# Edexcel IGCSE(9-1) Biology

## Specification Based Exam Questions

### Part 4: Ecology and the Environment

This resource is to help you gain exam technique as well as understand what is needed to develop your answers to nearly all the points of the specification. You should use this in conjunction with other revision practices.

Good luck!

# 4 Ecology and the environment

## 4.1 understand the terms population, community, habitat and ecosystem

(d) (i) What is meant by the term **habitat** (line 9)?

(1)

(ii) What is meant by the term **population** (line 9)?

(1)

(e) Ecology involves the study of organisms in their environment.

With reference to the investigation in this question, explain the terms

(i) population

(1)

(ii) community

(1)

(iii) habitat

(1)

## 4.2 *practical: investigate the population size of an organism in two different areas using quadrats*

**1** The passage describes the study of organisms and their ecosystems.

Complete the passage by writing a suitable word in each of the spaces.

(8)

Ecology is the study of the interaction of the organisms in an ecosystem with

their _____. This is made up of biotic or living factors and

abiotic or non-living factors.

In an ecosystem a group of organisms of the same species living in one place is a

_____. Different groups of species living in the same place or

habitat is called a _____.

To study the number and distribution of plants in an area, a wooden or metal frame is used. This

is called a _____. To compare numbers of organisms in two areas

several frames need to be placed at _____ places in each area.

The numbers in each frame are combined and then divided by the total number of frames.

This is done to calculate the _____ for each area. By using several

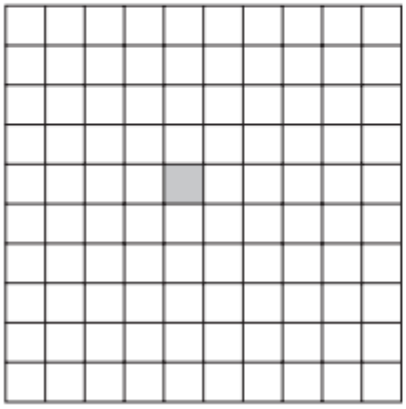
frames we improve the _____ of the data and make it easier to

detect any _____ results.

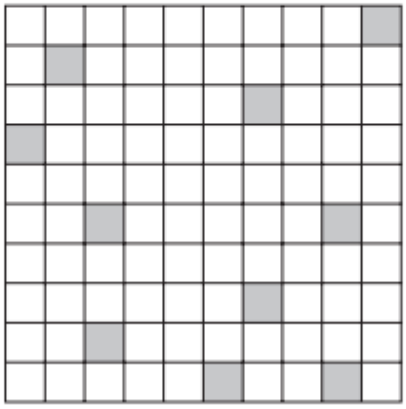
**5** Three students were asked to estimate the population size of a plant species in an area by using a quadrat.

The diagram shows where each student placed their quadrat in the area.

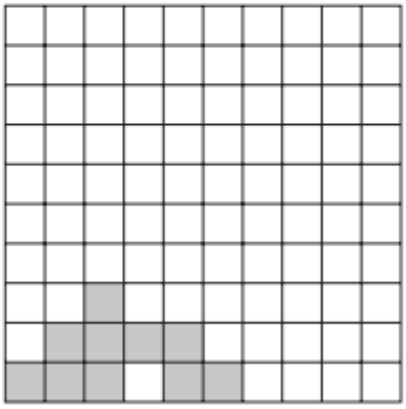
Student A



Student B



Student C



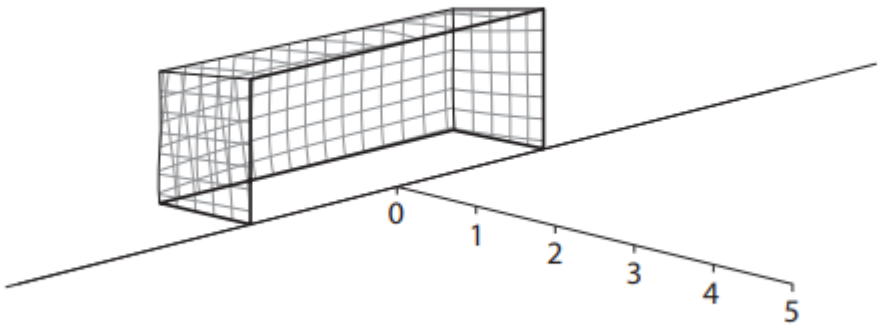
(a) (i) Which student would obtain the most reliable estimate?

