National 4 Biology

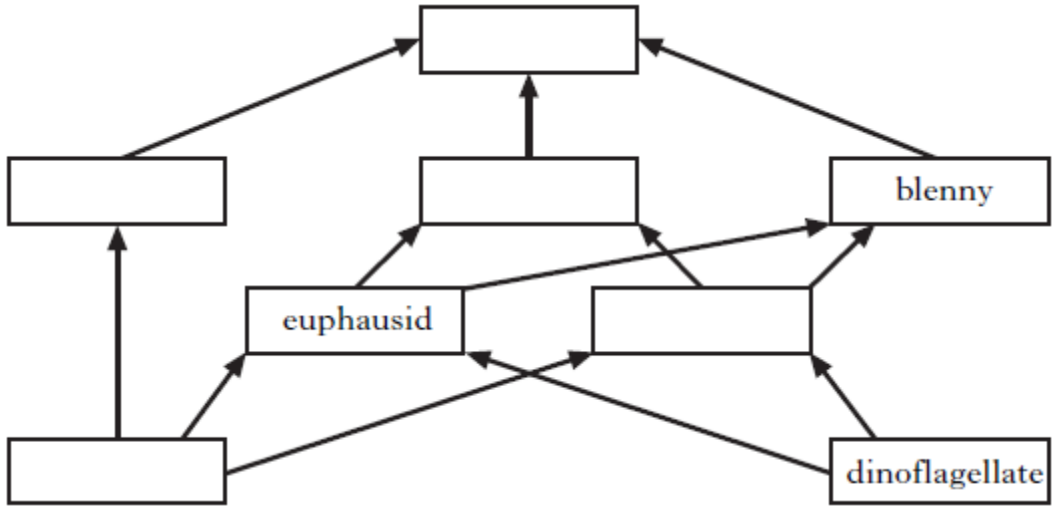
Homework Booklet

Life on Earth

1. The table below shows some of the feeding relationships in the marine ecosystem.

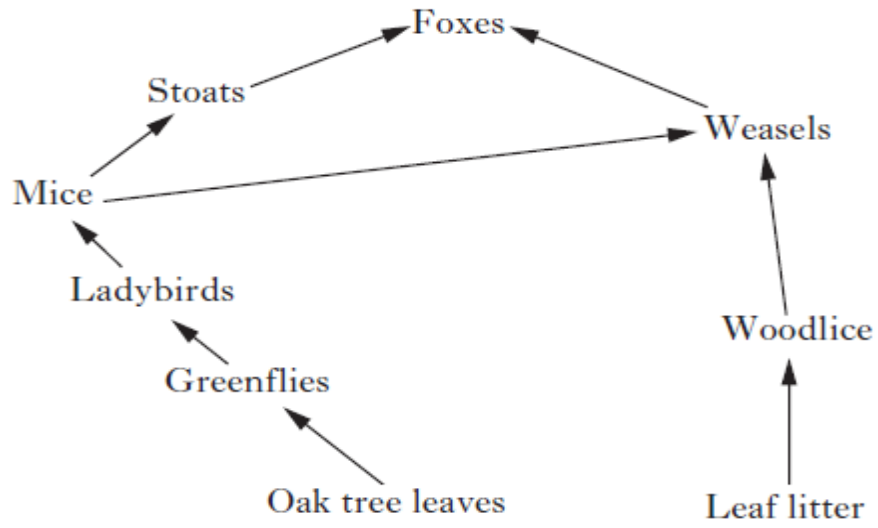
Organism	*Food eaten*
euphasid	dinoflagellate, diatom
dinoflagellate	none
sweep	diatom
snapper	sweep, pilchard, blenny
pilchard	water flea, euphausid
blenny	water flea, euphausid
diatom	none
water flea	diatom, dinoflagellate

a. Using this information, copy and complete the food web below. (2)



b. Pollution entering the ecosystem killed all the snappers. Predict what effect the removal of the snappers would have on;
(i) Blennys (ii) Euphausids (iii) Dinoflagellates.
Give a reason for your predictions. (3)
c. Suggest a type of pollution that could have killed the snappers. (1)

2. The diagram below shows part of a woodland food web from Scotland.



a. Use the terms ***increase***, ***decrease***, or ***stay the same*** to describe the effect on greenfly and stoat populations if all the mice were killed by a disease. Give reasons for your answers. (2)

