# Hyndland Secondary School
# Biology Department

## Biosphere

## Homework and Question Booklet[1]



[1] This booklet is available online from the Hyndland Secondary School website. Any grids for graphs are also available on the site should you wish them for practice. There is also a handy hints booklet which will help you should you get stuck, where appropriate this booklet also includes links to websites giving a more general help with the section. Answers booklet will also be made available when the section has been completed in class.

# Biosphere Section (a) - Investigating an Ecosystem

## Investigation Methods & techniques

1. What is meant by an abiotic factor?
2. Give two examples of abiotic factors.

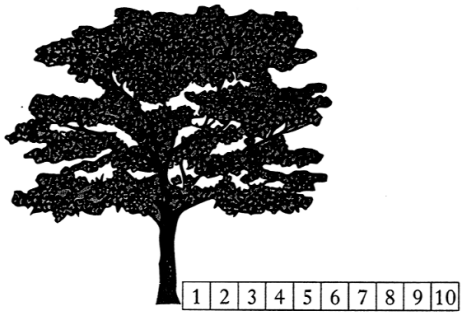
3. The following list contains examples of groups of organisms that can be easily sampled.

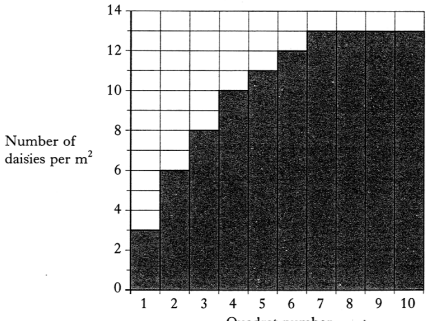
   **Group 1**: small invertebrates in the leaf litter below trees.
   **Group 2**: small invertebrates in the gravel of river bed.
   **Group 3**: species of a plant growing in a lawn.
   **Group 4**: small invertebrates in the foliage of a tree.
   **Group 5**: small invertebrates on the seashore.

Choose one of the examples from the list and answer the questions that follow. Before you answer write the name of the group at the start of your answer.

a) Name or describe a technique which could be used to obtain the sample.
b) Name two abiotic factors which may affect the distribution of organisms in your chosen sample.

4. The diagram below shows the position of some $1m^2$ quadrats under an oak tree. The graph shows the results of an investigation into the number of daisies growing under the tree.




a) How many daisies per $m^2$ were found in quadrat 6?
b) Which quadrat closests to the tree contained more than 10 daisies per $m^2$?
c) Describe the relationship between the number of daisies per $m^2$ and the distance from the trunk in quadrats 1 to 7.
d) Describe the relationship between the number of daisies per $m^2$ and the distance from the tree trunk in quadrats 1 to 7.
e) Suggest reason why there is no change in the results for quadrats 8,9, and 10.

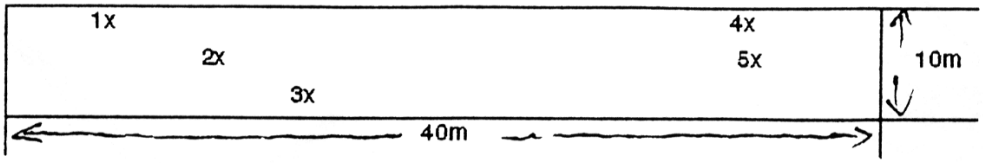
5. Name an instrument used to measure an abiotic factor.

6. Describe how the instrument is used.

7. **Describe a possible error when using this instrument.**

8. **How can this error be minimised?**

9. An investigation was carried out to estimate the number of dandelions and daisies in a lawn. A quadrat of $1m^2$ was used in sampling. The diagram below shows where the five samples were taken.



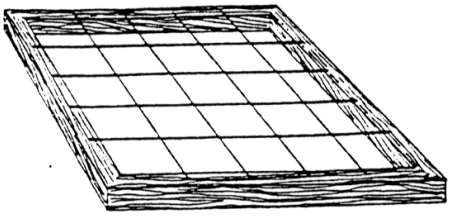

Results from the investigation are shown in the table below.

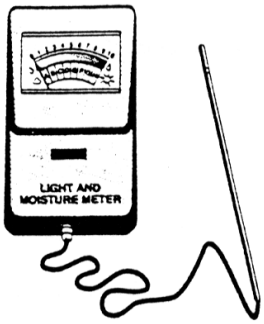
| Plant type | Average number / $m^2$ | estimated total number present |
|---|---|---|
| dandelion | 2 | |
| Daisy | 3 | 1200 |

a) Calculate the estimated total number of dandelions present.
b) How could the reliability of the results be improved?
c) In an investigation of a different lawn, it was estimated that each $m^2$ contained 0.23 dandelions, 0.68 daisies and 1.45 plantains. There were twice as many buttercups as plantains.
d) Using the results of the investigation, **copy** and **complete** the table below.

| Plants | Average number / m |
|---|---|
| | |
| | |
| | |
| | |

10. Some pupils carried out a survey of a part of a moorland using a quadarat. The quadrat was thrown at random on four different occasions. At each of the four quadrat sites, the pupils measured the area of the quadrat covered (percentage cover) by each of two species of plant, common heather and cross-leaved heath.
The pupils also measured the soil moisture in each quadrat using a moisture meter.



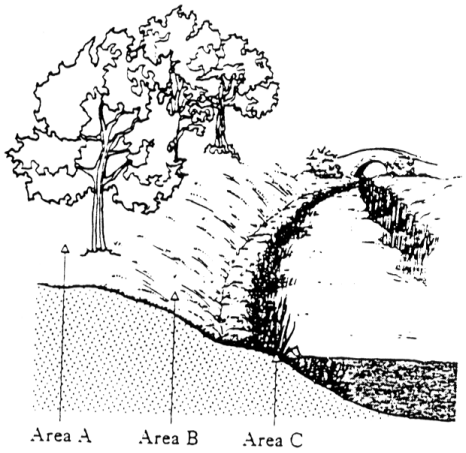



**The table below shows the results obtained**

| *Quadrat site* | *Percentage cover of common heather* | *Percentage cover of cross-leaved heath* | *Moisture reading (units)* |
|---|---|---|---|
| 1 | 100 | 0 | 3 |
| 2 | 80 | 15 | 5 |
| 3 | 75 | 10 | 6 |
| 4 | 95 | 0 | 3 |

a) Use the results suggest a reason for the distribution of the cross-leaved heath.
b) The pupils threw the quadrat at random. Describe one other way in which the pupils could have their results.
c) Suggest one way in which the pupils could minimise the errors in taking each moisture reading.
d) Calculate the whole number ratio of the percentage cover of common heather to that of cross-leaved heath in quadrat number 3.

11. A group of pupils carried out an investigation on the light intensity 0.5m above ground in areas A and B shown in the diagram below. Five readings were taken at 12 noon on the same day in each area. The results are shown in the table below.

