

GCSE Biology (9 – 1)

Nutrient Cycles and Decomposition

Name:

Group:

Instructions

- Read each question carefully before you begin to answer it.
- Use black ink or black ball-point pen for your answers.
- Fill in the boxes at the top of this page with your name and group.
- Attempt to answer every question in the booklet.
- Answer the questions in the spaces provided – there may be more space than you need in some answer spaces.
- Calculators may be used for this booklet.
- For any calculations, you **must** show all your working.
- Any and all drawings or graphs should be completed in pencil.



For markers use	
Question	Mark
1	/6
2	/7
3	/7
4	/7
5	/6
6	/18
Total	/51
%	
Grade	

Information

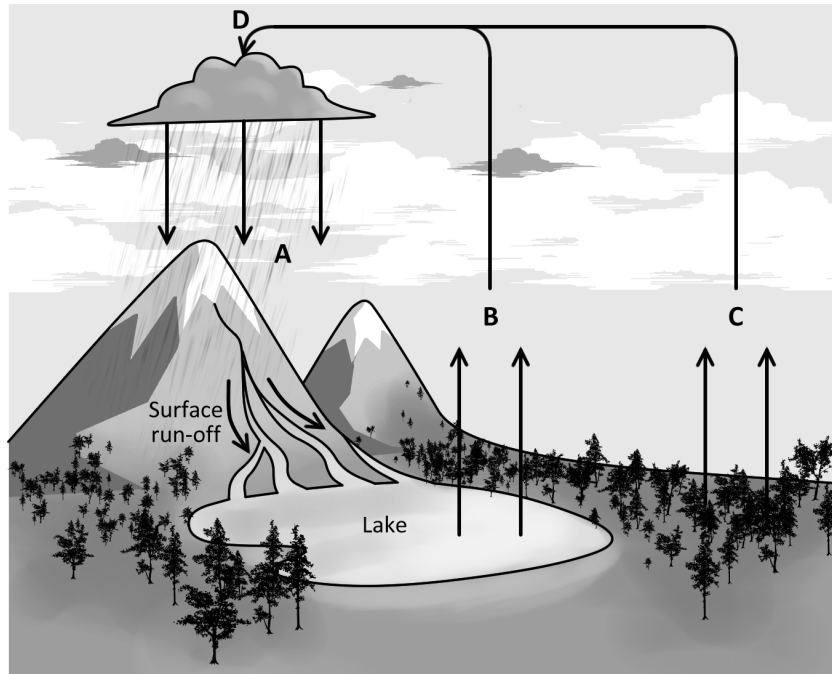
- The maximum mark for this paper is 51 marks.
- The marks for each question are shown in brackets.
- Please be aware that good English and clear presentation are required in your answers.



1. All living organisms require essential materials from their environment to survive and grow this question explores how these materials are continuously recycled within ecosystems through processes like the carbon and water cycles, driven by the vital role of decomposers.

For each of the multiple choice questions below circle the letter of the correct answer for each.

- a. The figure below shows a simplified image of the water cycle.
Which label represents **transpiration**?



A

B

C

D

(1 mark)

- b. Which statement best describes the role of decomposers in an ecosystem?

- A They produce glucose using energy from the sun.
- B They transfer energy by eating producers.
- C They return mineral ions to the soil.
- D They introduce new energy into the food chain.

(1 mark)

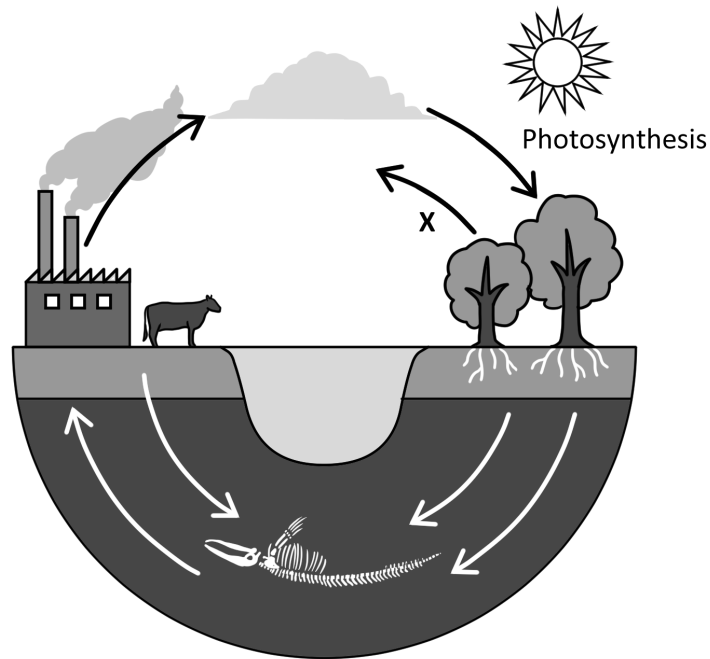
- c. A student sets up an investigation into the rate of decay. For decay to happen quickly, the decomposers need the right conditions to respire and grow.