Give reasons for your answer.

**(2)**

(b) Five other students investigated the distribution of grass in the goal area of a football pitch.

They placed a small quadrat at the goal line and then at one metre intervals in a straight line away from the goal line. The diagram shows their method.




The quadrat was 10 cm by 10 cm and was made from clear plastic. It was marked into 100 squares of 1 cm x 1 cm. If grass could be seen in 10 of the squares the percentage cover would get a score of 10%.

The table shows the results obtained by the five students.

| Student | Percentage cover of grass at different distances from the goal line | | | | | |
|---|---|---|---|---|---|---|
| | 0 m | 1 m | 2 m | 3 m | 4 m | 5 m |
| A | 14 | 14 | 38 | 41 | 90 | 100 |
| B | 20 | 13 | 5 | 47 | 82 | 90 |
| C | 15 | 14 | 45 | 50 | 86 | 85 |
| D | 10 | 18 | 35 | 50 | 75 | 83 |
| E | 10 | 15 | 30 | 50 | 70 | 90 |
| average | 14 | 15 | 37 | 48 | 81 | 90 |

(i) One of the averages of the results has been calculated ignoring an anomalous result.

Which student obtained the anomalous result?

(1)

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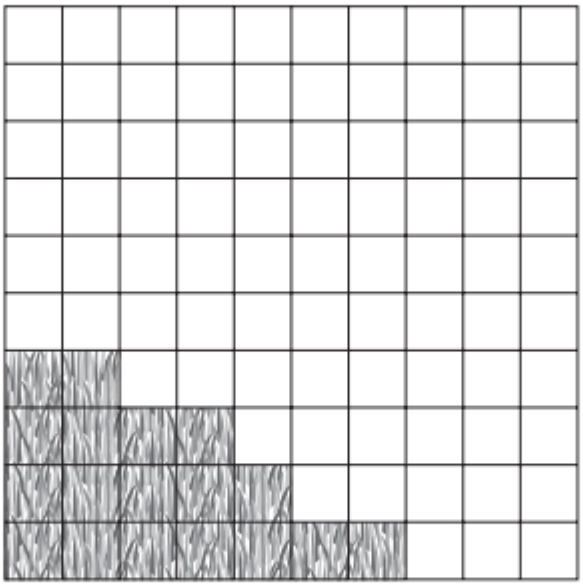
(ii) The diagram shows a quadrat used by one of the students, and the number of 1cm squares where grass can be seen.



Which student obtained the results shown in this quadrat?

(1)

**4.3B understand the term biodiversity**

**4.4B *practical: investigate the distribution of organisms in their habitats and measure biodiversity using quadrats***

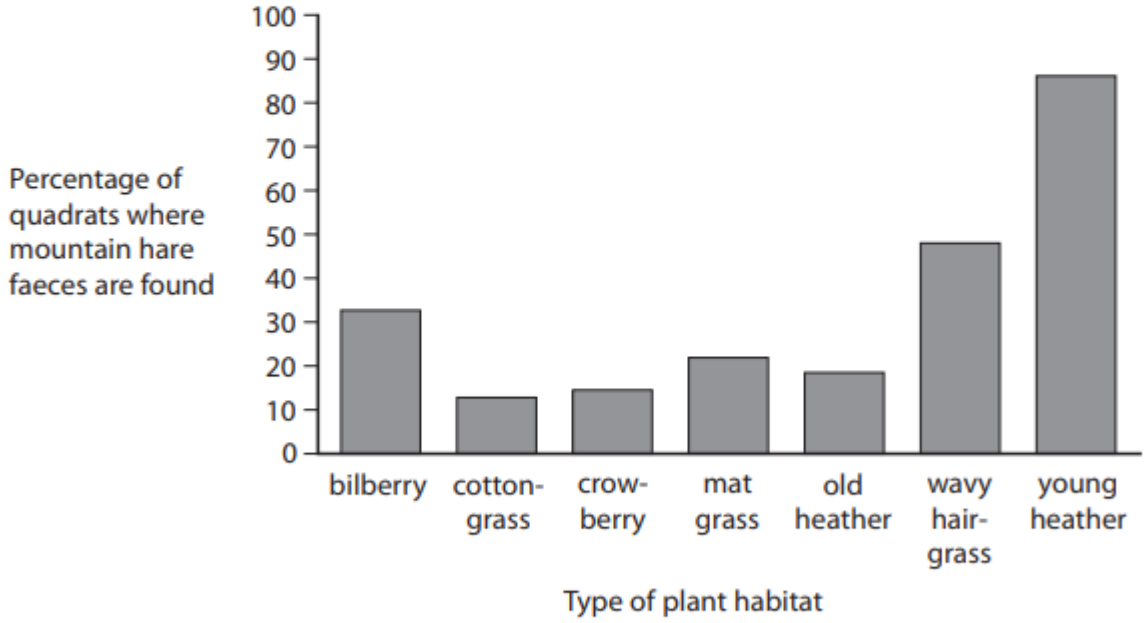
(b) Scientists want to find out which type of plant habitat mountain hares prefer.

