

GCSE Biology (9 – 1)

Feeding Relationships and Energy Flow

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	/4
2	/14
3	/6
4	/13
5	/6
6	/10
Total	/53
%	
Grade	

Information

- The maximum mark for this paper is 53 marks.
- The marks for each question are shown in brackets.
- Please be aware that good English and clear presentation are required in your answers.



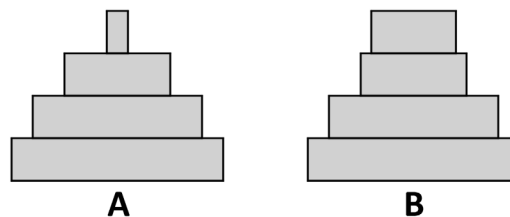
1. Feeding relationships are the vital links between species in an ecosystem, showing the pathways by which energy and nutrients flow from one organism to another.

The multiple choice questions below focus on feeding relationships and energy flow in an ecosystem. Circle the letter of the correct answer for each.

- a) Biomass is lost between different trophic levels in a food web.
One reason for this is the release of undigested food from the body.
Which term is used to describe this release?

A	B	C	D
Excretion	Decomposition	Egestion	Peristalsis
(1 mark)			

- b) The diagram shows pyramids of biomass for two food webs, A and B.



Which statement explains the difference between the two pyramids?

- A** The energy transfer between primary and secondary consumers is higher in food web A than in food web B.
- B** The energy transfer between secondary and tertiary consumers is higher in food web A than in food web B.
- C** The energy transfer between primary and secondary consumers is lower in food web A than in food web B.
- D** The energy transfer between secondary and tertiary consumers is lower in food web A than in food web B.

(1 mark)

- c) Which term describes an organism that makes its own food, usually using light energy?

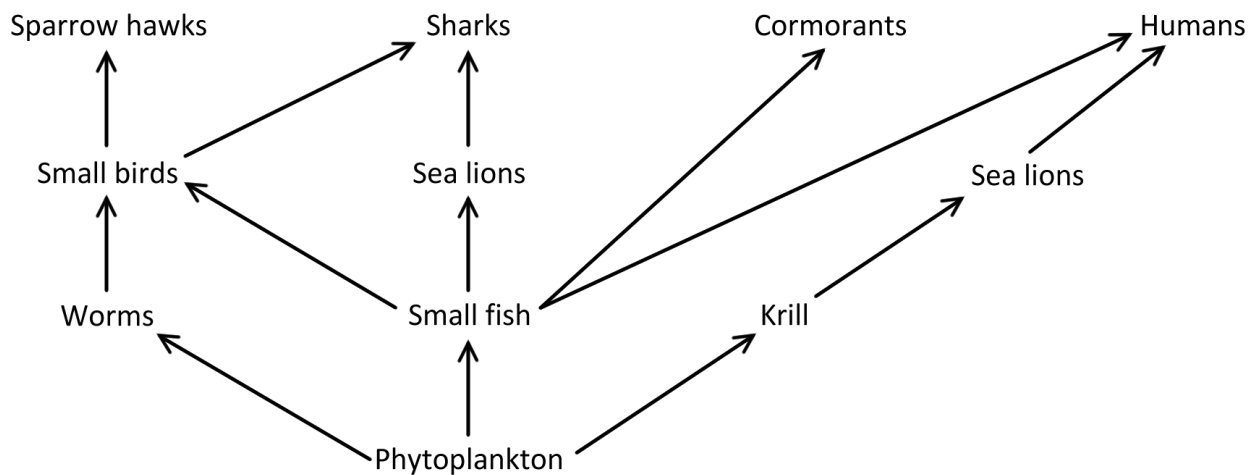
A	B	C	D
Consumer	Decomposer	Producer	Herbivore
(1 mark)			

- d) In the food chain: Grass → Rabbit → Fox → Eagle
What is the trophic level of the Fox?