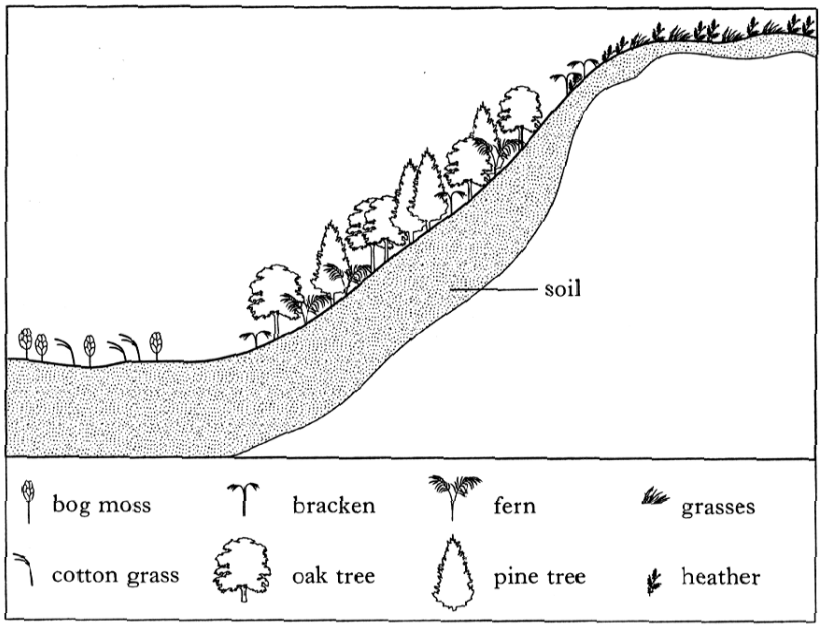



| | *Light reading (Units)* | |
|---|---|---|
| | *Area A* | *Area B* |
| | 4 | 20 |
| | 5 | 22 |
| | 3 | 19 |
| | 4 | 19 |
| | 4 | 20 |
| Average | 4 | 20 |

a) Give one reason why the average reading for Area A was lower than that for Area B.

b) Name an abiotic factor, other than light intensity, which may have been responsible for plants growing in Area C as distinct from Area B.

12. The diagram below shows the distribution of plants on a Scottish hillside.

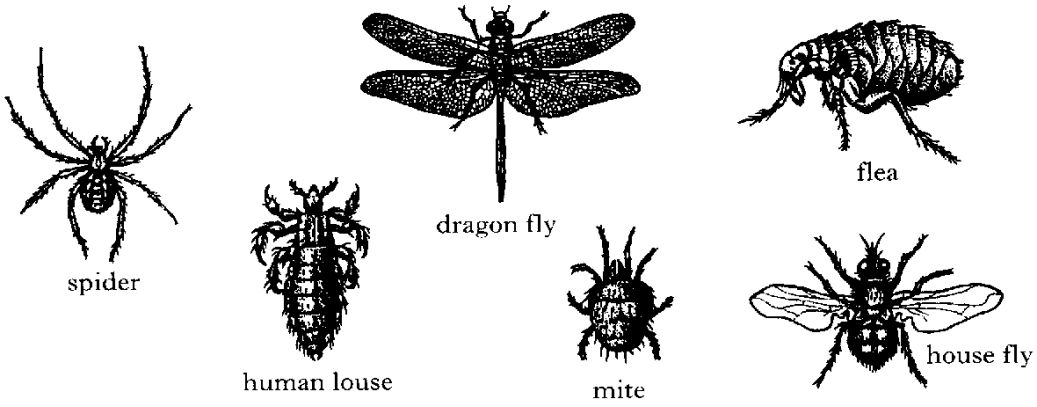



a) From the diagram, identify the plants which can live under oak trees and pine trees.

b) Heather does not grow well under trees. Suggest **one** abitoic factor which might be needed for heather to grow well.

## Keys

13. Use information from the diagrams of invertebrates to complete the following paired statement key.
The diagrams are not to the same scale.



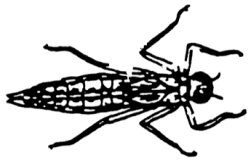

| | | | |
|---|---|---|---|
| 1 | Wings present ..... | Go to | (a) |
| | Wings absent ..... | Go to 3 | |
| 2 | One pair of wings ..... | house fly | |
| | (b) | ..... dragon fly | |
| 3 | Four pairs of legs ..... | Go to 4 | |
| | Three pairs of legs ..... | Go to 5 | |
| 4 | Body clearly divided into two parts ..... | (c) | |
| | Body not clearly divided into two parts ..... | (d) | |
| 5 | Hooked claw on legs ..... | human louse | |
| | No claw on legs ..... | flea | |

e) Give two features, not mentioned in the key which thehuman louse and the flea have in common.

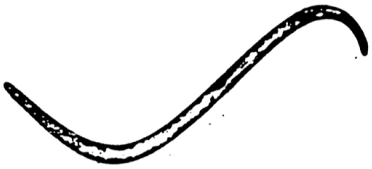
14. Below is a key which can be used to identify some freshwater animals.

| Key | |
|---|---|
| 1. Animal with shell | go to 2 |
| Animal without shell | go to 3 |
| 2. Shell with two halves hinged together | Bivalve |
| Shell is a single coil | Water snail |
| 3. Body not made up of sections (segments) | go to 4 |
| Body made up of segments | go to 5 |
| 4. Tubular body | Roundworm |
| Flattened body | Flatworm |
| 5. Legs absent | Leech |
| Legs present | go to 6 |
| 6. Three pairs of legs | Dragonfly nymph |
| Four pairs of legs | Spider |

a) Use the key to identify the two animals shown in the diagrams below.



i)



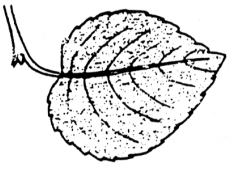
ii)

b) Use the key to identify two features of a leech.

15. Below is a key which can be used to identify some trees.

| Key | |
|---|---|
| 1. Broad leaves | go to 2 |
| Narrow leaves | go to 5 |
| 2. Leaf divided into separate parts | go to 3 |
| Leaf made of a single part | go to 4 |
| 3. 5 pointed parts | Sycamore |
| Many rounded parts | Oak |
| 4. Leaf edge smooth | Beech |
| Leaf edge saw - toothed | Elm |
| 5. Leaves grow singly | Yew |
| Leaves grow in groups | go to 6 |
| 6. Leaves grow in pairs | Scots pine |
| Leaves grow in tufts | Larch |

a) Use the key to name the leaves drawn below.