They use quadrats to sample seven habitats.

Each habitat contains a different type of plant.

The scientists calculate the percentage of quadrats in each habitat where mountain hare faeces are found.

The graph shows the results.




(i) Name the type of plant habitat that the mountain hares like best.

**(1)**

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(ii) Suggest three reasons why mountain hares may prefer to eat the plants in some habitats rather than plants in other habitats.

**(3)**

1 .....

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2 .....

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3 .....

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(c) The scientists use 700 quadrats in one plant habitat and find that 224 quadrats contain mountain hare faeces.

(i) Calculate the percentage of quadrats containing mountain hare faeces in this habitat.

Show your working.

(2)

percentage of quadrats = ..... %

(ii) Name the type of plant habitat where the scientists collected these results.

(1)

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(d) The scientists use a large number of quadrats to make sure the data collected is reliable.

Describe a procedure they should follow to make sure the data collected using quadrats is valid.

(1)

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**4.5 understand how abiotic and biotic factors affect the population size and distribution of organisms**

(b) After 20 years, the plants in area A had a greater biomass than those in area B.

(i) Explain how abiotic (non-living) factors could cause this difference.

**(4)**

(ii) Explain how biotic (living) factors could cause this difference.

**(2)**

**4** The photograph shows an Arabian oryx.

Arabian oryx live in the desert where there is no free-standing water. Most of their habitat is sand. Plants, such as grass and small trees, cover only a small area. Oryx feed mainly on grass.

Summers are hot. Daytime temperatures can be as high as 41 °C and temperatures at night only fall to 24 °C. Oryx are less active in summer than in winter. In summer, they reduce their energy use by changing their behaviour and body processes.

(a) Suggest why oryx are less active in summer than in winter.

**(3)**

(b) In summer, oryx rest under trees during the day and feed at night. Suggest why they do this.

