Perth Academy

N5 Biology

Life on Earth

Homework 1

1. Ladybirds are the predators of greenfly. These figures show how the numbers of greenfly and ladybirds change over 3 years.

Plot these results **onto graph paper**. Use a different colour for each invertebrate and plot a **line graph**.

Time	Number of Ladybirds (000's)	Number of Greenfly (000's)
Jan 97	5	10
Apr 97	25	80
Jul 97	45	100
Oct 97	60	30
Jan 98	30	20
Apr 98	10	70
Jul 98	35	110
Oct 98	75	50
Jan 99	20	30
Apr 99	35	50
Jul 99	60	80
Oct 99	75	30

b) Explain the shape of the graph **(2)**

(c) Calculate the average number of ladybirds **(1)**

(d) What is the range of greenfly found over the 3 years? **(1)**

(e) What is the percentage increase in the greenfly population between April and July 97? **(1)**

2) Name 3 abiotic factors that may affect a population of daisies growing in a field. **(3)**

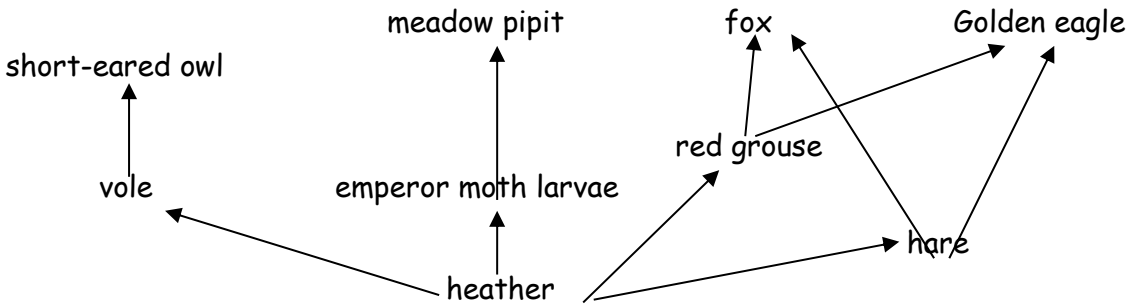
3) Match the term to the correct description. (use the letters to write your answers e.g. i) D)

i) Biodiversity ii) Population iii) Producer iv) Consumer v) Ecosystem vi) Niche vii) Habitat	A. The role an organism plays in its community. B. An organism which must eat other plants or animal material for energy. C. Where an organism lives. D. The range of species in an ecosystem. E. Green plants which make their own food. F. The number of organisms of one species. G. The living and non-living components in a particular habitat.

(7)

Homework 2

1. The diagram below shows part of a food web from a moorland ecosystem.



a)i) Write each organism from the food web in the correct column in the table below.

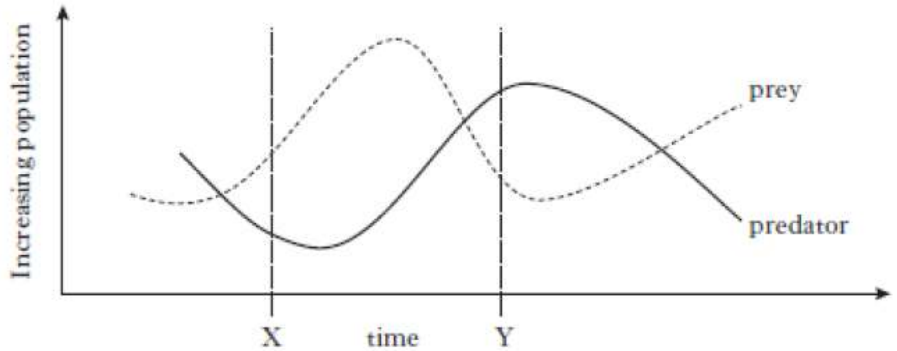
Producer	Primary consumer	Secondary consumer

ii) Describe **one** possible effect on the food web of a large increase in the grouse population. (1)

iii) Human activities can affect the biodiversity of an ecosystem. Explain the term 'biodiversity'. (1)

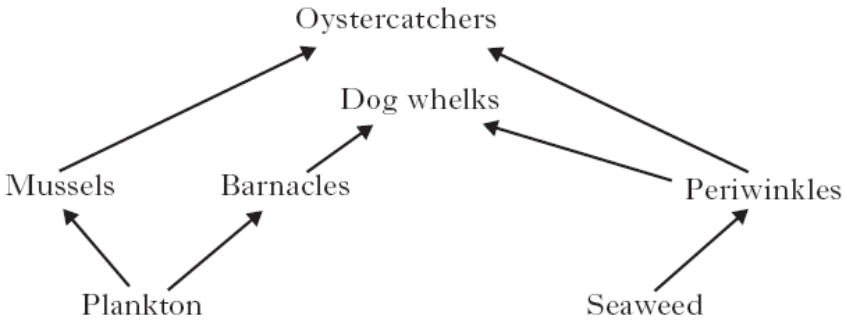
iv) Name two of these human activities that can affect the biodiversity of an ecosystem. (2)

2. The diagram below shows the relationship between a predator population and the population of its prey over a period of time.



a) Explain the changes in the population of **prey** between X and Y. (2)

3. Part of the food web from a shore is shown below.



The number of muscles and periwinkles may be affected if the barnacles were removed from the food web.