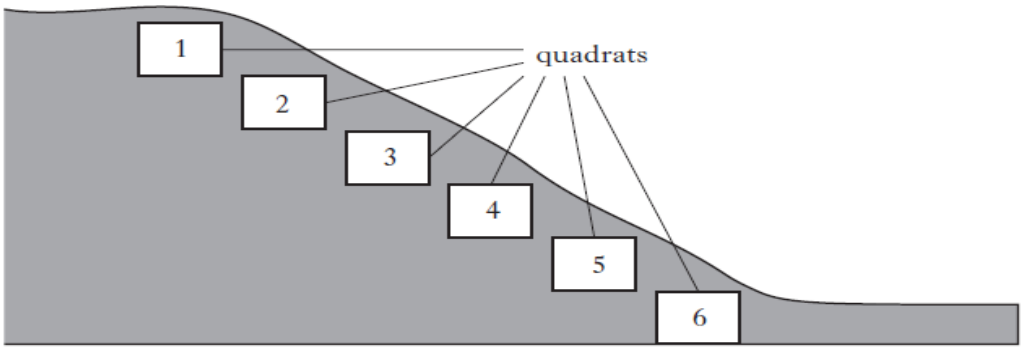
b. What organisms in the food web are in direct competition? (1)

c. In May of one year, Scotland experienced hurricane force winds for 2 days which blew many leaves from the trees.

(i) Which animal would benefit the most from this? (1)

(ii) How would the mice be affected? (1)

3. In an investigation into the distribution of heather plants, a team of researchers placed 6 quadrats in a line from the top to the bottom of a hill. Soil moisture, pH, surface light intensity (abiotic factors), and heather abundance score (biotic factor) were recorded for each quadrat. The researchers also observed many beetles living amongst the heather and many bees visiting the heather flowers.



The following table shows the results.

Quadrat	*Soil moisture* (%)	*Surface light intensity* (lux)	*pH*	*Heather abundance score*
1	10	10 000	5·5	25
2	15	11 000	5·4	22
3	40	10 000	5·5	15
4	63	10 500	5·5	9
5	71	12 000	5·6	6
6	81	11 000	5·4	0

a. Describe the distribution of the heather on the hill slope. (1)

b. Which of the abiotic factors does heather appear to rely on the most? (1)

c. Predict what could happen to heather abundance scores if the hillside became waterlogged for a long period of time. (1)

d. Which quadrat had 60% of the heather abundance score found in quadrat number 1? (1)

e. Suggest two things that the heather could provide for the beetles. (2)

f. How might the bees benefit the heather plants? (1)

4. Two groups of pupils set pitfall traps in the school ground for 24 hours. The results were;

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

a. What was the total number of invertebrates trapped by both groups? (1)

b. What was the most common invertebrate found by **group B**? (1)

c. Calculate the average number of earthworms trapped by **group B**. (1)

d. Calculate the simplest whole number ratio for the total number of spiders trapped by group A compared to the total number of spiders trapped by group B. (1)

e. Using graph paper provided by your teacher, construct a bar chart of the total numbers of each invertebrate type trapped by **group A**. (2)

5. The effect of light intensity on the time taken for one bluebottle larva (maggot) to travel 10cm was investigated by four groups of students. The larva was placed in a covered glass dish and light intensity was varied by placing a light at different distances above the dish. The results are shown below.

Light intensity	*Time taken for larvae to travel 10 cm (s)*				
	Group 1	*Group 2*	*Group 3*	*Group 4*	*Average*
High	20	22	24	22	22
Medium	39	42	47	44	43
Low	48	50	50	52	50
Very low	66	70	64	76	

a. Calculate the average result at very low light intensity. (1)
b. What is the percentage decrease in time taken for larvae to move 10cm when light intensity is changed from low to medium? (1)
c. Which light intensity produced the least response from the larvae? (1)
d. Predict the effect on the time taken for larvae to move 10cm if the experiment was conducted in darkness. (1)