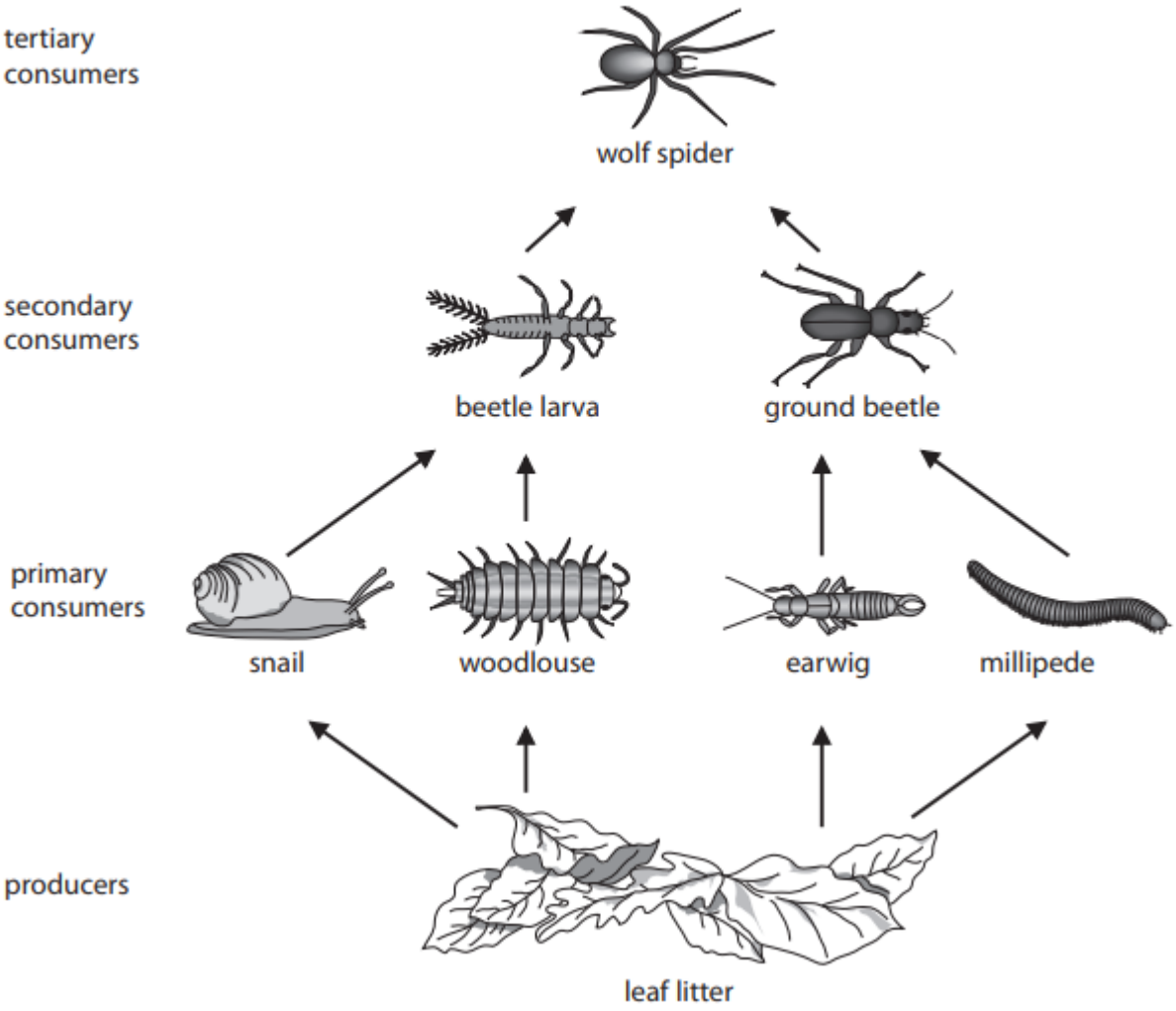
(2)

(c) Suggest where the oryx get their water from in the absence of free-standing water.

(1)

**4.6 understand the names given to different trophic levels, including producers, primary, secondary and tertiary consumers and decomposers**

**3** When trees lose leaves, they fall to the ground and form leaf litter. The leaf litter provides food for many animals. The diagram shows a food web that includes leaf litter.




(a) Use information in the food web to complete the table.

The first one has been done for you.

(4)

| | Number |
|---|---|
| the number of different tertiary consumers | 1 |
| the number of trophic levels | |
| the number of food chains | |
| the number of different predators | |
| the number of different consumers | |

**4.7 understand the concepts of food chains, food webs, pyramids of number, pyramids of biomass and pyramids of energy transfer**

**2** Pigeons are birds that eat seeds. They are hunted by predators called hawks.

(a) Use this information to draw a food chain in the space below.

**(2)**

**1** The photograph shows a mammal called a mountain hare.

©Author: Alan Wolfe

Mountain hares eat plants.

Foxes, cats and eagles are predators that eat mountain hares.

(a) (i) Use this information to draw a food web.

(2)

(ii) Give the name used to describe animals that eat plants.

(1)

## 4.8 understand the transfer of substances and energy along a food chain

**1** The table gives information about what happens to energy in food eaten by a mammal and in food eaten by a fish.

| | Percentage of energy in the food that is absorbed | Percentage of absorbed energy released by respiration | Percentage of absorbed energy assimilated into biomass |
|---|---|---|---|
| Mammal (cow) | 37.5 | 89.1 | 10.9 |
| Fish (trout) | 86.0 | 65.0 | 35.0 |

(a) Suggest why the cow absorbs a lower percentage of energy from the food it eats than the fish.

**(2)**

(b) Suggest why the cow releases more of the absorbed energy by respiration than the fish.