A	B	C	D
Secondary consumer	Primary consumer	Producer	Tertiary consumer
(1 mark)			

(Total for Question 1 is 4 marks)

2. Look at the food web below.

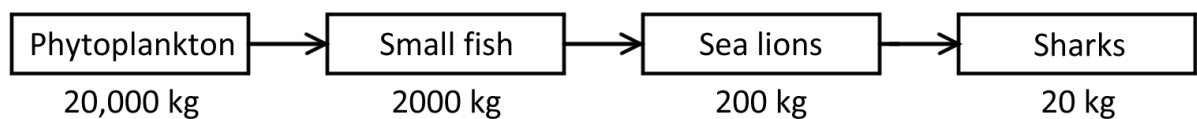


a) Name **two** animals from the food web that are secondary consumers.

.....

(2 marks)

b) The figure below shows the biomass at each stage in one of the food chains from the food web.



Calculate the total percentage of biomass **lost** from the start of this food chain (Phytoplankton) to the end of this food chain (Sharks).

Show your working.

Percentage change = ...

(3 marks)

c) Calculate the percentage efficiency of biomass transfer from the Small Fish to the Sea Lions.

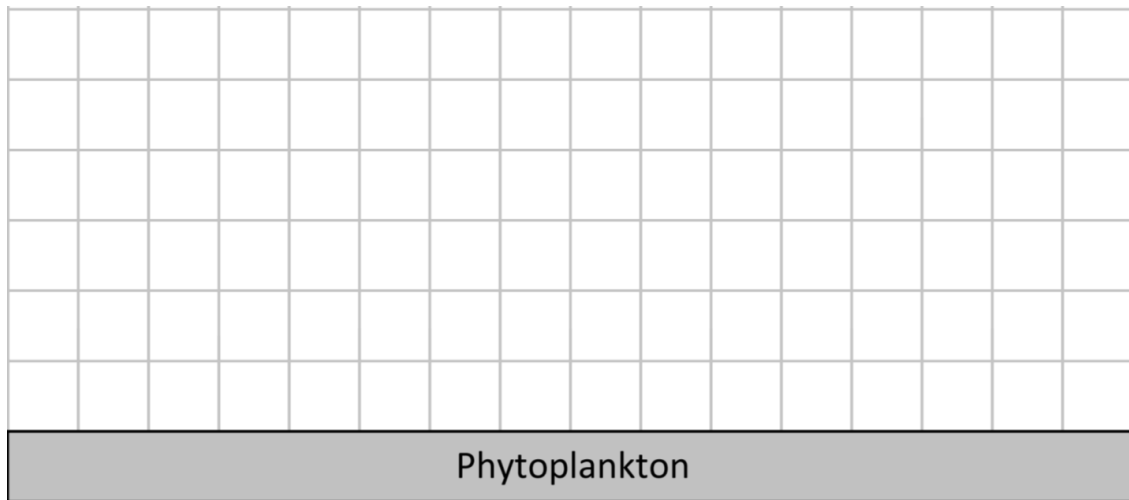
Show your working.

Percentage efficiency = ...

(2 marks)

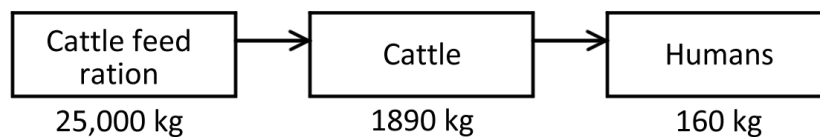
- d) A pyramid of biomass shows the relative amount of biomass at each level of a food chain. For the food chain: **Phytoplankton** → **Small fish** → **Cormorants**, the producer (phytoplankton) is shown at the base of the pyramid on the grid.

Continue building this pyramid of biomass by drawing appropriately scaled and labelled bars for the small fish and then the cormorants in their correct trophic positions."



(3 marks)

- e) The figure below shows the flow of biomass through a different food chain.



- f) Calculate the percentage efficiency of transfer of biomass between the cattle food crop and humans.

Percentage efficiency = ...

(2 marks)

- g) State **two** ways that biomass is lost from the above food chain.

.....

.....

.....

.....

(2 marks)

(Total for Question 2 is 14 marks)

3. A scientist estimated the biomass of various desert communities, categorizing organisms into four groups based on their food web roles in the table below. Detritivores, one such group, are defined as animals that eat dead organic material.

Types of Organisms	Biomass in g/m ²
Producers	840
Herbivores	420
Detritivores	210
Carnivores	105

- a) Using the data in the table above, calculate the percentage of biomass that is lost between the producer level and the carnivore level. Show your working.

Percentage lost = ...