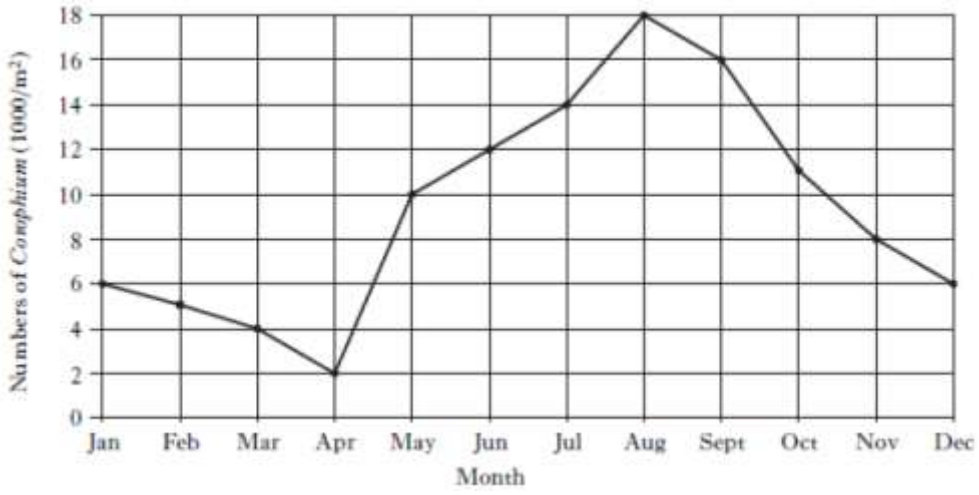
a) Choose one answer in the brackets and give an explanation for it.
i) The mussel population would (increase / decrease/ stay the same) (1)

ii)The periwinkle population would (increase / decrease /stay the same) (1)

4. The small burrowing invertebrate, *Corophium*, is found in the mud of Scottish estuaries.

Corophium is the major prey of many species of migratory wading birds. These birds are present in large numbers from August to April.

The graph below shows the results of a one year survey on the numbers of Corophium taken on the first day of each month.



a) Describe the changes in the numbers of *Corophium* from January to December. (2)

b) How many times greater are the number of *Corophium* on the 1st of June compared to the 1st of April? (1)

Homework 3

1. The table below shows information about the feeding relationships in the marine ecosystem.

Organism	Food eaten
euphausid	dinoflagellate, diatom
dinoflagellate	none
sweep	diatom
snapper	sweep, pilchard, blenny
pilchard	water flea, euphausid
blenny	water flea, euphausid
diatom	none
Water flea	dinoflagellate, diatom

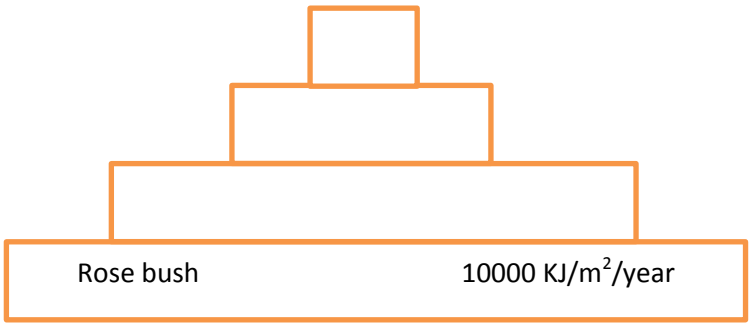
(*a*) (i) Use the information in the table to draw a food web.
(ii) What term is used to describe the snapper in this ecosystem? (8)

(*b*) A pod of dolphins arrived in the area. Dolphins feed on snappers.
(i) Add dolphins to the food web. (1)
(ii) What will happen to the size of the euphausid population?
Give an explanation for you answer. (2)

2. Rose Bush ⟶ Green fly ⟶ lady bird ⟶ black bird

A rose bush contains 10 000 kJ/m^2/year of energy and only 10% of this energy is passed on at each stage of the food chain.