**(1)**

(c) The data suggests that fish farming is more productive than farming cows.

Using your knowledge of energy transfer, suggest two ways in which the productivity of cows could be improved.

(4)

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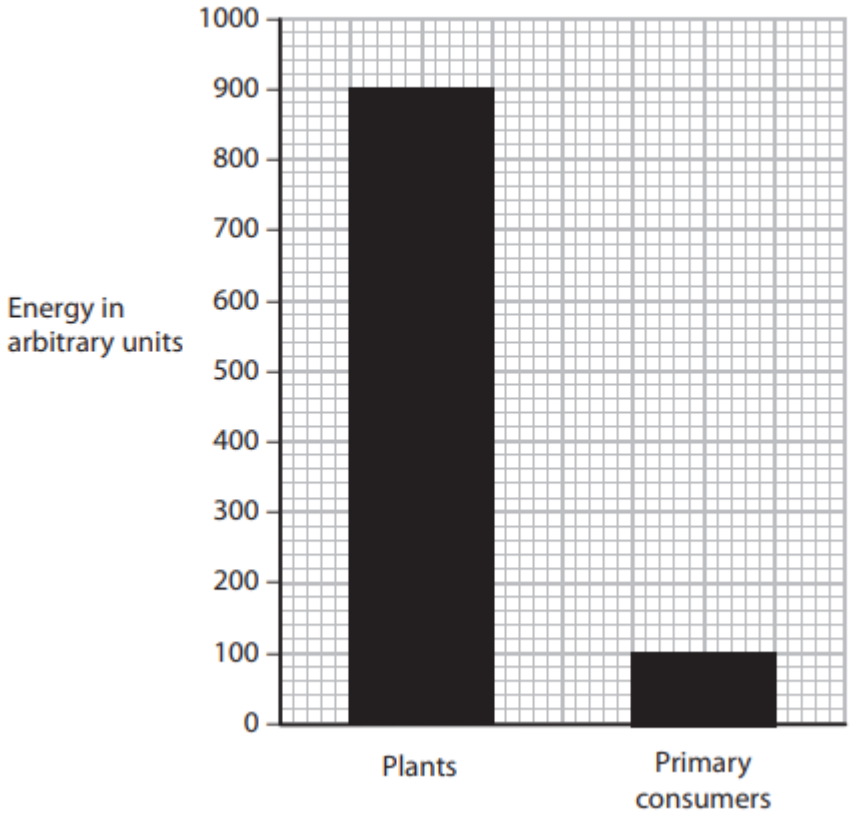
**4.9 understand why only about 10% of energy is transferred from one trophic level to the next**

**1** The graph shows the units of energy in the plants and primary consumers in a food chain.




(a) Not all the energy in the plants is transferred to the primary consumers.

(i) Calculate the percentage of energy in plants that is transferred to the primary consumers.

Show your working.

(2)

Answer ..... %

(ii) One reason why energy is not transferred is because certain molecules in plants cannot be digested.

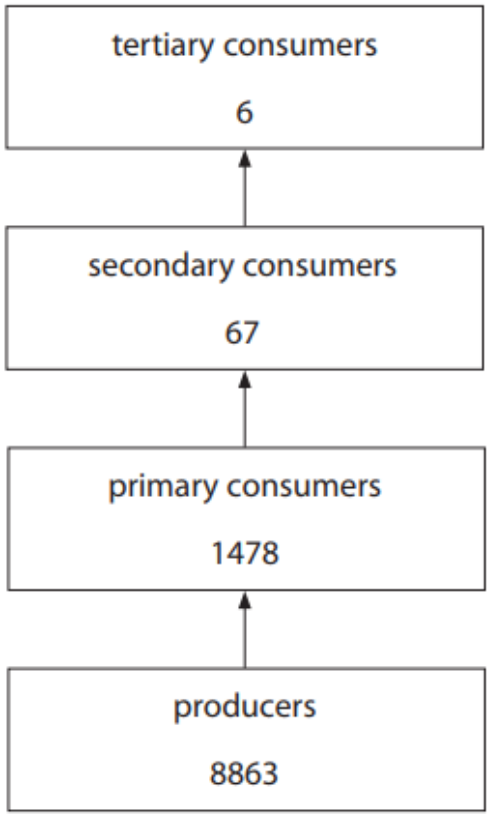
Give two other reasons why energy is not transferred.