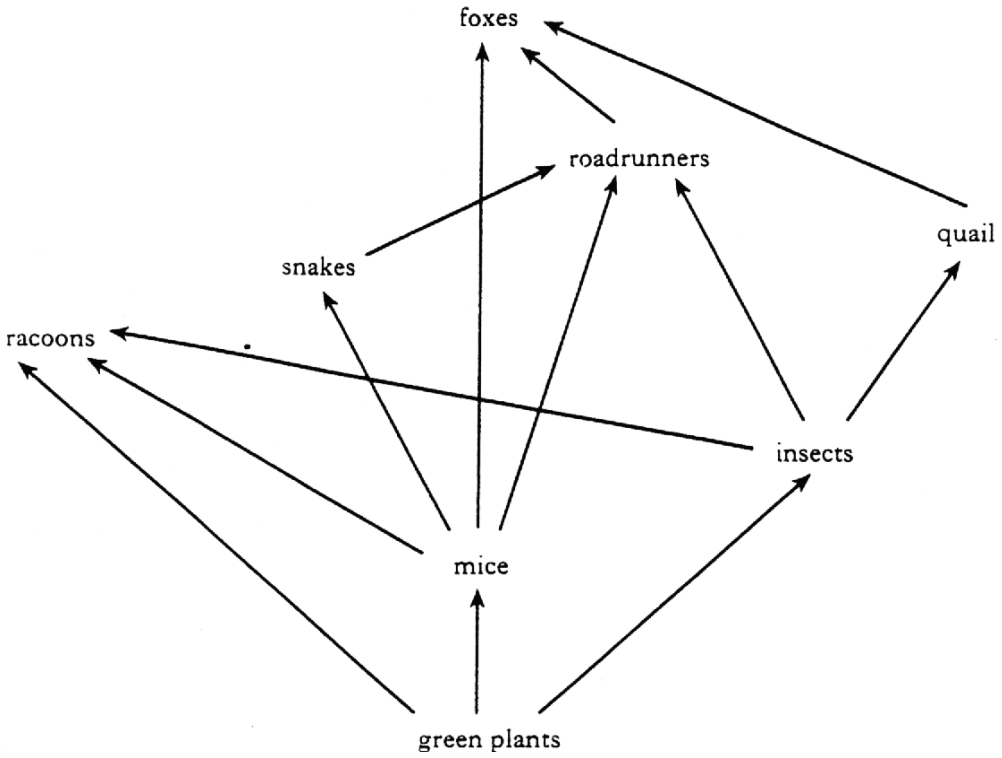
b) Beech leaves have smooth edges. Using information from the key, state two other features of beech trees.

# Biosphere Section (b) – How it works

## Food webs & chains

17. Give definitions of the following:
    a. habitat
    b. population
    c. community
    d. ecosystem
18. Describe what is meant by a producer and a consumer.

19. The following diagram shows part of a food web in Californian scrubland.

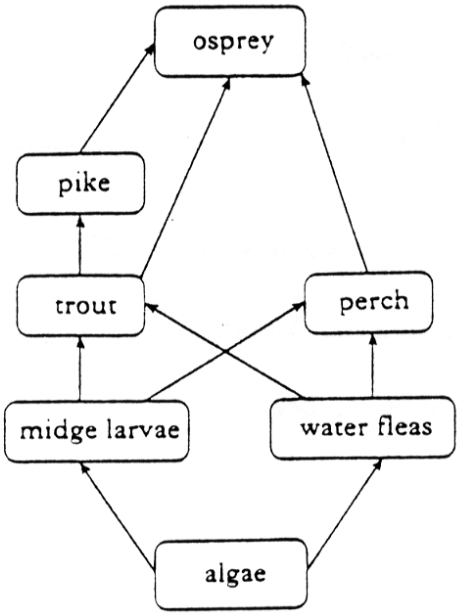



a) Which organisms are the producers in the food web?
b) Name the process by which producers make food.
c) Name **two** animals in the food web that are not eaten by other animals in this food web.
d) Pmnivores eat both plants and animals. Name two omnivores in the food web.
e) Use the information for the food web to **copy** and **complete** the food chain below.

_____ → _____ → snake → _____ → _____

f) How many individual food chains in the food web include road runners?
g) Mice obtain energy from the food they eat. Some of this energy is used for growth. State two other ways in which mice use this energy.
h) Competition occurs when different organisms have a need for the same food source. Describe one example of competition in the food web, naming the food source competed for and the competing organisms.

20. The diagram below shows part of a food web in a Scottish loch.




a) Name the producer in this food web.
b) Select an example of a complete food chain consisting of four organisms from the food web above.
c) Not all energy in a food web becomes available as energy for the next level. Give two ways in which energy is lost from a food web.

21. Some pupils sampled organisms in a pond and used a book to find out their feeding relationships.

*Pond snails, shrimps, mayfly larvae and stonefly larvae feed on weeds and plant plankton in the pond. The shrimps are eaten by water beetles. The water beetles are eaten by minnows and sticklebacks. The pond snails are eaten by leeches which in turn are eaten by trout.*

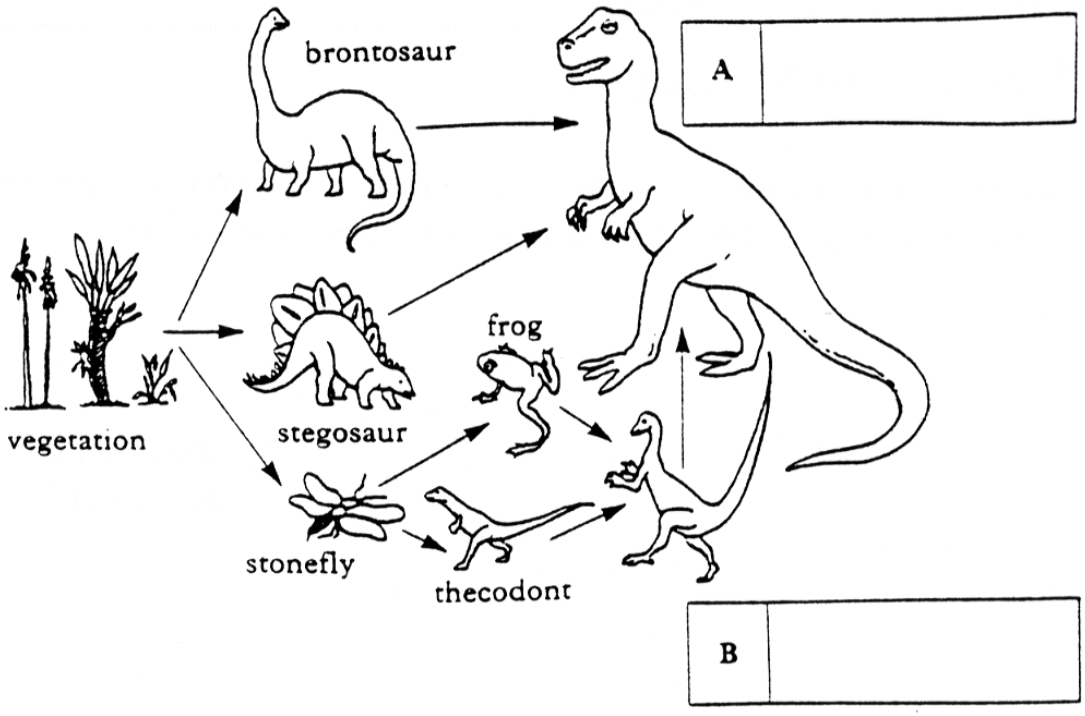
a) The arrows in a food chain show the direction of energy flow. Use the information in the passage to complete the food chain below.

_____ → **pond snails** → _____ → _____

b) Name two organisms that are in competition with each other for the same food.
c) Some organisms in the pond are producers, others are consumers. Describe what is meant by these terms.

22. What do the arrows in a food chain show?
23. In what two ways can energy be lost from a food chain?

24. The diagram below represents a food web for organisms which existed about 180 million years ago. Organisms are not drawn to scale.