(a) Copy the pyramid of energy below and add in the missing energy and organism name for this food chain. (3)



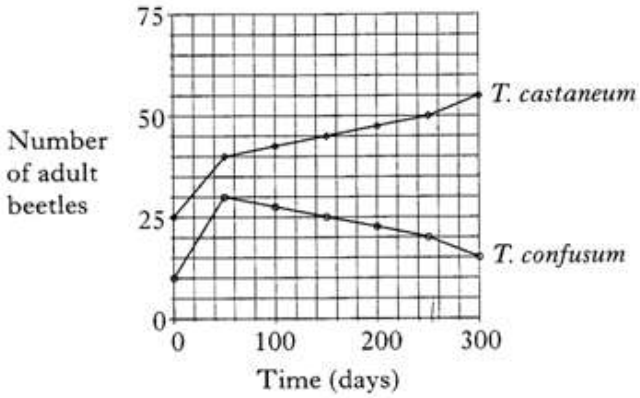
(b) Give a possible explanation why not all of the energy taken in by the greenfly is passed on to the birds. (1)

3. An investigation was carried out into the effects of competition when two species of flour beetle, *Tribolium confusum* and *Tribolium castnaneum*, were kept together in a container with a limited food supply. Tribolium beetles can be infected by a parasite which causes disease.

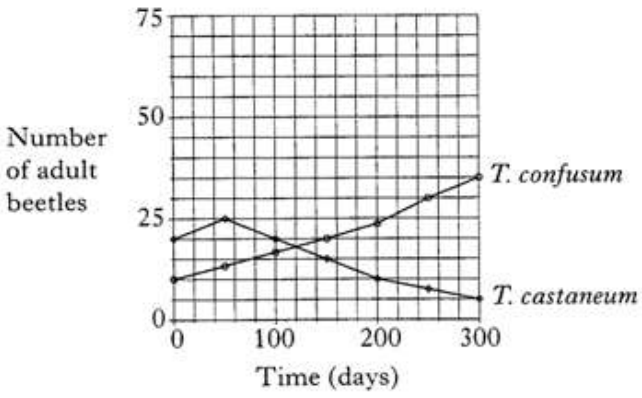
Graph 1 – shows the numbers of the two species over the period of time in the **absence of** the parasite.

Graph 2 – Shows the effect of the presence of the parasite on beetle numbers.

Graph 1 Parasite absent



Graph 2 Parasite present



a) Use values from **Graph 1** to describe how the numbers of *T.confusum* change from day 0 to day 300. (2)

b) From **Graph 1**, express, as the simplest whole number ratio, the population size of *T.confusum* to *T. castaneum* at 250 days.
(1)

_____ : _____

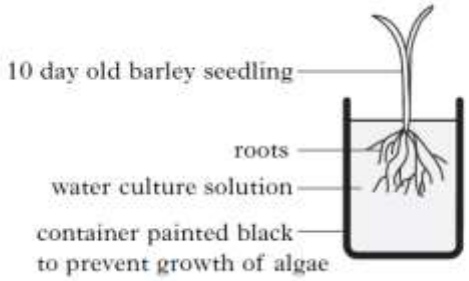
T.confusum : T castaneum

c) Using the information in **Graph 2**, calculate the % increase in T.confusum over the 300 days. (1)

Homework 4

1. The element Nitrogen is vital to life;
   a) What substance is Nitrogen a vital component of?
   b) What form do plants obtain Nitrogen from the soil in?
   c) How do animals obtain Nitrogen?
   d) How might the nitrogen content of soil be increased artificially?

2. A pupil carried out an investigation into the effects of nitrates on the growth of barley seedlings. Ten containers were set up as shown in the diagram below.



The water culture solution provided the nutrients needed for normal growth. However, five of the containers contained a solution that had nitrates in it and five contained a solution lacking nitrates.
After one week the increase in height of each seedling was measured.
Results are shown in the table below.

Container Number	*Increase in height of seedlings that had nitrate (mm)*	*Increase in height of seedlings that did not have nitrate (mm)*
1	24	14
2	18	12
3	17	16
4	22	9
5	19	14

(a) Name **two** variables that would have to be kept constant during the week that the seedlings were left to grow. (2)

(b) Calculate the average increase in height for each group of seedlings. (2)

(c) Draw a bar graph to show the average increase in height for both groups of seedlings. (you will need graph paper for this) (3)

(d) What can be concluded from this set of results? (1)

(e) How did the pupil make sure that her results were reliable? (1)

(f) Suggest one way that the pupil could improve the design of her investigation. (1)

(h) Which type of competition is being investigated in this experiment (1)

Homework 5

1. a) Two groups of pupils set pitfall traps in the school gardens to sample invertebrates living there. All traps were left for the same amount of time. The results are shown in the following tables.