Which combination of conditions would lead to the fastest rate of decay?

- A Cold, dry and high oxygen levels.
- B Warm, waterlogged and low oxygen levels.
- C Warm, moist and high oxygen levels.
- D Hot, dry and low oxygen levels.

(1 mark)

- d. The figure below shows an image of the carbon cycle.
Identify the process labelled X in the figure.



- A** **B** **C** **D**
Photosynthesis Transpiration Aerobic respiration Decomposition
(1 mark)

- e. Water is continuously cycled between the land, the atmosphere and living organisms.
Which process describes water vapour turning back into liquid water droplets?

- A** **B** **C** **D**
Condensation Evaporation Precipitation Transpiration
(1 mark)

- f. A scientist investigated how temperature affects the rate of decay. They placed identical samples of dead leaves into two composters, J and K. Both composters started with 4000 g of dead leaves.

Composter J was kept at a constant temperature of 25 °C.

Composter K was kept at a constant temperature of 10 °C.

The mass of the leaves in each composter was recorded after 50 days. The results are shown in the table below.

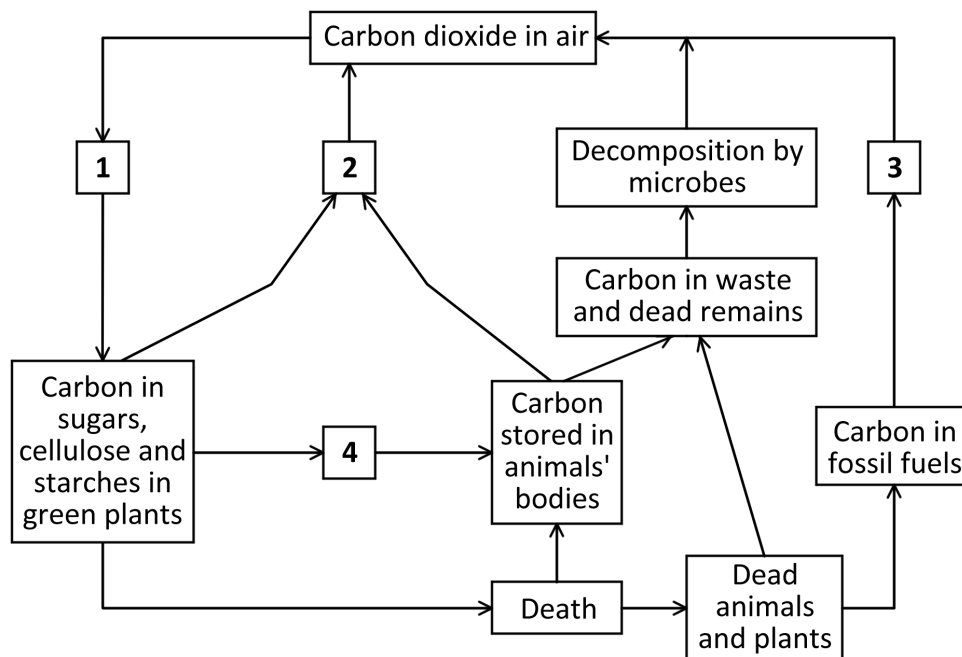
Composter	Temperature in °C	Final mass of leaves after 50 days in g
J	25	1800
K	10	3200

Calculate the mean rate of decay in composter J.

- A** **B** **C** **D**
0.036 kg/day 0.044 kg/day 0.080 kg/day 44.0 kg/day
(1 mark)

(Total for Question 1 is 6 marks)

2. The figure below shows the carbon cycle.



a. Identify the processes taking place at the labelled points in the figure above.

1 = ...

2 = ...

3 = ...

4 = ...

(4 marks)

b. Green plants are important in the carbon cycle.

Describe **two** processes by which green plants affect the concentration of carbon dioxide in the atmosphere.