(2 marks)

- b) Explain why food chains are usually short and have fewer than five trophic levels.

.....

.....

.....

.....

.....

.....

(2 marks)

- c) A food chain consists of one large oak tree, 2,000 caterpillars that eat its leaves, and 10 birds that eat the caterpillars.

Explain why a pyramid of numbers is a poor way to represent this food chain, and why a pyramid of biomass would be better.

.....

.....

.....

.....

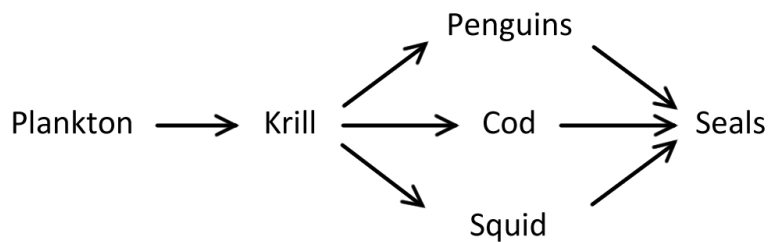
.....

.....

(2 marks)

(Total for Question 3 is 6 marks)

4. The figure below shows part of a food chain for a marine habitat.



a) State which trophic level the cod is in.

.....
(1 mark)

b) Each year humans fish large number of cod out of the Atlantic ocean.

Explain why the removal of large numbers of cod could lead to an **increase** in the numbers of squid and penguins.

.....
.....
.....
.....
.....
.....
(2 marks)

c) The total energy stored in the plankton at the start of the food web is 800 000 kJ.

Scientists have estimated that, due to energy losses at each trophic level, only 0.02% of the original energy from the plankton is transferred to the seals.

Calculate the amount of energy that is transferred to the seals.

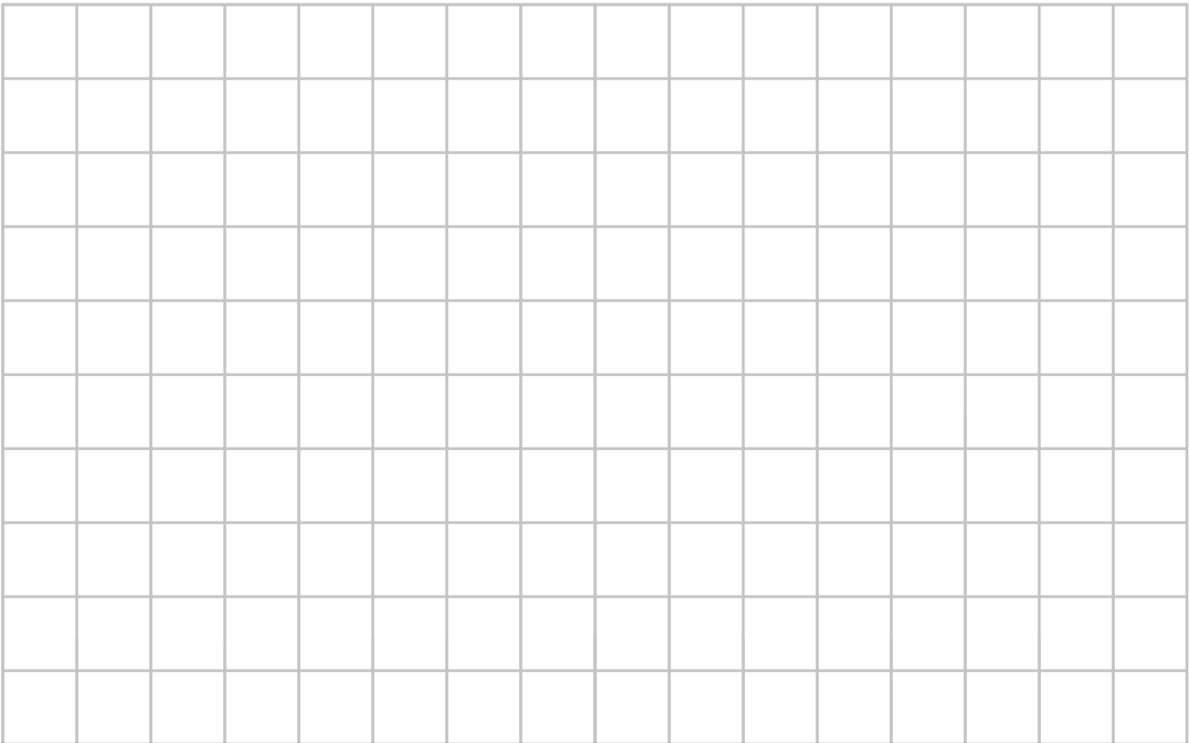
Energy = ... kJ
(3 marks)

d) The table below shows information about the biomass of some of the organisms in one part of the food web above.

