

Exercise walk-through

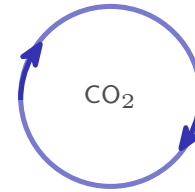
19.2

Food chains and food webs

IGCSE Biology

What we will cover

- 1 Energy flow & food chains
- 2 Food webs & feeding roles
- 3 Pyramids & energy loss
- 4 The carbon cycle
- 5 The nitrogen cycle
- 6 Populations

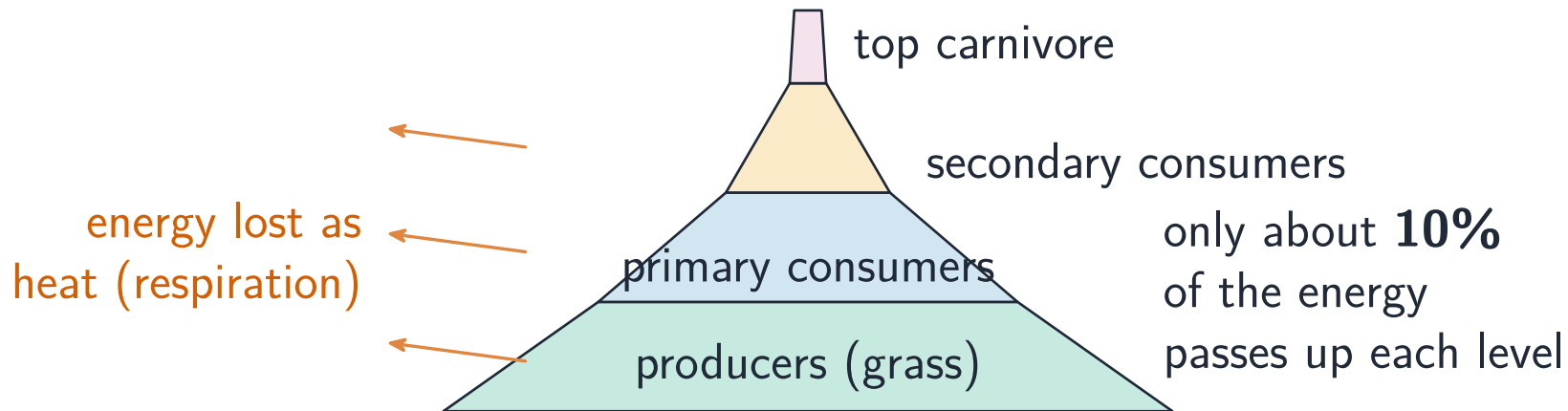


in and out

the carbon cycle

Pyramids and energy loss

Each **trophic level** passes only $\sim 10\%$ of its energy up, so levels shrink & chains are short. A **pyramid of numbers** counts organisms and can come out the wrong shape – one oak tree feeding many insects. A **pyramid of biomass** weighs them, which is usually the better picture. Eating crops directly wastes less than eating animals; humans harm webs by **overharvesting**.



Exam tips

- Energy enters from the Sun, flows one way along the chain, and is lost as heat at each step. Nutrients are recycled.
- Food chain starts with a producer; arrows show energy flow. Learn producer, consumer, herbivore, carnivore, decomposer.
- Only ~10% of energy passes up each trophic level, so chains are short and eating plants is more efficient.
- Carbon cycle: photosynthesis $\leftrightarrow$ respiration and combustion; nitrogen cycle (Supplement): fixation, nitrification, denitrification by microorganisms.
- Population: one species, one area, one time. Learn the four phases of the S-shaped growth curve.

Exercises 2.1-2.3

2.1 Define a producer.

[1]

2.2 State what the arrows in a food chain show.

[1]

2.3 State what the 10% figure refers to in a food chain, and name two ways the other 90% is lost.

[3]

Exercises 2.1-2.3

2.1 Define a producer. [1]

2.1

- a producer **makes its own food** (usually by photosynthesis)
-

2.2 State what the arrows in a food chain show. [1]

2.2

- arrows show the **direction of energy flow**
-

2.3 State what the 10% figure refers to in a food chain, and name two ways the other 90% is lost. [3]

2.3

- 10% is the energy **passed on** to the next trophic level
- any **two** of: heat from respiration / faeces / urea