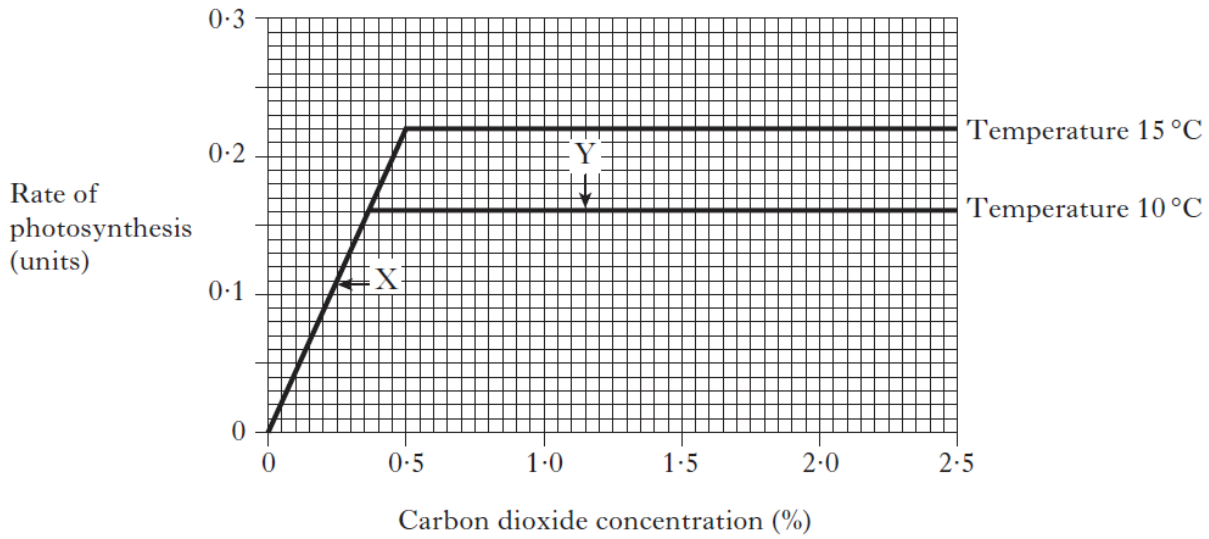
6. The rate of photosynthesis can be affected by several factors.

a. Copy the sentence below with the correct words to explain the term limiting factor.

The limiting factor is the factor which is preventing the rate of photosynthesis from { increasing / decreasing } unless the supply of that factor { increases / decreases }.

(1)

b. The following graph shows the effect of increasing carbon dioxide concentration on the rate of photosynthesis at two different temperatures. All other factors were kept constant.



From the evidence in the graph, what are the limiting factors at points X and Y? (2)

c. Describe two changes to the environmental conditions in a greenhouse which could increase the rate of photosynthesis. (2)

7. The table below gives details of the effects of adding nitrogen on the yield of two crop species grown in the English county of Norfolk.

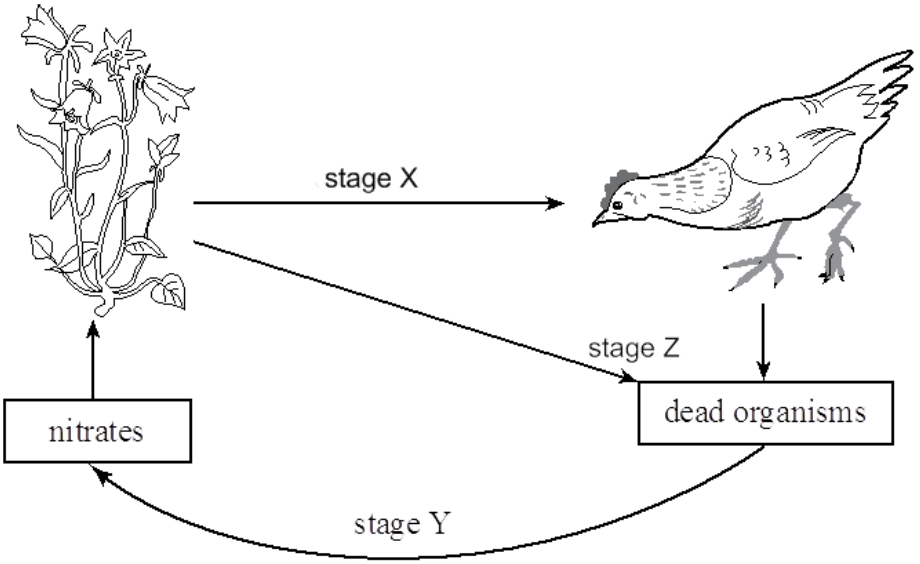
Crop & Treatment	Crop yield (tonnes)
Barley with **nothing** added to soil	40
Barley with **nitrogen** added to soil	56
Peas with **nothing** added to soil	50
Peas with **nitrogen** added to soil	54

a. Calculate the percentage increase in yield for each crop when nitrogen is added to soil. (2)
b. Why do plants need nitrogen? (1)
c. Fertilisers are a source of added nitrogen. State one advantage and one disadvantage of; (i) a natural fertiliser; and (ii) an artificial fertiliser. (2)

The Norfolk broads are waterways that attract much wildlife and many tourists to the area. Boat users must observe a strict 5 miles per hour speed limit

d. Describe the problems that could occur in the Norfolk broads if;
(i) Farmers applied too much fertiliser to their fields and any excess was able to leach into the waterways. (3)
(ii) Boat users kept breaking the speed limit. (2)

8. The diagram below represents the nitrogen cycle.



a. What type of organisms are responsible for stage Y? (1)

b. What is nitrogen needed for? (1)

c. Which lettered stage would be part of a food chain? (1)

9. In African grasslands, Impala, Giraffe, and Zebra are all species that graze on *Acacia* trees. Impala and Zebra also graze on grasses.