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(2 marks)

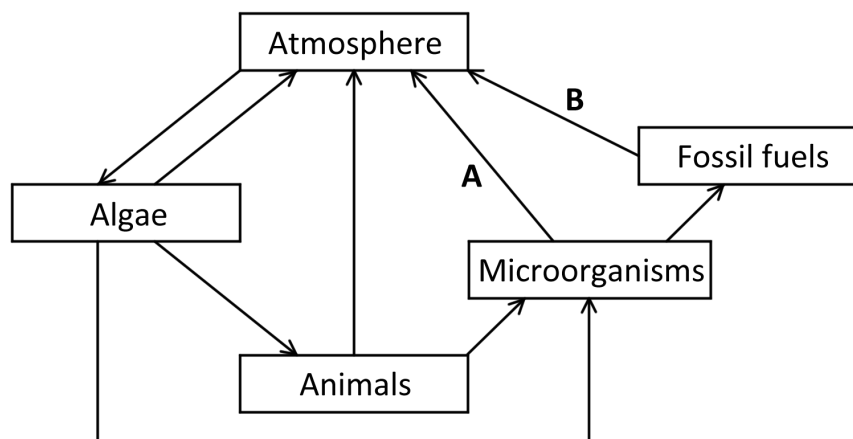
c. Give **one** biological process that could cause the lower concentration of carbon dioxide in the summer.

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(1 mark)

(Total for Question 2 is 7 marks)

3. The figure below shows a small part of a carbon cycle in a marine habitat.



a. Identify the processes shown by arrows **A** and **B**.

A = ...

B = ...

(2 marks)

b. Describe how the activities of algae can both decrease and increase the concentration of dissolved carbon dioxide in the water.

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(3 marks)

c. Decomposition of dead organic matter happens much faster in tropical rainforests than in colder habitats. Explain two reasons why.

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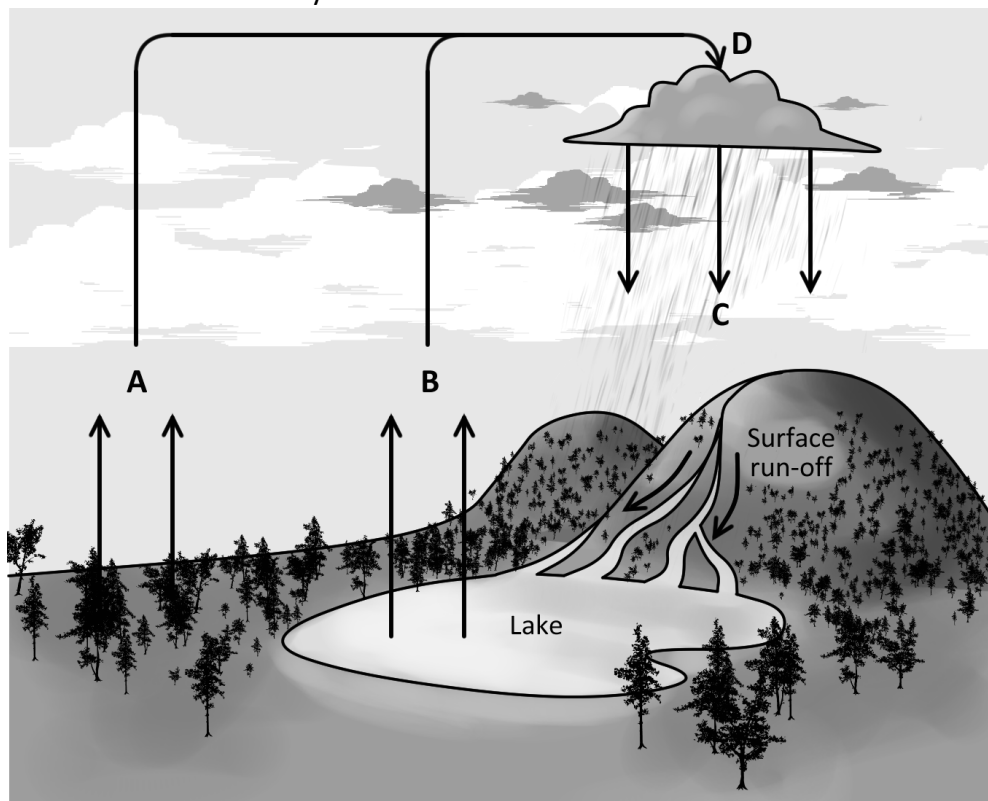
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(2 marks)

(Total for Question 3 is 7 marks)

4. The figure below shows the water cycle.



a. Identify the processes **A**, **B**, **C** and **D**.

A = ...

B = ...

C = ...

D = ...

(4 marks)

b. Explain how surface run-off from a field fertilised by farmers can lead to an increase in the population of fish in a lake.