Group A	*Pitfall trap number*	*Number of each type of invertebrate caught*				
		spider	beetle	snail	earthworm	woodlouse
	1	2	1	2	0	1
	2	3	2	1	0	0

Group B	*Pitfall trap number*	*Number of each type of invertebrate caught*				
		spider	beetle	snail	earthworm	woodlouse
	1	2	3	2	1	1
	2	2	0	3	1	2
	3	0	2	1	1	1
	4	3	2	1	0	1
	5	3	1	1	2	1

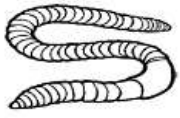
i) How many types of invertebrate did Group A find? (1)

ii) Calculate the average number of spiders found in Group B's traps. (1)

iii) Explain why conclusions made by Group B from their results would be more reliable than conclusions made by Group A. (1)

iv) Give one precaution which must be taken when setting up a pitfall trap and explain the reason for it. (2)

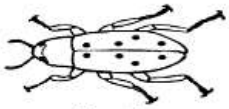
b) The diagram below shows the invertebrates collected by the pupils. (They are not drawn to scale).



Earthworm

Snail

Spider



Beetle

Woodlouse

i) **Complete the following key using information from the diagrams.**
Write down the word/phrase which should replace each letter.

1	Legs	Go to 2
	No legs	Go to a
2	12 legs or more	*Woodlouse*
	Fewer than 12 legs	Go to 3
3	Spots on body	*Beetle*
	No spots on body	b
4	Shell	*Snail*
	c	d

(3)

2.a) Give two examples of biotic factors that can affect members of a species (2)

b) For each of the below abiotic factors, state what equipment would be used to measure it and one precaution that would have to be taken when using this equipment;

i) Moisture (2)

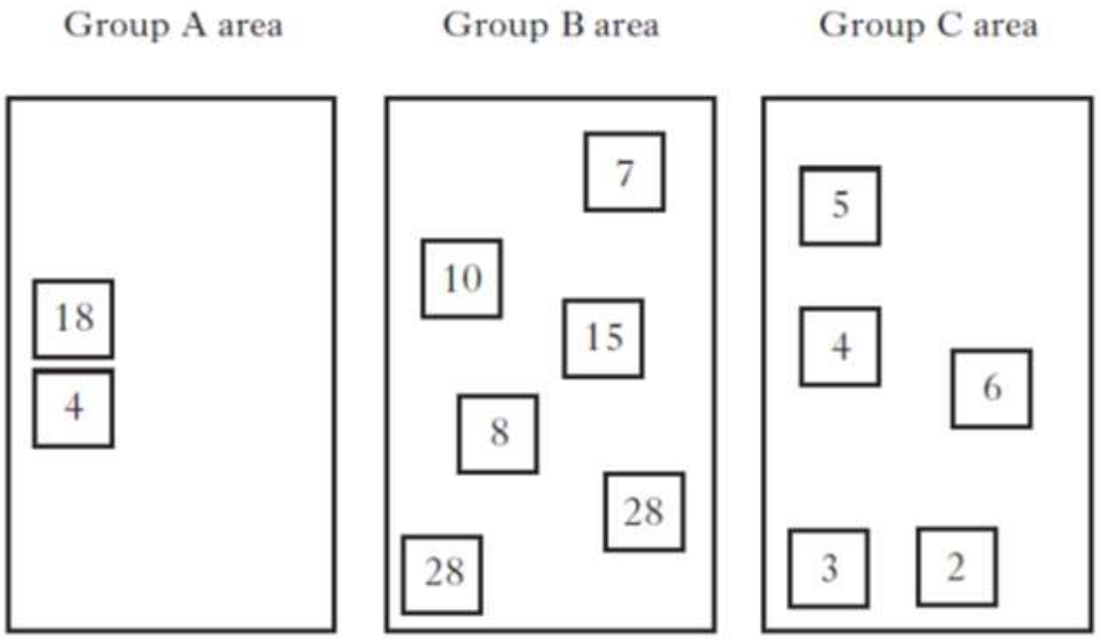
ii)Light Intensity (2)

Continued on next page.

3. Three groups of students used quadrats to carry out a survey on the distribution of mussels on different areas of the shore.

Each quadrat measured 50cmx50cm (four quadrats=1m)

The position of the quadrats and the number of mussels found is shown below for each group.