(2)

1 .....

2 .....

**2** The diagram shows the energy transfer in a river ecosystem. The numbers on the diagram refer to the energy in the biomass at each trophic level in arbitrary units.



(a) The formula shows how to calculate energy transfer efficiency as a percentage.

$$\text{percentage energy transfer efficiency} = \frac{\text{total energy in biomass}}{\text{total energy available}} \times 100$$

(i) The total energy available to the producers from sunlight is 1 700 000 in arbitrary units.

Use this information, and the formula, to calculate the percentage energy transfer efficiency from sunlight to plants.

Show your working.

**(2)**

Answer ..... %

(ii) Suggest why the percentage energy transfer efficiency from sunlight to plants is low.

**(1)**

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(b) The table shows the calculated energy transfer efficiencies between the different trophic levels in the river ecosystem.

| Trophic levels | Percentage energy transfer efficiency |
|---|---|
| plants to primary consumers | 16.7 |
| primary consumers to secondary consumers | 4.5 |
| secondary consumers to tertiary consumers | 9.0 |

Suggest two reasons why the energy transfer from plants to primary consumers is not 100%.

**(2)**

1 .....

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2 .....

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(c) Chickens in factory farms are kept in cages inside buildings rather than being kept outdoors.

Suggest how factory farming can affect egg production.

**(3)**

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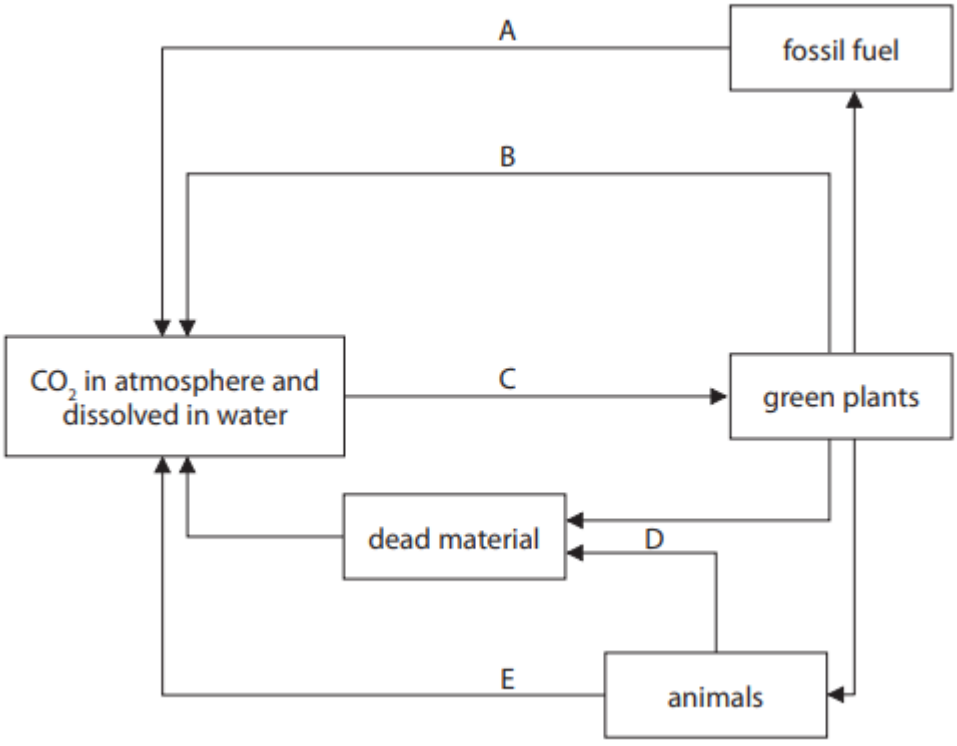
**4.10 describe the stages in the carbon cycle, including respiration, photosynthesis, decomposition and combustion**

**4** Many hardwood trees are cut down and used to make outdoor furniture. This is because hardwood is less likely to decompose than other types of wood.

(a) Describe the process that decomposes wood.

**(2)**

**2** The diagram shows the carbon cycle.



(a) (i) Identify the processes labelled A, B, C, D and E.

**(5)**

A .....

B .....

C .....

D .....

E .....