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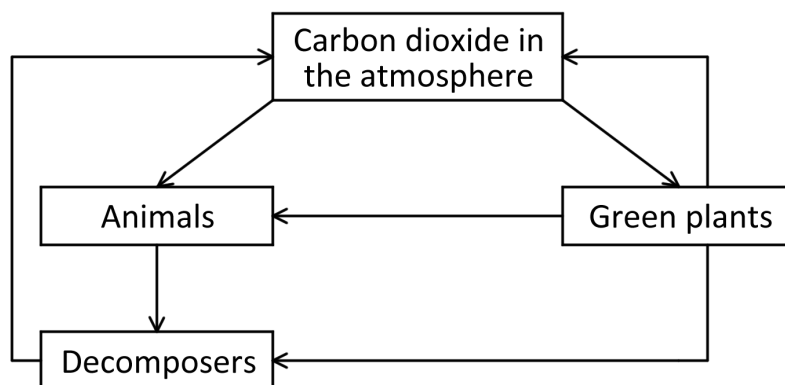
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(3 marks)

(Total for Question 4 is 7 marks)

5. The figure below shows part of the carbon cycle in a grassland habitat.



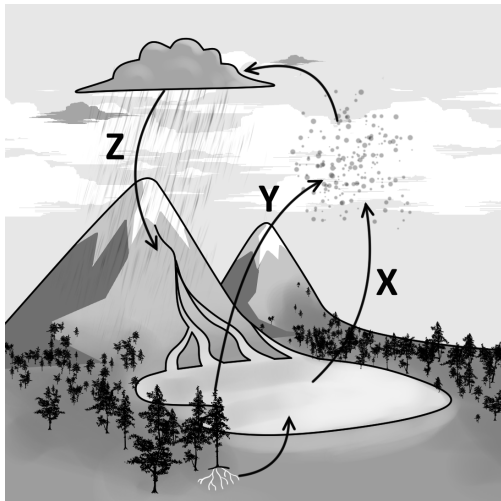
Describe how living things are involved in the constant cycling of carbon.

[illegible]

(6 marks)

(Total for Question 5 is 6 marks)

6. Water is cycled through ecosystems. The figure below shows a water cycle.



a. Identify the processes **X**, **Y** and **Z**.

X = ...

Y = ...

Z = ...

(3 marks)

b. Describe the role of water in **two** named life processes that occur in plants.

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(2 marks)

c. Burning fossil fuels releases gases like sulphur dioxide.

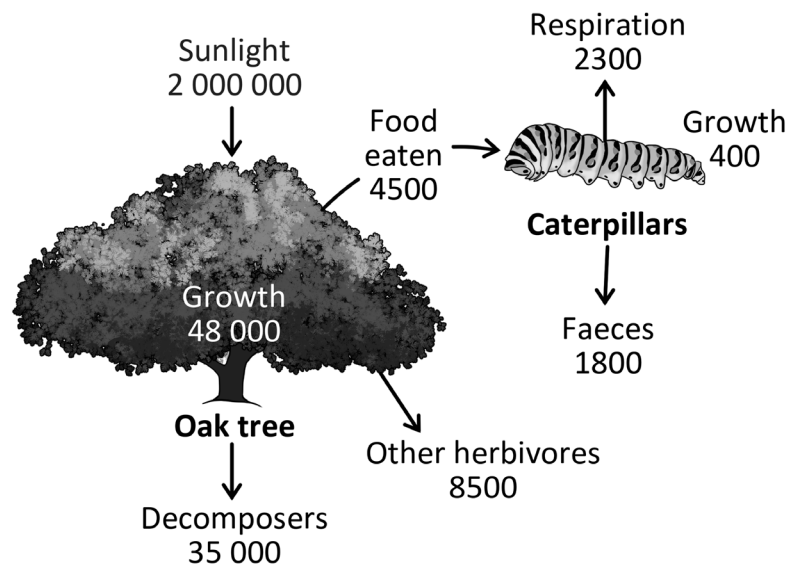
Explain how this type of air pollution can negatively affect organisms when it interacts with the water cycle.

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(2 marks)

The image below shows the flow of energy through a grassland chain.

The figure are in kilojoules/m²/year.



- d. Use the information in the figure above to calculate the percentage efficiency of energy transfer for the oak tree. Give your answer to **two** significant figures.

Percentage efficiency = ... %
(2 marks)

- e. The total energy taken in by the caterpillar is 4500 kJ/m²/year.
The caterpillar uses 600 kJ/m²/year of this energy for growth.

Calculate the percentage of the energy taken in by the caterpillar that is **not** used for growth.
Give your answer to **three** significant figures.

Percentage = ... %
(2 marks)

- f. The efficiency of energy conversion for the caterpillar is 8.9%.
The efficiency for the oak tree is significantly lower.

Calculate how many times more efficient the caterpillar is at converting its energy input into growth compared to the oak tree. Use your answer from part (d).

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(2 marks)

- g. A large proportion of the energy taken in by the caterpillar is not converted to biomass.
Explain **two** ways this energy is lost. The figure above shows two of these losses.

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(2 marks)

- h. The diagram shows that 35 000 kJ/m²/year of energy is transferred to decomposers when parts of the oak tree, such as leaves, die.
Describe the role of decomposers in the carbon cycle.

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(3 marks)

(Total for Question 6 is 18 marks)