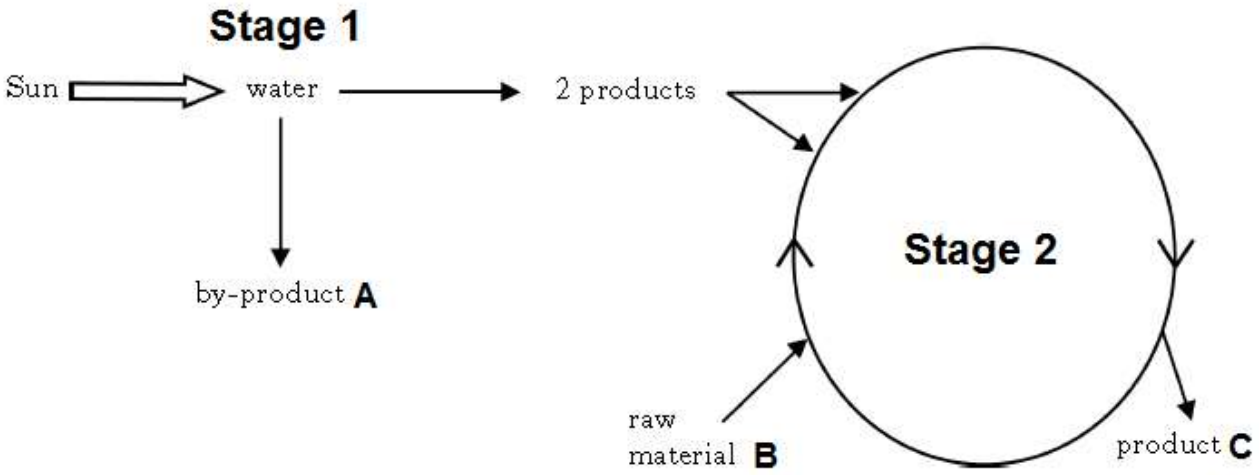
a) Work out the average number of mussels per quadrat and the average number of mussels per metre for Group C. (2)

Group	*Average number of mussels per quadrat*	*Estimated number of mussels per* m^2
A	11	44
B	16	64
C		

b) i) Which group has made an error in this sampling technique? State the error which has been made (1)
ii) How they could minimise this error? (1)

Homework 6

1. The diagram below shows the stages of photosynthesis and the exit and entry of materials to the process:

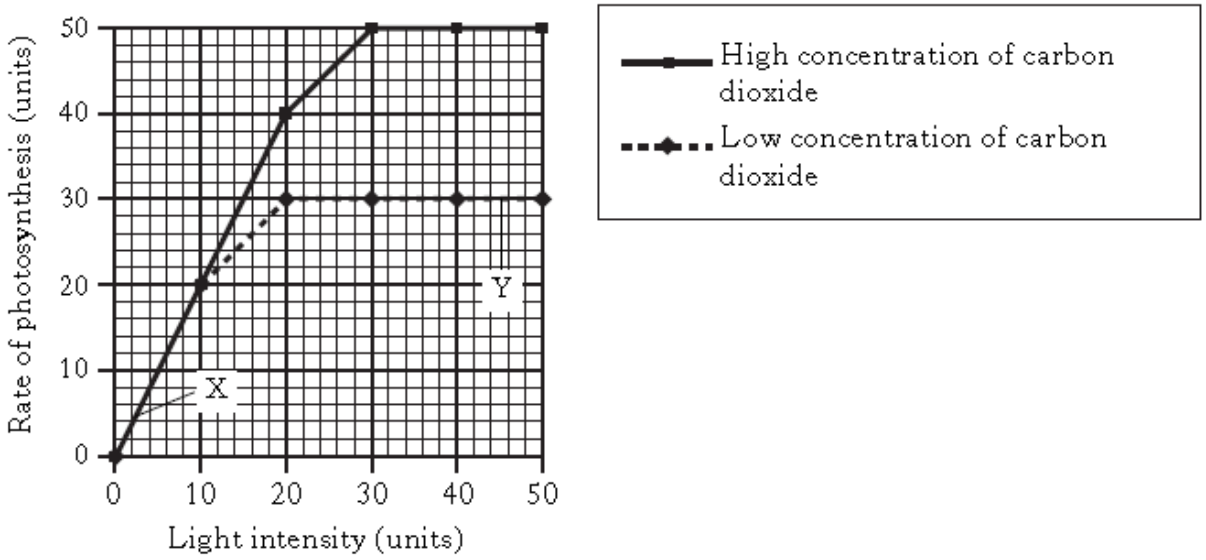


a) Name Stages 1 and 2 [2]

b) What energy-rich substance is produced during the first stage? [1]

c) Name 2 uses for product C. [2]

2. The graph below shows the effect of 2 environmental factors on the rate of photosynthesis.



a) What are the limiting factors at X and Y? [2]

b) Describe the results in the graph for a low concentration of carbon dioxide. [2]

c) Name another factor not mentioned that can affect the rate of photosynthesis [1]

d) For each experiment, what is the independent variable? [2]

Homework 7

1. Samples of water were taken from a river at a sewage outfall and at a number of points downstream from the outfall.

The table below shows the oxygen content of the water at different distances below the outfall.

