

1(a). Mistletoe is a green plant that is often seen growing high in a tree in winter.



Mistletoe can photosynthesise, but not at a very fast rate.

It therefore needs to act as a parasite on the tree.

Explain why the mistletoe grows into the phloem of the tree.

[2]

(b). Scientists investigate two different species of mistletoe growing on a tree. One species of mistletoe has greener leaves than the other.

They give the tree carbon dioxide which contains radioactive carbon.

The carbon dioxide is not supplied to the mistletoe.

They then measure:

- the chlorophyll content of the mistletoe plants,
- the percentage of sugar that is radioactive in each type of mistletoe.

The table shows their results.

Species of mistletoe	Chlorophyll content in mg / g of tissue	Percentage of sugar in the mistletoe that is radioactive (%)
Dwarf mistletoe	0.4	39
Eastern mistletoe	0.9	1

- i. Explain why sugar in the mistletoe becomes radioactive.

[2]

- ii. Explain the relationship between the chlorophyll content and the percentage of radioactive sugar in each species of mistletoe.

[3]

2(a). Bacteria are found in milk.

They can cause the milk to decompose.

Enzymes from the bacteria convert sugar in the milk into lactic acid.

Some students investigate the effect of temperature on the decomposition of milk.

This is the method the students use:

- Pour 20 cm³ of milk into 3 different beakers.
- Keep each beaker in a water bath at a different temperature: 15 °C, 25 °C and 35 °C.
- Measure the pH of the milk at different times over 4 days.

The table shows their results.

Temperature (°C)	pH of milk				
	at the start	after 12 hours	after 24 hours	after 48 hours	after 72 hours
15	6.5	6.4	6.3	6.1	5.8
25	6.5	6.3	6.2	5.9	5.5
35	6.5	6.3	6.1	5.5	4.9

Explain why the students measured the pH of the milk.

----- [2]

(b). Describe how the students should display their results in a graph.

----- [3]

(c). Explain the effect of increasing the temperature on the decomposition of the milk in the experiment.

----- [3]

(d). The students plan a further experiment where they boil the milk first before placing it in the beaker.

Predict what effect this would have on the results.

Explain your answer.

Prediction

Explanation

----- [2]

3. All the living organisms and the place where they live is called ...

- A A community
- B A habitat
- C A population
- D An ecosystem

Your answer

☐

[1]

4. Which processes in the carbon cycle return carbon to the atmosphere?

- A Decomposition and photosynthesis
- B Decomposition and respiration
- C Photosynthesis and fossilisation
- D Respiration and fossilisation

Your answer

☐

[1]

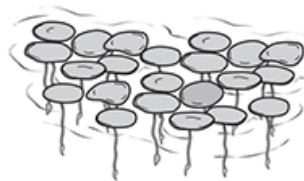
5. Explain how there can be a large community of butterflies but a low biodiversity of butterflies in an area.

[2]

6(a). Some students investigate the effect of run-off water from a farm on the growth of plants. The run-off water is washed off the fields in the farm when it rains.

They use a pond plant called duckweed, shown in the diagram. A duckweed plant has a single leaf that floats on the surface of the water.

They chose duckweed because it is easy to count the plants.



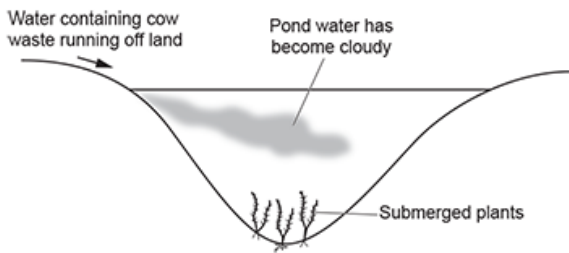
This is the method they follow:

- Put different volumes of clean pond water and run-off water into 4 beakers.
- Add 3 duckweed plants into each beaker.
- Leave the beakers for ten days at the same temperature.

The table shows the results.

Beaker number	Contents	Number of duckweed plants after ten days
1	250 cm ³ of pond water	6
2	230 cm ³ of pond water + 20 cm ³ of run-off	12
3	210 cm ³ of pond water + 40 cm ³ of run-off	24
4	190 cm ³ of pond water + 60 cm ³ of run-off	48

An article said that the run-off water contains waste from cows and this makes the pond water cloudy. The run-off water is reducing the growth of submerged plants that grow in the pond. The diagram shows this process.



Explain the results of the students' experiment and why using duckweed produces results that do **not** agree with the effect of run-off water described in the article.

[3]

(b). The students change their method to use a submerged plant rather than using duckweed.

Describe how the students could change their method to measure the growth of the submerged plant.

[1]

7.

Buddleia, a butterfly's friend?

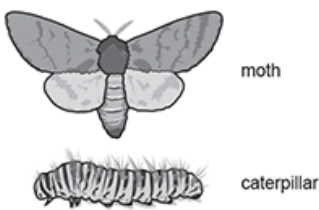
Buddleia flowers attract butterflies that feed on nectar.

Buddleia bushes produce large numbers of very small seeds. This means that buddleia bushes quickly colonise new habitats.

This has resulted in the populations of other plants decreasing. Scientists have noticed there are large communities of butterflies in these areas but the biodiversity of butterflies is low.

Suggest why the colonisation of land by buddleia bushes has caused a decrease in the populations of other plants.

8(a). Pine processionary moths lay eggs that develop into larvae and then into caterpillars, as shown in the diagram.



The caterpillars are a major pest, eating and killing pine trees.

The caterpillars are fed on by birds such as cuckoos. The caterpillars are also parasitised by fungi.

Draw a labelled pyramid of biomass for these feeding relationships showing the organisms at each level.

[2]

(b). Scientists have tried to use natural plant defence methods on the larvae to conserve the pine trees.

The table shows the effects of two plant-based oils on the larvae in laboratory conditions and on the pine trees.

Type of oil	Deaths per 1000 larvae	
	In the laboratory	On the pine tree
Ginger	712	874
Rosemary	300	761
Control treatment	13	22

- i. Calculate the percentage increase in the death of larvae on the pine trees compared to in the laboratory for the control treatment.

Percentage change = % **[2]**

- ii. More larvae die in the natural environment of the pine trees than in the laboratory for all treatments.

Suggest **one** reason why.

-----**[1]**

- iii. Evaluate the use of the two plant oils in the control of the larvae.

Use data from the table.

-----**[3]**

9. What is the definition of a parasite?

- A** An organism that kills another organism and then feeds from it.
B An organism that kills another organism by out-competing it.
C An organism that lives on or in another organism causing it harm.
D A microorganism that causes disease in another living organism.

Your answer

☐

[1]

END OF QUESTION PAPER