*award **2** marks for correct answer irrespective of working*
*allow **1** mark for 60 × 100 with incorrect or no answer*
allow answer in table if answer line blank

2

(ii) bar width 6000 **or** to match answer to (a)(i)

anywhere on scale ignore depth / height of bar

1

drawn below slugs

label not required

1

(b) any **three** from:

ignore references to number / size / mass of organisms

assume reference is to / of hedgehog unless stated otherwise

- respiration (by hedgehog)

  *do **not** accept idea that respiration uses / produces energy*

- faeces (of hedgehog) **or** (slug) not absorbed (by hedgehog) **or** (slug) not digested (by hedgehog) /
- excreted / urine / urea (by hedgehog)

  *accept waste for **1** mark if neither faeces nor excretion point made*

- not all slug (s) eaten (by hedgehogs) **or** some slugs eaten by other things **or** not all parts (of slug) eaten

  ignore (some) slugs die

- movement (by hedgehog)

- heat (from hedgehog)

  allow appropriate references to biomass lost by these methods, rather than energy losses

3

[7]

12. any **three** from:

ignore references to carbon cycle

accept digested / decomposed / broken down / rotted for decay throughout

ignore eating

- dead leaves / flowers / bluebells are decayed
- idea that microorganisms do the decaying

  accept microbes / bacteria / fungi / mould / decomposers for microorganisms

- minerals / ions / nutrients / named released (by decay / microorganisms)

  ***not** mineral ions unqualified*

- (released) into soil **or** minerals / ions / nutrients taken up / in by (bluebell) roots (next year)

  look for idea that minerals / ions / nutrients are in soil (eg released into soil or taken up from soil)

3

[3]

13. (a) (i) (white) clover

1

(ii) reed sweet-grass

allow reed

allow grass

1

(iii) (only) found in swamp and aquatic zones **or** <u>only</u> found in water
or doesn't grow in marsh

ignore wet conditions

1

(b) Marks awarded for this answer will be determined by the Quality of Written Communication (QWC) as well as the standard of the scientific response.
Examiners should also apply a 'best-fit' approach to the marking.

0 marks

No relevant content.

Level 1 (1-2 marks)
There is a basic description which describes how a quadrat **or** a metre tape could be used to collect data

Level 2 (3-4 marks)
There is a clear description of how a quadrat **and** a metre tape could be used to collect data along a line

Level 3 (5-6 marks)
There is a clear, logical and detailed description of a method that will produce valid, repeatable results across / at intervals along the stream.

examples of procedural points made in the response:

- use of tape measure to produce transect
- placing of quadrats
- transect placed across stream
- score presence of each plant species
- use quadrat at regular intervals along tape
- repeat transect several times (≥ 3)
- along stream
- at random **or** regular intervals

6

[9]

14. (a) *answer to be marked as a whole*

has thorns / prickles / points

accept sharp points

1

(these) hurt animal

allow frighten animal

***only** accept prevent animal eating leaves if qualified by 'hurting' or 'frightening'*

1

(b) *answer to be marked as a whole*

camouflaged / looks like twig / disguised

allow blends in

ignore too small to see

1

(animal) cannot **see / detect** / recognise it

allow animal does not eat twigs

***only** accept prevents animal eating it if qualified by 'seeing' or 'wrong food'*

1

(c) *answer to be marked as a whole*

red / colour

1

warns that insect might be poisonous / dangerous

allow inedible / tastes bad

1

[6]