Sample Point	Distance from outfall (m)	Oxygen content (units)
1	0	0.10
2	250	0.04
3	500	0.20
4	750	0.40
5	1000	1.00
6	1500	1.28

The oxygen content is twice as great at Sample point 4 compared with Sample point 3.

a) How many times greater is the oxygen content at Sample point 3 compared with Sample point 2? 1

b) Describe what happens to the oxygen content of the water as the distance from the outfall increases. 1

c) Explain why the smallest number of organisms was found at the greatest distance from the outfall at Sample point 6. 1

d) Identify the sample point at which there will be the least variety of species of organisms, other than micro-organisms. 1

e) What is the term used to describe a species whose presence at a point in the river gives information about the level of oxygen present? 1

2. Increasing human population requires an increased food yield. One way of achieving this is the use of fertilisers.

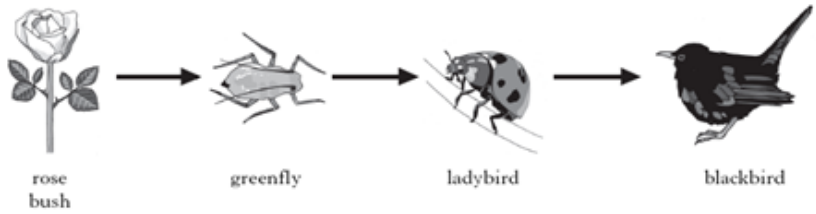
a) One disadvantage of using fertilisers is that they can leach into fresh water and cause the rapid growth of algae. What is this mass growth of algae called? 1

b) Explain how this can lead to the death of fish in the affected water. 2

3. Pesticides sprayed onto crops can accumulate in the bodies of organisms over time. As they are passed along food chains their toxicity increases and can sometimes reach fatal levels.

a) What is this process called? 1

b) Below shows a food chain with the concentration of pesticide (DDT) present in the rose bush and the number of organisms consumed along the chain.



Rose petals contain 0.01ppm DDT	greenfly eats 2 rose petals	ladybird eats 10 greenfly	blackbird eats 20 greenfly

Use the above information to work out the DDT concentration in the greenfly, ladybird and blackbird and complete the below table.

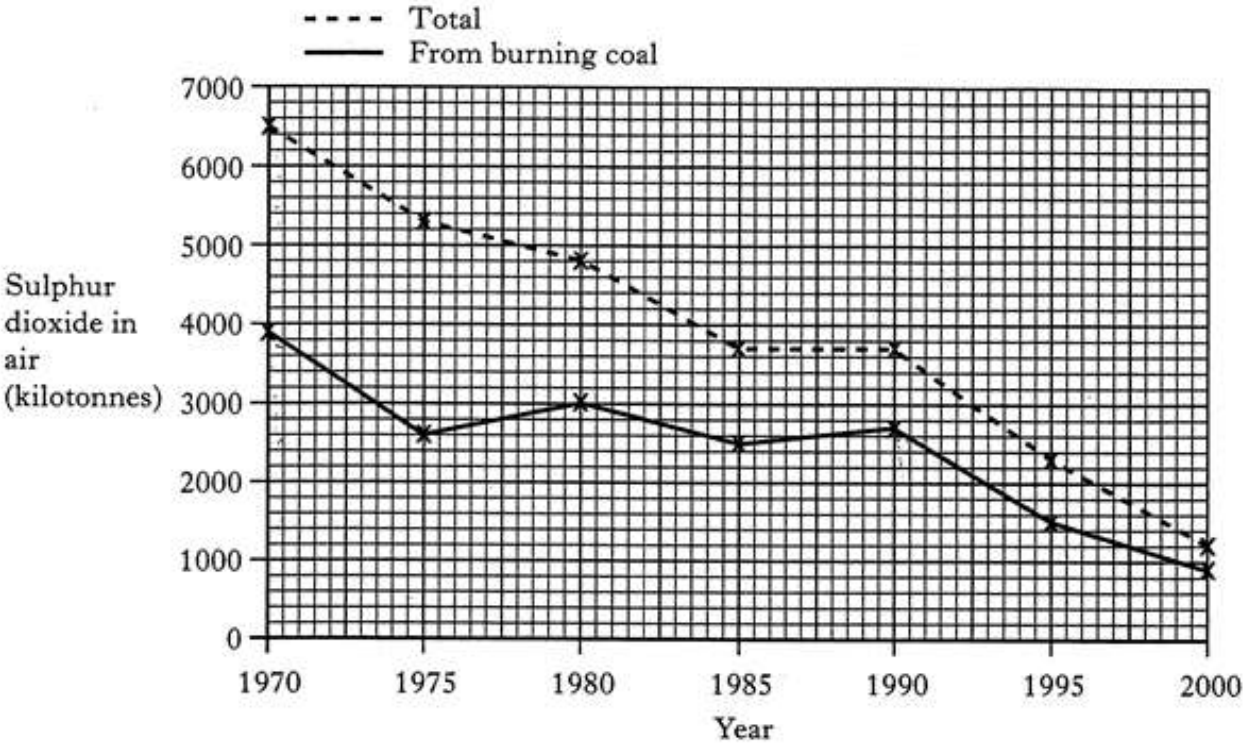
Organism	Concentration of DDT in organism(ppm)
rose petals	0.01
greenfly	
ladybird	
blackbird	