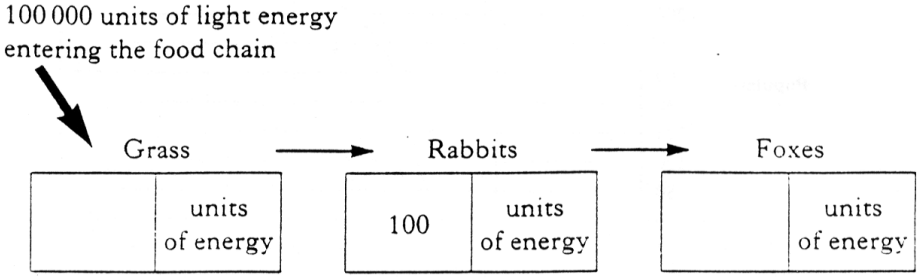

Brontosaurs and stegosaurs were herbivores which were eaten by aliosaurs. Stoneflies were eaten by both thecodonts and frogs, both of which were eaten by ornitholestids. Ornitholestids were preyed upon by alisaurs.
Predict the effect upon the populations of

a. brontosaurus and
b. frogs if the stegosaurs become extinct.

Say whether the populations will increase, decrease or stay the same. In each case explain your answer.

25. Plants convert 1% of the light energy they receive into new plant material. Animals convert 10% of the energy in the food they eat into new body material.

a) Use the information to complete the boxes below to show the energy present at each stage of the food chain.

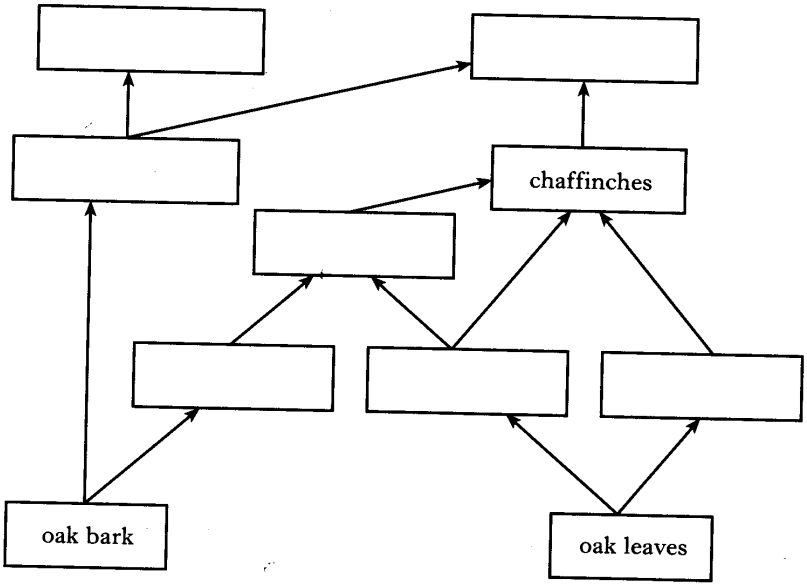



b) Energy and total mass decrease at each successive stage of a food chain. What else can decrease at each successive stage?

26. The food of eight animals is listed in the table below.

| *Animal* | *Food* |
|---|---|
| beetles | oak bark |
| caterpillars | oak leaves |
| slugs | oak leaves |
| woodmice | oak bark |
| spiders | beetles, caterpillars |
| chaffinches | spiders, caterpillars, slugs |
| owls | woodmice |
| hawks | woodmice, chaffinches |

a) Using the information from the table **copy** and **complete** the food chain in to your jotter, placing each animal into the correct position.




b) The owls and the hawks are in competition with each other. State **one** possible effect of competition between organisms.

c) Complete the sentence below by using the correct words from the list.

*List* ***community*** ***producers*** ***habitat*** ***population*** ***biosphere*** ***consumers***

i. The place where an organism lives is its _____

ii. All the members of one species living together are called a _____.

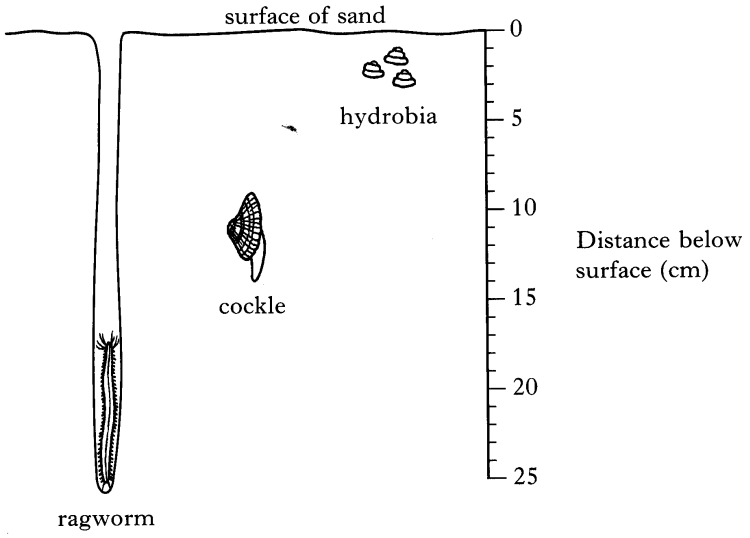
iii. The _____ and habitats make up an ecosystem.

27. Explain how birth and death rates affect the growth of a population.

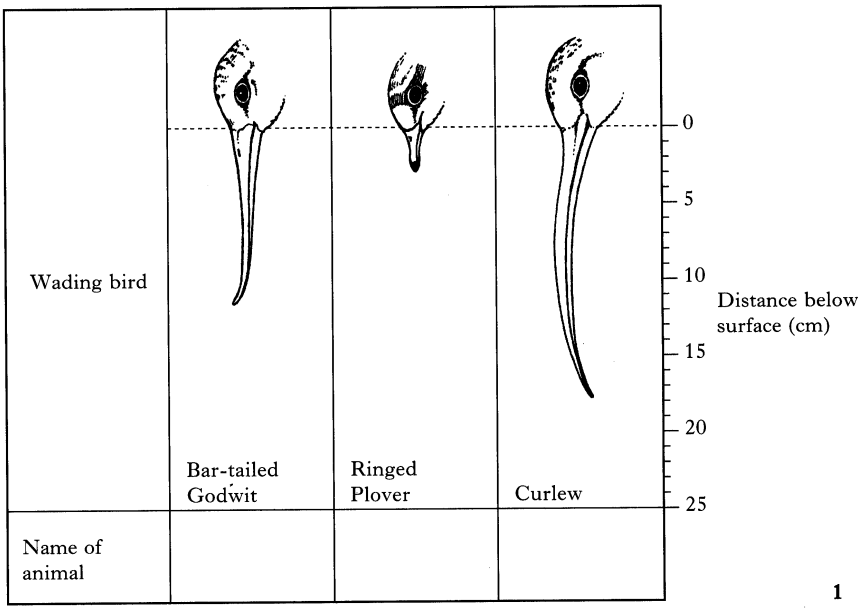
28. Give three factors that can limit the growth of a population.