(ii) Give the letter of the process that reduces the carbon dioxide in the atmosphere.

**(1)**

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**2** When plants die they may decompose.

(a) Explain what is meant by the term **decompose**.

**(2)**

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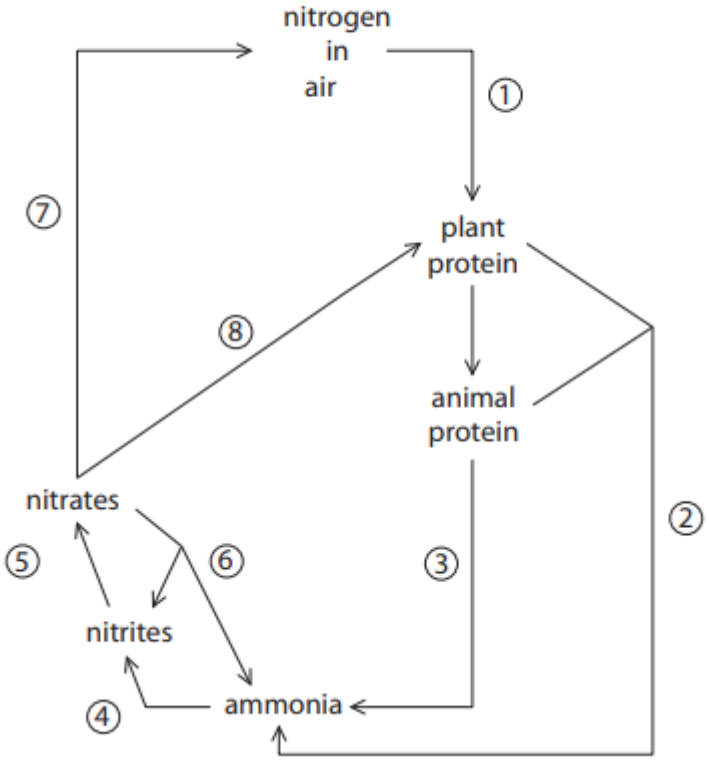
**4.11B describe the stages in the nitrogen cycle, including the roles of nitrogen fixing bacteria, decomposers, nitrifying bacteria and denitrifying bacteria (specific names of bacteria are not required)**

**5** The diagram shows the nitrogen cycle. Different stages have been numbered 1 to 8.




(a) The table lists the stages involved in the nitrogen cycle.

Complete the table by giving the correct number, or numbers, corresponding to each stage.

The first one has been done for you.

**(4)**

| Stage | Number |
|---|---|
| absorption | 8 |
| denitrification | |
| nitrogen fixation | |
| excretion | |
| decomposition | |

(d) The scientists wrote that, 'leaf decomposition by bacteria ensures the release of nitrate ions into the soil'.

Explain how other bacteria can reduce the availability of nitrate ions to plants.

**(2)**

(ii) Name the type of bacteria that live in the root nodules of legumes.

**(1)**

(b) Many animals excrete urine that contains urea. Some soil microorganisms use the enzyme urease to change urea to ammonium ions and carbon dioxide.

Describe how ammonium ions can be converted to nitrate ions in the soil.

**(2)**

*(b) Describe the roles of bacteria in the nitrogen cycle.

(6)

**4.12 understand the biological consequences of pollution of air by sulfur dioxide and carbon monoxide**

Explain how carbon monoxide affects a person's ability to exercise.

(3)

**4.13 understand that water vapour, carbon dioxide, nitrous oxide, methane and CFCs are greenhouse gases**

(b) The release of pollutant gases into the atmosphere also has effects on the environment.

Complete the table by giving the names of the missing gases, and the effects of the gases on the environment.

(5)

| Gas | Source | Effect on the environment |
|---|---|---|
| | cattle farming | |
| water vapour | combustion | |
| | burning fossil fuels | causes acid rain |
| | incomplete combustion | affects transport of oxygen in blood |
| CFC | refrigerators and air conditioning units | |

**4.14 understand how human activities contribute to greenhouse gases**

**4** Carbon dioxide, methane and nitrous oxide are all greenhouse gases.

(a) (i) Name a source of nitrous oxide.

(1)

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(ii) Name one other greenhouse gas.

(1)

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(c) Suggest two ways to reduce the build up of greenhouse gases in the atmosphere.