1

4. a) Give an example of an organism used as a biological control and name the pest it controls. 1

b) Detail one advantage and one disadvantage of using a biological control to manage pests. 2

5. The graph below gives information about levels of sulphur dioxide in the air.



a) The graph shows an overall reduction in the total level of sulphur dioxide in the air.

i) During which 5 year period was there no reduction in the total level of sulphur dioxide in the air? [1]

ii) During which 5 year period was there the greatest decrease in the total level of sulphur dioxide in the air? [1]

iii) In 1970, 3900 kilotonnes of sulphur dioxide were produced from burning coal. What percentage of the total is this? [1]

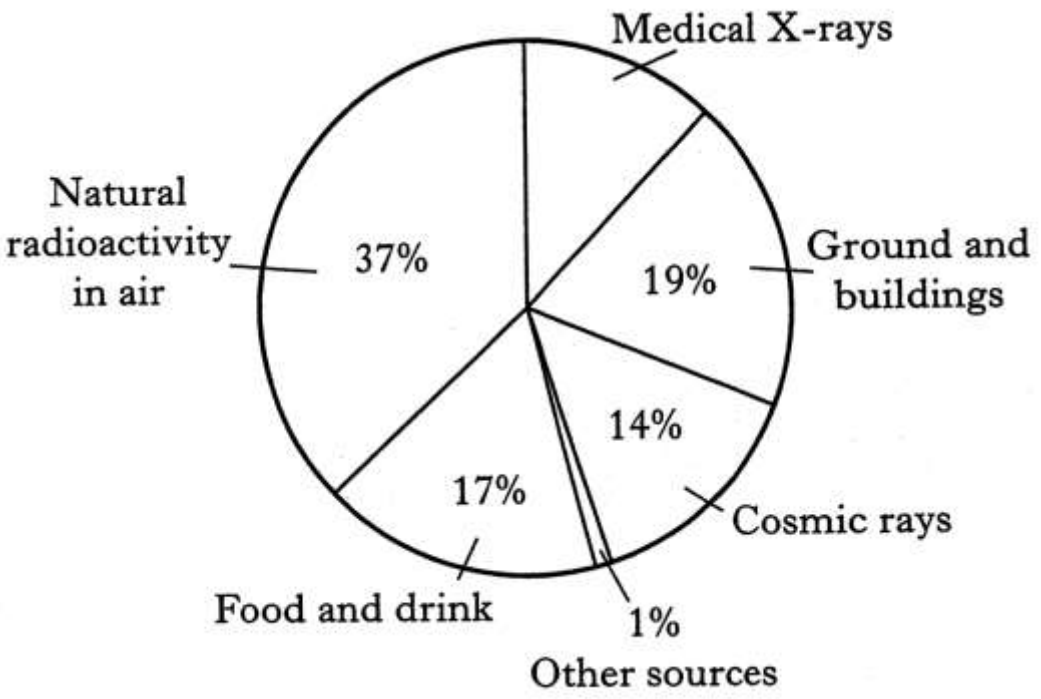
b) What species indicates the level of sulphur dioxide pollution by its presence or absence? [1]

Homework 8

1.a) What is meant by the term mutation? (1)

b) Mutations can be neutral, advantageous or disadvantageous. In what way are mutations sometimes advantageous to a species? (1)

2.a) Exposure to radiation can cause mutation. The pie chart below shows the contribution of various sources of radiation to the total exposure.



i) Which source of radiation contributes most to the total exposure? (1)

ii) What percentage of the total exposure comes from X-rays? (1)

iii) Other than radiation, name two other mutagenic agents. (1)

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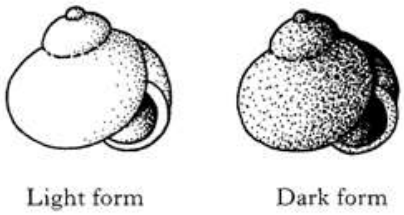
3. The snail Cepea shows variation in shell colour and different forms of shell are found. Two of the forms are shown below.