29. **Diagram A shows three burrowing animals which live at different depths on Scottish beaches. They are eaten by various wading birds.**

**Diagram A**




**a) The diagram below shows the heads of three different species of wading birds. In your jotter, name the burrowing animal each wading bird is likely to be feeding on.**




1

**b) Which bird would be able to feed on all the burrowing animals shown?**

**c) Which bird would be able to feed on only one of the burrowing animals?**

**d) Cockles are very sensitive to pollution and cannot live in polluted sand. Give one effect on the wildlife of a beach if the cockles were to die out.**

30. **What is meant by a pyramid of numbers?**

31. **What happens to**

**a. The <u>size</u> of an organism as you move along a food chain?**

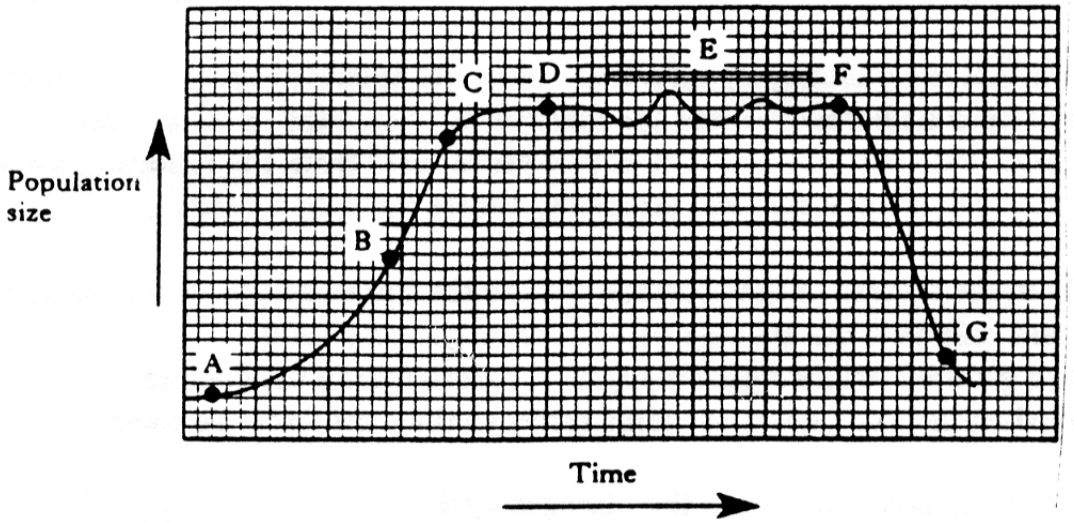
**b. The <u>number</u> of organisms as you move along a food chain?**

32. **What is meant by a pyramid of biomass?**

33. **Why does the biomass decrease as you move along a food chain?**

## Populations

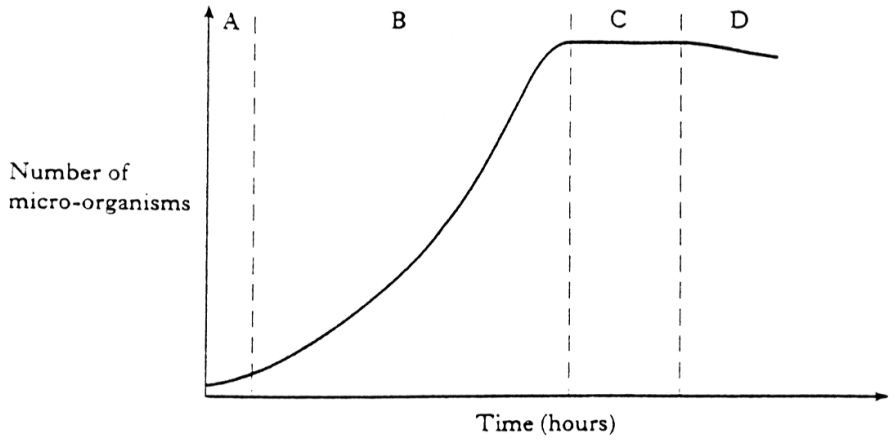
34. The graph below shows the changes in the size of a population of organisms in a new habitat, over a period of time.




Copy the table below into your jotter and complete it inserting a letter which correctly indentifies when each factor affected the population size.

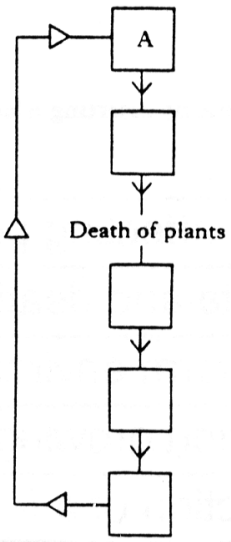
| Factors affecting population size | Letter |
|---|---|
| Birth rate and death rate are equal | |
| Short - term environmental change | |
| Population growing without limiting factors | |
| Introduction of a fatal disease | |

35. The graph below shows the changes in the number of micro-organisms in a population.




a) Which letter shows the population increasing most rapidly?
b) Which letter shows the birth and death rate equal?

## Nitrogen Cycle




36. The processes listed below are involved in part of the nitrogen cycle.

A Uptake of nitrogen compounds by plant roots
B Production of nitrates in soil
C Production of nitrites in soil
D Production of protein by plants
E Production of ammonium compounds from organic material

a) Copy the diagram opposite and complete it to show the correct order of these processes.
b) Which of these processes involve the action of bacteria?

37. The nitrogen cycle describes the essential movement of nitrogen between living organisms and their environment.
The grid below lists some of the ways in which this is achieved.

| | | |
|---|---|---|
| A nitrification | B denitrification | C decay and decomposition |
| D nitrogen fixing | E eating | F uptake by roots |

Copy each statement into your jotter and identify the correct term to match it.

(*a*) Protein in plants becomes animal protein. _____

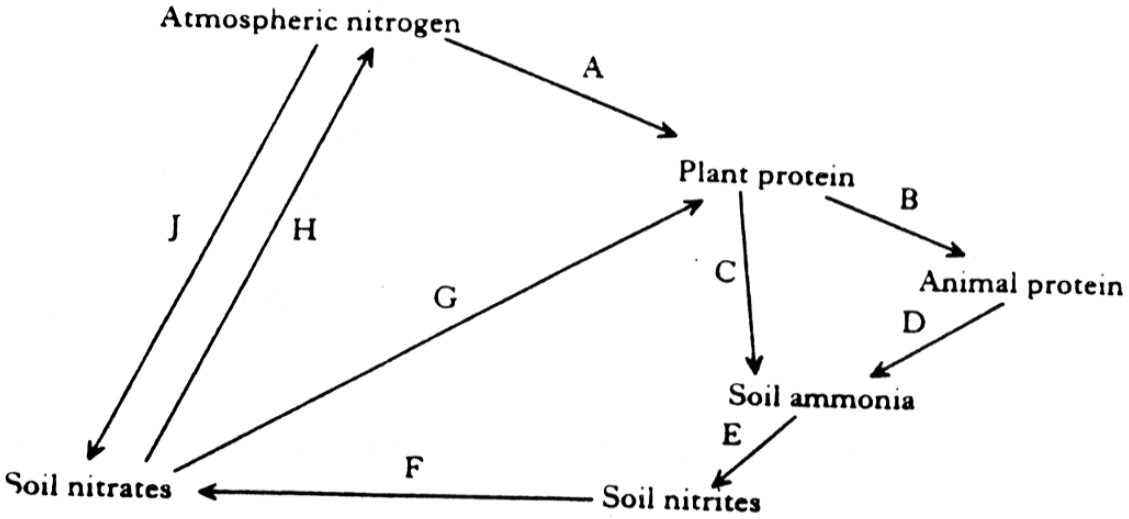
(*b*) Nitrates in soil become plant protein. _____

(*c*) Atmospheric nitrogen becomes nitrates in soil. _____

(*d*) Nitrates in soil become atmospheric nitrogen. _____

(*e*) The stage in which fungi are most important. _____

38. The diagram below shows a part of the nitrogen cycle.




Which letter from the diagram identifies:

a) A stage which does not involve bacteria?

b) A stage is called nitrification?