Acacia

impala

giraffe

zebra

a. Suggest two adaptations of Zebra that help them avoid becoming prey to lions. (2)

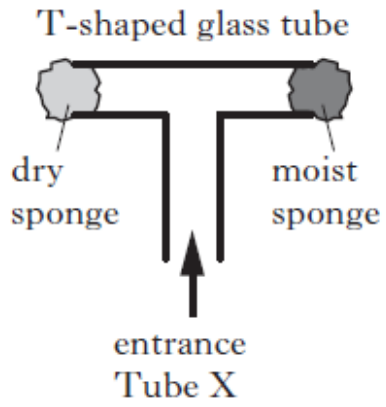
b. How is competition for food reduced between Giraffe and the other two grazers? (1)

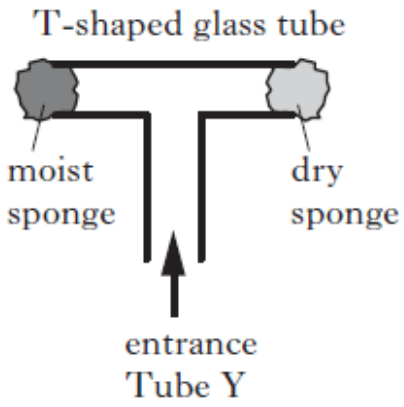
c. *Acacia* trees have adapted to grazing by growing sharp thorns on their branches. Suggest an adaptation of Giraffes that allows them to eat *acacia* leaves. (1)

d. The *acacia* trees can also tolerate long periods of drought. Describe one possible adaptation that allows this. (1)

e. Describe the impact that a two year period without rainfall (drought) would have on all the organisms above? (2)

10. The apparatus below was used to investigate the responses of flour beetles to humidity.





Each T-shaped tube was left for 10 minutes before one beetle was placed at the entrance. The direction in which the beetle turned was recorded. This was repeated with 25 beetles and a new T-shaped tube each time. The results were;

	Tube			
	X		Y	
Direction turned	left	right	left	right
Humidity	dry	moist	moist	dry
Number of beetles	21	4	5	20

a. Describe the response of flour beetles to humidity. (1)

b. Tubes X and Y were set up differently. How does this improve the investigation? (1)

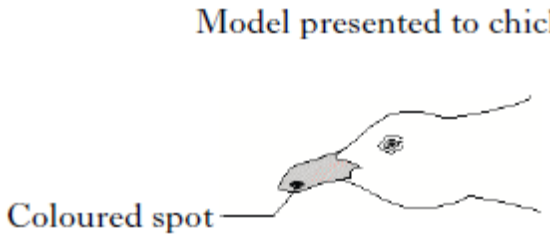
c. What was the purpose of leaving the tubes for 10 minutes before introducing a beetle to the tube? (1)

d. Suggest a reason why a new T-shaped tube was used for each beetle used. (1)

e. Calculate the percentage of beetles that turned towards the moist side in tube X. (1)

f. State two environmental factors that should be kept constant in this investigation. (2)

11. Herring gull chicks are fed on food regurgitated by their parents. To make the parent regurgitate, a chick pecks at a coloured spot on the parent's beak. An investigation into the responses of one herring gull chick to 'model' gull heads with different coloured spots on the beak was conducted.



The following results were obtained.

Colour of spot on beak	Number of times pecked by chick
Black	7
Blue	???
Red	9
Green	???
White	2
No spot	1

a. The blue spot was pecked once fewer than the black spot. The green spot was pecked half of the number of times the blue spot was pecked. Use this information to calculate the missing values from the table. (2)

b. Name one variable that had to be kept constant. (1)

c. Why is the investigation unreliable? (1)

d. What colour are Herring gull beak spots likely to be? (1)

e. Is the behaviour displayed by herring gull chicks **innate** or **learned**? Justify your answer. (2)