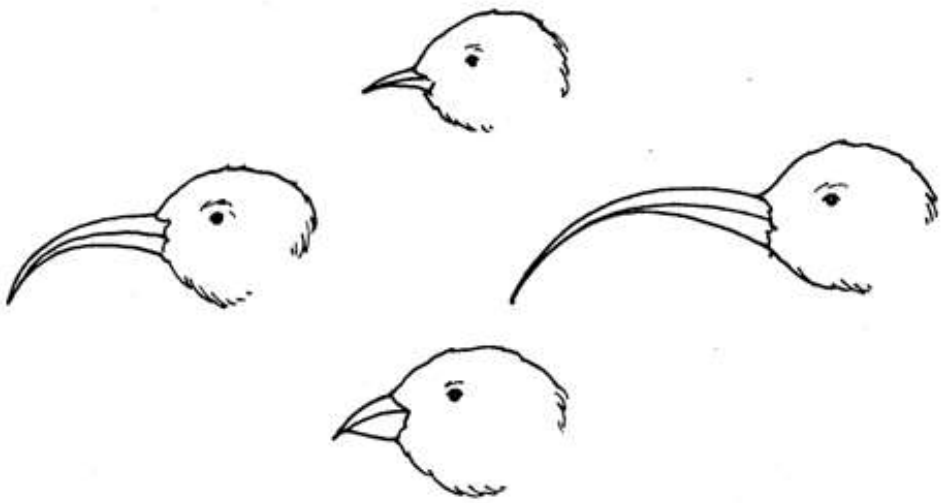
Light form Dark form

The table below shows the results of an investigation into the numbers of different forms of snails found in two habitats.

Habitat	Light form	Dark form	Other forms
dense woodland	14	64	22
open grassland	58	12	30

a) Explain how natural selection has resulted in the high numbers of the dark form of the shell in dense woodland. (2)

b) Hawaii is a group of islands isolated in the Pacific Ocean. Different species of Honeycreeper birds live on these islands. The heads of four species of Honeycreeper are shown below.



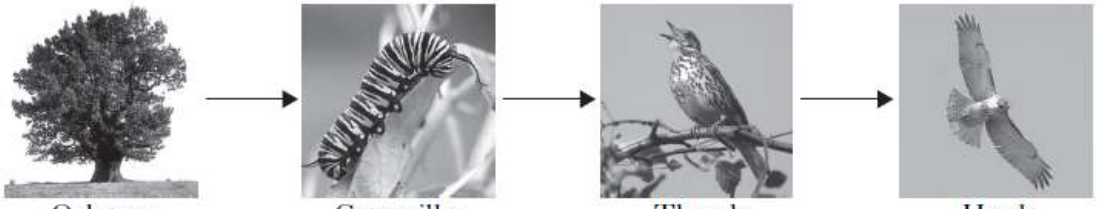
4. a) How does the diagram of the different Honeycreeper species support the statement that they occupy different niches. (1)

b) The Honeycreeper species have evolved in geographical isolation. Name one other type of barrier involved in the evolution of new species. (1)

Extended Answer Questions

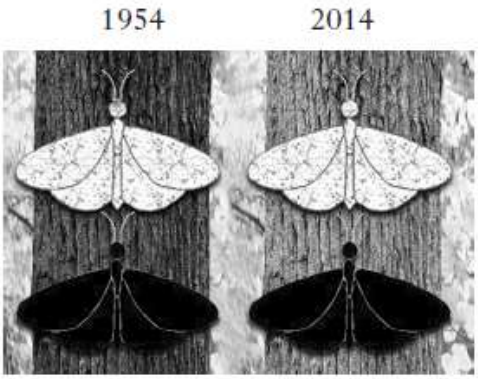
1 Describe the **two** stages of photosynthesis **including** the names of the raw materials and products for **each** stage. 5

2 A. The pictures below show a food chain which is also represented by two types of pyramid.



Name the type of pyramid X. Explain why **both** pyramids are correct for this food chain. 5

3 B The peppered moth (*Biston betularia*) has a dark form and a pale form. Both forms rest on tree trunks during the day. The diagrams below show peppered moths in 1954 and 2014 in the same woodland.



Describe how changes in the environment caused the colour of the tree trunks to get lighter. Explain how this change in tree trunk colour affected the population size of **one form** of peppered moth in the woodland. 5

4. Describe how new species can be formed from one population. 5
5. Describe how nitrogen is used by plants and what happens when excess nitrogen is released into freshwater. (5)
6. Describe one sampling technique and one way of measuring an abiotic factor. For each identify a source of error and how this could be minimised. (5)