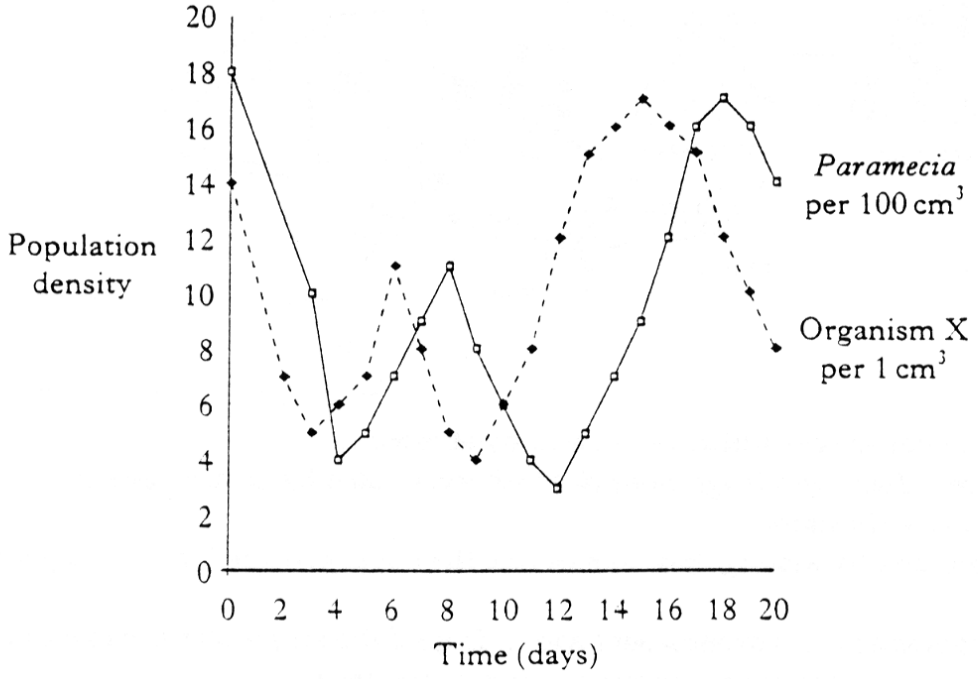
## Problem Solving

39. A group of pupils carried out some survey work on a freshwater pond over a period of time. The results in the table show some of their findings.

| *Temperature of water (°C)* | *Oxygen concentration (mg/l)* |
|---|---|
| 0 | 15 |
| 10 | 13 |
| 15 | 12 |
| 20 | 10 |
| 25 | 8 |

a) Plot a line graph to show the effect of temperature on the oxygen concentration found in water.
b) Describe the relationship between the temperature of the water and the oxygen concentration.

40. Two different species of single celled organism were cultured in the same container. The graph below shows the changes in both populations over a period of twenty days.

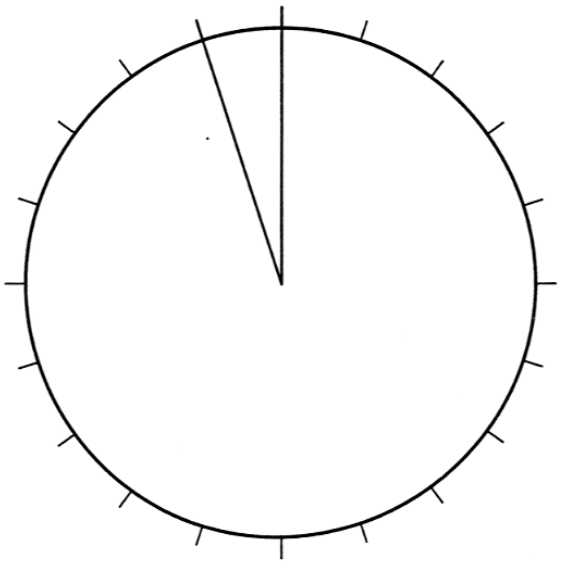



The total volume of the container was 1000cm$^3$. Calculate the highest number of each organism, Paramecia and organism X, present ion the culture.

41. Samples of invertebrate animals were collected in two separate areas. The table below shows the percentages of each type of animal in the survey.

| *Type of animal* | *Area* | |
|---|---|---|
| | *Bushes* | *Playing field* |
| flies | 60% | 50% |
| beetles | 35% | 36% |
| spiders | 5% | 4% |
| ants | 0% | 10% |

a) Copy and complete the pie chart to show the proportions of animals found in the area of the **bushes**.



b) 150 animals were collected in the playing field. How many were beetles?

c) What was the ratio of flies to spiders in the area of the **bushes**? Show your answer as a simple whole number ratio.

# Biosphere Section (c) – Control & Management

## Pollution Sources

42. Name the four ecosystems that can be affected by pollution.
43. Name the three main sources of pollution and give an example of each.
44. Describe one way in which pollution can be controlled.

45. **Describe the negative effects of using fossil fuels and nuclear power as energy sources.**

46. The list below contains statements about the management of natural resources.

**X Modern agriculture often involves the creation of large areas used to grow one type of crop.**

**Y Tropical rainforests are burnt to allow crops to be grown**

**Z Rivers and seas are often used for the disposal of sewage material.**

Choose one of the statements and describe a problem which may result from it.