(2)

1 .....

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2 .....

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(b) The table shows the masses of three different greenhouse gases released into the atmosphere in the United Kingdom from 1990 to 2010.

| Year | Mass of gas released each year in millions of tonnes | | |
|---|---|---|---|
| | carbon dioxide | methane | nitrous oxide |
| 1990 | 590.3 | 4.6 | 0.2 |
| 1995 | 566.7 | 4.0 | 0.2 |
| 2000 | 550.5 | 3.0 | 0.1 |
| 2005 | 552.0 | 2.2 | 0.1 |
| 2010 | 496.0 | 2.1 | 0.1 |

(i) Calculate the percentage decrease in the mass of carbon dioxide released between 1990 and 2010.
Show your working.

**(2)**

percentage decrease in mass = ..... %

(ii) Suggest why the mass of carbon dioxide released has decreased from 1990 to 2010.

(3)

(iii) Describe the changes in the mass of methane released between 1990 and 2010.

(2)

**4.15 understand how an increase in greenhouse gases results in an enhanced greenhouse effect and that this may lead to global warming and its consequences**

(b) An increase in the level of carbon dioxide in the atmosphere can lead to an enhanced greenhouse effect.

Describe the possible consequences of an enhanced greenhouse effect.

**(4)**

(c) Explain the advantages of reducing the mass of greenhouse gases released into the atmosphere.

**(5)**

## 4.16 understand the biological consequences of pollution of water by sewage

**1** When organic material in sewage, manure, silage effluents and waste milk enters a lake or river it causes pollution.

The organic material is broken down by microorganisms. This process removes oxygen from the water.

The amount of oxygen removed from the water is called the Biological Oxygen Demand (BOD).

The table shows data for different pollutants.

| Pollutant | BOD in mg of $O_2$ per litre of pollutant |
|---|---|
| treated domestic sewage | 20 – 60 |
| raw domestic sewage | 300 – 400 |
| cattle manure | 10000 – 20000 |
| pig manure | 20000 – 30000 |
| silage effluent | 30000 – 80000 |
| waste milk | 140000 |

(a) Explain which pollutant is likely to have the most severe effect on the organisms in a river.

**(2)**

(b) A quan y of pollutant is released into a river. The effect on the organisms will depend on the BOD value and other factors.

Suggest one of these other factors.

**(1)**

(c) Waste milk is one of the pollutants.

Name one of the biological molecules found in milk that the microorganisms could feed on.

(1)

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(d) Suggest a reason for the difference between the BOD of raw domestic sewage and the BOD of treated domestic sewage.

(2)

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**2** The passage describes water pollution caused by untreated human sewage and by fertiliser.

Complete the passage by writing a suitable word or words in each of the spaces.

(7)

If sewage gets into fresh water it will increase the number of pathogenic

..... in the water. The sewage contains waste organic material in the

form of ..... from humans. Microorganisms break down this material

using a process called aerobic ..... . This process reduces the level of

..... in the water making it less likely for larger organisms to survive.

Fertilisers can get into water by a process called ..... . The minerals

present in the fertiliser such as ..... cause the rapid growth of

..... in the water.

**4.17 understand the biological consequences of eutrophication caused by leached minerals from fertiliser**

(c) Explain the consequences of fertiliser containing nitrates polluting a river.

**(6)**

(c) Nitrogenous waste released into the environment can cause eutrophication.

Describe the process of eutrophication and the effects that it can have on the environment.

**(5)**

**4.18B understand the effects of deforestation, including leaching, soil erosion, disturbance of evapotranspiration and the carbon cycle, and the balance of atmospheric gases**

**3** Deforestation has an effect on the environment.

(a) (i) What is meant by the term **deforestation**?

**(1)**

(ii) Deforestation also affects the carbon cycle.
Explain these effects.

**(4)**

**1** The world's rainforests could completely vanish in a hundred years at the current rate of deforestation.

(a) Suggest two reasons why humans are removing rainforest.

**(2)**

1 .....

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2 .....

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(b) (i) Explain how deforestation can change the balance of gases in the atmosphere.

**(2)**

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(ii) Suggest how deforestation can change the soil structure.

**(2)**

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(c) Suggest how countries can reduce the impact of deforestation.

**(2)**

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