Types of Organism	Number of Organisms
Plankton	500 000
Krill	20 000
Squid	400
Seals	10

i. Use the data in the table to draw a pyramid of numbers for this food chain on the graph paper below. (2 marks)

ii. Label each trophic level of your pyramid with the correct organism. (2 marks)



d) Scientists estimate that only about 10% of the energy stored in the plankton is transferred to the krill. Explain why so much energy is lost between the plankton and the krill.

.....

.....

.....

.....

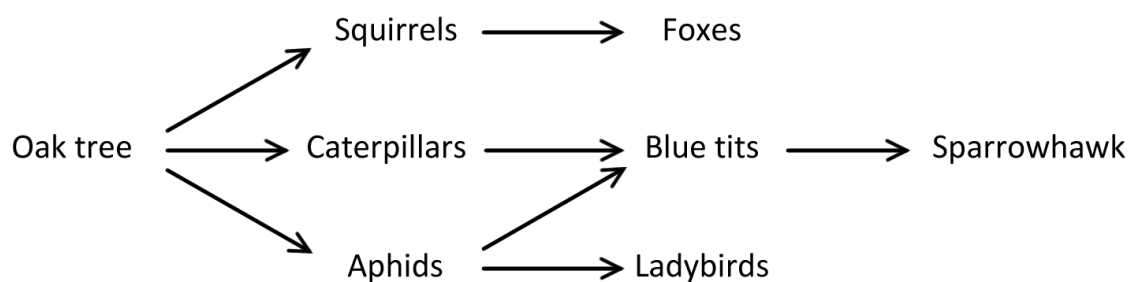
.....

.....

(3 marks)

(Total for Question 4 is 13 marks)

5. The figure below shows a food web for a wooded grassland habitat.



Oak trees are eaten by squirrels, caterpillars, and aphids. Foxes eat squirrels. Blue tits eat caterpillars and aphids. Ladybirds also eat aphids. Sparrowhawks eat blue tits.

A farmer sprays a pesticide that kills a large proportion of the caterpillars.

Describe and explain the likely effects of the decrease in caterpillars on the other organisms in this food web. In your answer, you should refer to ideas about food availability and competition.

[illegible]

(6 marks)

(Total for Question 5 is 6 marks)

6. A group of students investigated the feeding relationships in a woodland ecosystem. They focused on one food chain from the wider food web:

Oak Tree → Caterpillars → Blue Tits → Sparrowhawk

The students counted the number of organisms in their study area.
Their results are shown in the table below.

Types of Organism	Number of Organisms
Oak tree	1
Caterpillars	8000
Blue tits	40
Sparrowhawk	2

- a) On the graph paper below, draw a labelled **pyramid of numbers** for this food chain.



(3 marks)

- b) Explain why the pyramid of numbers you have drawn is not a typical pyramid shape.

.....

.....

.....

.....

.....

.....

(2 marks)

To investigate the biomass of the caterpillars, the students collected all the caterpillars from 5 different, similar-sized branches of the oak tree. The mass of caterpillars on each branch is shown below.

Caterpillars	1	2	3	4	5
Mass (g)	1.4	1.6	1.5	1.4	1.6

- c) Calculate the mean mass of caterpillars found per branch.

Mean = ...
(2 marks)

- d) Scientists calculated the energy transfer along this food chain.

They found that the chemical energy stored in the **oak tree leaves** available to the food chain was **4,000,000 kJ**.

The total energy that was finally incorporated into the biomass of the **sparrowhawks** was only **20 kJ**.

Calculate the **percentage efficiency** of the energy transfer from the oak tree to the sparrowhawk.
Give your answer to 2 significant figures.

Percentage efficiency = ...
(3 marks)

(Total for Question 6 is 10 marks)