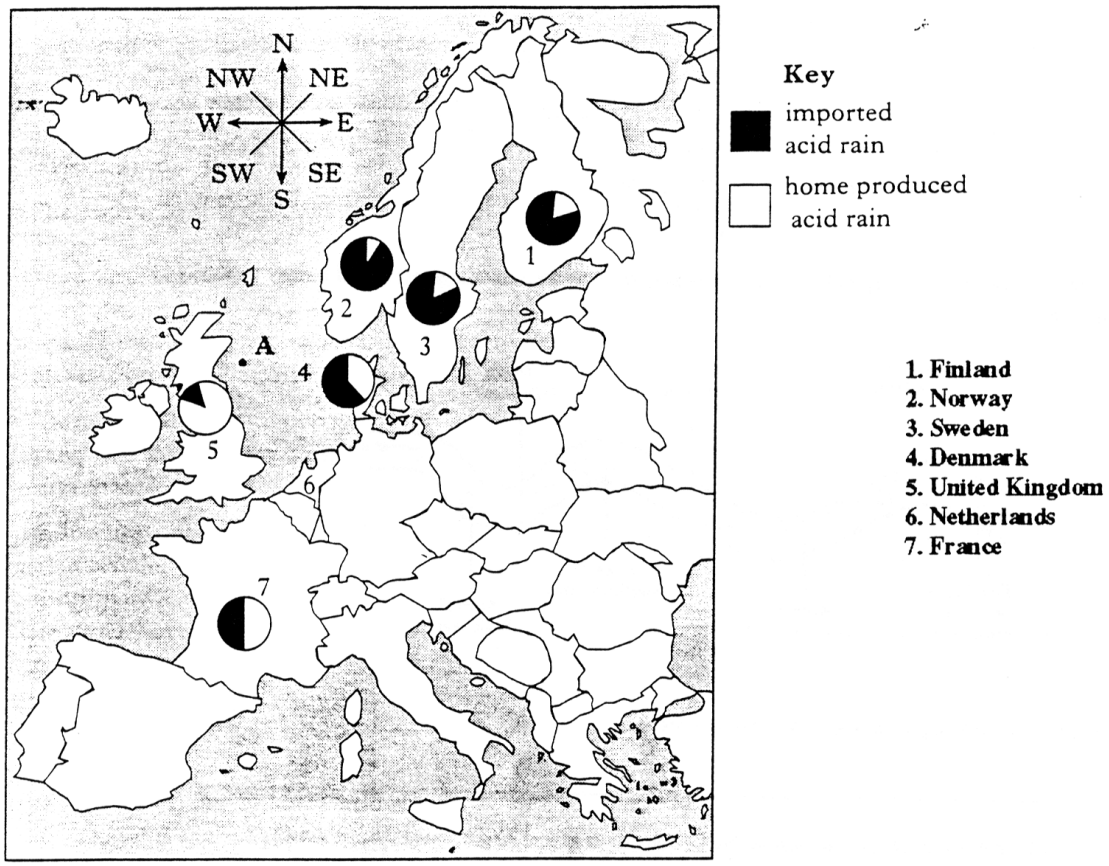
47. Copy and complete the following table using statements from the list below.

**List**

**A Treat sewage**
**B Use lead-free petrol**
**C Set up conservation areas**
**D Use alternatives to fossil fuels**

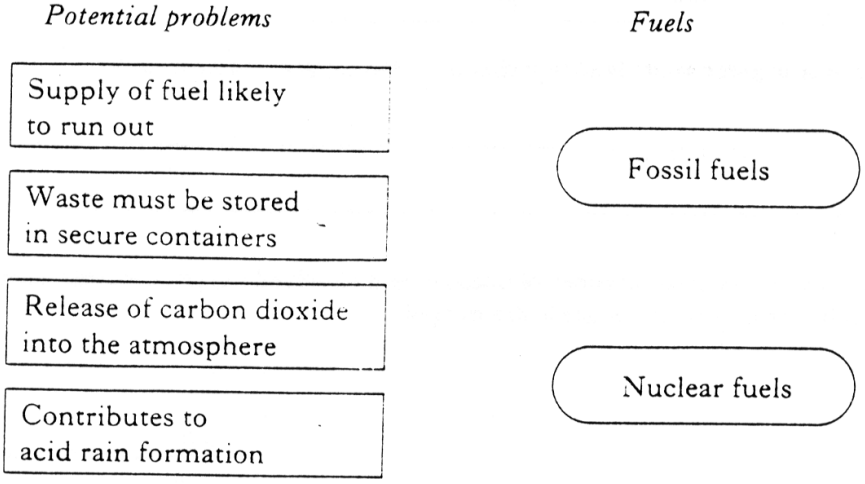
| *Environmental problem* | *How to reduce damage* |
|---|---|
| Brain damage to children from lead poisoning | |
| Extinction of rare species | |
| Death of fish from lack of oxygen | |
| Global warming from increased atmospheric carbon dioxide | |

48. The map below gives information about acid rain in Europe.




a) Name the country where 50% of the acid rain is "home produced".
b) At point A in the North Sea, the wind normally blows towards the north east. What information from the map would support this statement?
c) Acid rain is caused by various Gases which pollute the atmosphere. State one major **source** of such gases.
d) The Netherlands, country six on the map, has acid rains, 75% of which is imported. Draw a pie chart to show the proportions of home produced and imported acid rain in the Netherlands.

49. **Fossil fuels and nuclear fuels are used in the production of electricity. Copy the diagram below into your jotter and use arrows to link each potential problem to the appropriate fuel.**




50. **Radioactivity can be dangerous. Caesium – 137 is a radioactive element produced in nuclear power stations. It gradually breaks down into a non-radioactive element. The table shows the breakdown of 4000 units of Caesium- 137 over a period of 150 years.**

| *Time (years)* | *Units of Caesium-137 remaining* |
|---|---|
| 0 | 4000 |
| 30 | 2000 |
| 60 | 1000 |
| 90 | 500 |
| 120 | 250 |
| 150 | 125 |

a) **Caesium – 137 has a half life o f 30 years. Use the information in the table to explain the meaning of this statement.**
b) **Calculate the percentage of original Caesium – 137 remaining after 90 years.**

51. Describe one way in which pollution can be controlled.

52. **Describe the negative effects of using fossil fuels and nuclear power as energy sources.**

## Water Pollution

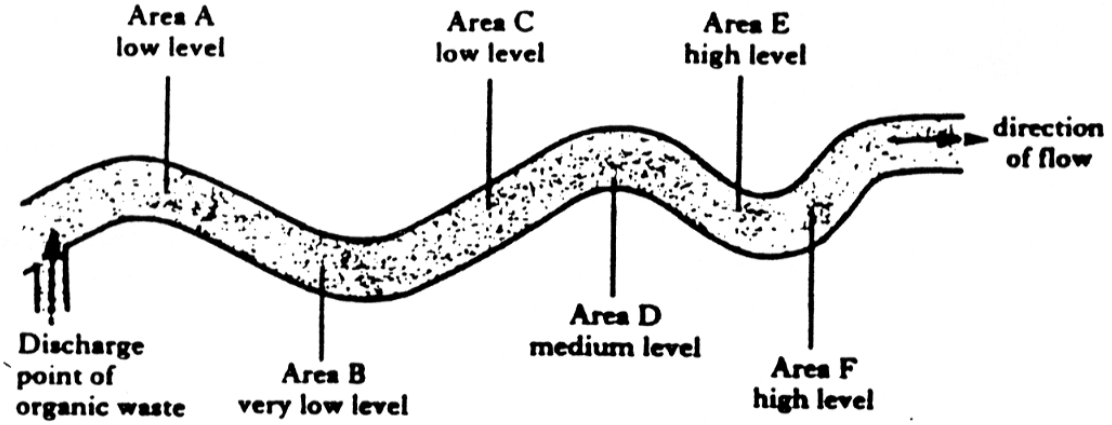
53. What do micro-organisms use a food source?

54. Describe what happens to the oxygen levels of a fresh water stream due to increased numbers of micro-organisms.

55. **State what is meant by an 'indicator species'.**

56. **Describe how the growth of weeds and the spread of crop eating insects can be controlled.**

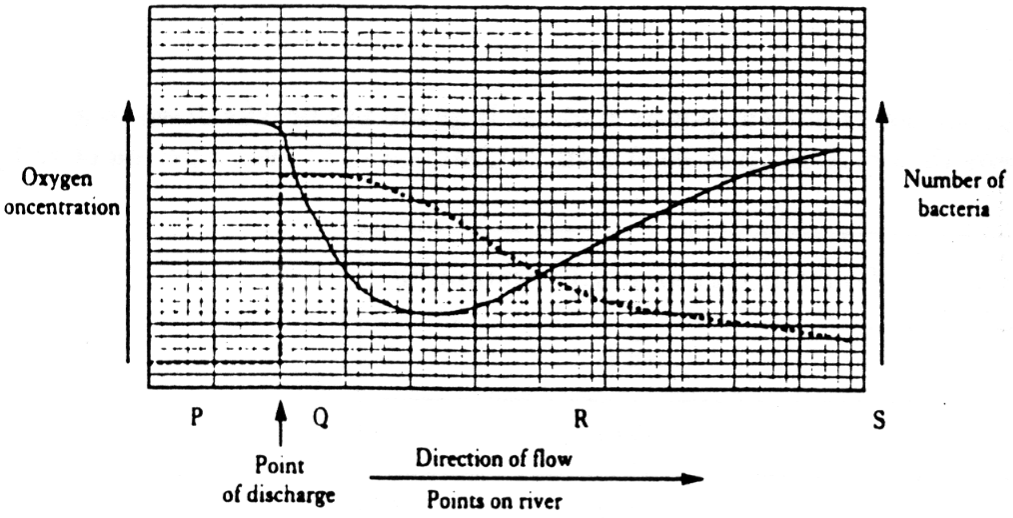
57. The diagram below shows oxygen levels in the water of a stream at different locations below a discharge of organic waste.




a) Which organism uses organic waste as a food source?
b) Between which two areas of the stream is the breakdown of the organic waste completed?
c) Samples were taken from the stream at each area and examined for "indicator species". What is meant by "indicator species"?
d) Apart from the oxygen level, name two other abiotic factors.
e) Copy and complete the table below by providing suitable headings for the two boxes to name the main sources of pollution.

| *Source of pollution* | | |
|---|---|---|
| *Domestic* | | |
| sewage<br>litter<br>detergents | fertilisers<br>pesticides<br>slurry | toxic chemicals<br>radiation<br>noise |

58. The graph below shows the changes in the number of bacteria and dissolved oxygen concentration in a river close to a point where organic waste is discharged.




a) Account for the changes in the number of bacteria between points R and S.

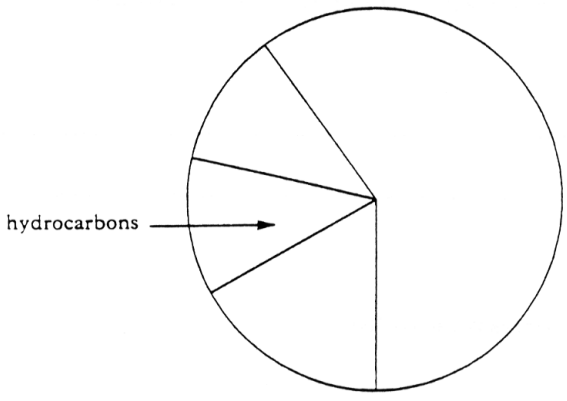
b) Account for the changes in the level of dissolved oxygen between points R and S.

c) Copy and complete the table below to describe the expected levels of organic waste at points P. Q. R and S.
Use the terms: LOW, HIGH and VERY HIGH.

| *Point* | P | Q | R | S |
|---|---|---|---|---|
| *Level of organic waste* | | | | |

59. a) The table below shows the mass of some pollutants entering the air in Britain in one year. Using the information from the table, copy and complete the pie chart so that it represents the data correctly.

| *Pollutant* | *Mass (units)* |
|---|---|
| Carbon monoxide | 100 |
| Sulphur dioxide | 34 |
| Hydrocarbons | 23 |
| Dust | 23 |
| Nitrogen oxides | 20 |
| Total | 200 |




b) Calculate the percentage of sulphur dioxide in the total mass of pollutants.

c) In 1970, smoke concentrations in the air in Britain were 55 units/ $m^3$. In 1958, they were 165 units/$m^3$. How many times greater were smoke concentrations in 1958 than in 1970?

## Problem Solving

60. Read the following passage carefully and answer the questions below.

Adapted from *Algal Blooms in Scottish Lochs* from Data Support, WWF Scotland/Scottish Natural Heritage

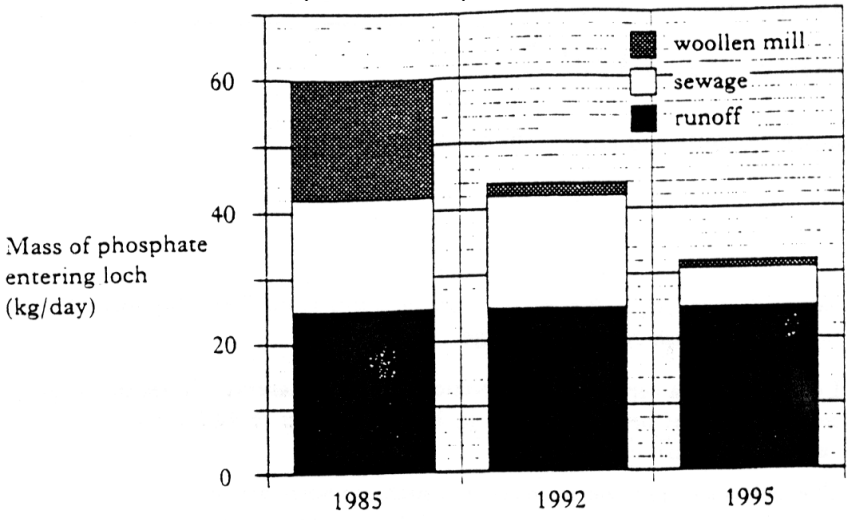
Loch Leven is a very important National Nature Reserve. It has the biggest concentration of breeding ducks in Britain and up to 40 000 waterbirds of various kinds visit it each winter.

The loch is naturally rich in nutrients such as phosphate and nitrates, but the levels have been increased because of human activity in the surrounding area. One result has been the appearance of massive blue-green algal blooms in summer. These are composed of microscopic plants which multiply rapidly and turn the water a deep green colour. These microscopic plants release poisonous chemicals when they die and decompose.

The key nutrient in producing an algal bloom is phosphate. Phosphates enter the loch in discharges from a local woollen mill, in domestic sewage and in run-off from the surrounding farmland.

Following a particularly intense algal bloom in 1992, the woollen mill further reduced the phosphates in its discharges and the sewage works installed equipment to remove phosphates from the water it discharged into the loch. Controls have also been imposed on housing development in the area to ensure that phosphate from domestic sewage remains at low levels.

a) Why is Loch Leven Nature Reserve an important site?
b) What caused the outbreaks of algal blooms in the loch?
c) Why were efforts made to prevent the formation of algal blooms?
d) Name two sources of phosphate pollution in Loch Leven.
e) Describe one way in which pollution from domestic sewage is being controlled.
f) The bar chart shows the mass of phosphate entering the loch each day from different sources in three particular years.




g) Which major source of phosphate pollution remained the same over the period for which information is given?
h) What mass of phosphate entered the loch each day in discharges from the woollen mill in 1985?