Exercises 2.4·2.5

2.4 Name the trophic level of a fox in the chain grass → rabbit → fox, and of the grass. [2]

2.5 Explain why food chains rarely have more than five trophic levels. [2]

Exercises 2.4-2.5

2.4 Name the trophic level of a fox in the chain grass → rabbit → fox, and of the grass. [2]

2.4

- fox: **secondary consumer**
 - grass: **producer**
-

2.5 Explain why food chains rarely have more than five trophic levels. [2]

2.5

- only about **10%** passes to each next level
- after four or five levels **too little energy** is left

Exercise 3.1

3.1 In the chain grass $\rightarrow$ rabbit $\rightarrow$ fox, the rabbit is a:

[1]

☐

A producer

B primary consumer

C secondary consumer

D decomposer

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3.1 In the chain grass $\rightarrow$ rabbit $\rightarrow$ fox, the rabbit is a:

[1]

☐

A producer

B primary consumer

C secondary consumer

D decomposer

3.1 B

- the rabbit eats the producer, so it is a **primary consumer**
- A is grass; C is the fox; D is bacteria/fungi

Exercise 3.2 (a)

3.2 A food web links several chains.

(a) Explain what could happen to the other organisms if all the rabbits were removed.[2]

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(a)

- animals that ate rabbits would have **less food** and may decrease
- plants the rabbits ate may **increase**

Exercise 3.2 (b)

3.2 A food web links several chains.

(b) State one way humans can damage a food web.

[1]

Exercise 3.2 (b)

3.2 A food web links several chains.

(b) State one way humans can damage a food web.

[1]

(b)

- **overharvesting** (e.g. overfishing) or introducing a foreign species

Exercise 3.3 (a)

3.3 A food web in a garden contains: lettuce $\rightarrow$ slug $\rightarrow$ thrush $\rightarrow$ hawk, and lettuce $\rightarrow$ caterpillar $\rightarrow$ thrush.

(a) Name the producer, and name one secondary consumer.

[2]

Exercise 3.3 (a)

3.3 A food web in a garden contains: lettuce $\rightarrow$ slug $\rightarrow$ thrush $\rightarrow$ hawk, and lettuce $\rightarrow$ caterpillar $\rightarrow$ thrush.

(a) Name the producer, and name one secondary consumer. [2]

(a)

- producer: **lettuce**
- secondary consumer: **thrush**

Exercise 3.3 (b)

3.3 A food web in a garden contains: lettuce $\rightarrow$ slug $\rightarrow$ thrush $\rightarrow$ hawk, and lettuce $\rightarrow$ caterpillar $\rightarrow$ thrush.

(b) State what the arrows in the web represent.

[1]

Exercise 3.3 (b)

3.3 A food web in a garden contains: lettuce $\rightarrow$ slug $\rightarrow$ thrush $\rightarrow$ hawk, and lettuce $\rightarrow$ caterpillar $\rightarrow$ thrush.

(b) State what the arrows in the web represent.

[1]

(b)

- arrows show the **direction of energy transfer** (eaten $\rightarrow$ eater)

Exercise 3.3 (c)

3.3 A food web in a garden contains: lettuce $\rightarrow$ slug $\rightarrow$ thrush $\rightarrow$ hawk, and lettuce $\rightarrow$ caterpillar $\rightarrow$ thrush.

(c) All the slugs are removed by a gardener. Explain the effect on the caterpillar population and on the hawk population. [4]

Exercise 3.3 (c)

3.3 A food web in a garden contains: lettuce $\rightarrow$ slug $\rightarrow$ thrush $\rightarrow$ hawk, and lettuce $\rightarrow$ caterpillar $\rightarrow$ thrush.

(c) All the slugs are removed by a gardener. Explain the effect on the caterpillar population and on the hawk population. [4]

(c)

- caterpillars **rise**: less competition for lettuce
- hawks **fall** (or stay similar): thrushes have lost a food source

Exercise 3.3 (d)

3.3 A food web in a garden contains: lettuce $\rightarrow$ slug $\rightarrow$ thrush $\rightarrow$ hawk, and lettuce $\rightarrow$ caterpillar $\rightarrow$ thrush.

(d) The lettuces contain 48 000 kJ of energy and the thrushes 290 kJ. Calculate the percentage of energy that reaches the thrushes. [2]

Exercise 3.3 (d)

3.3 A food web in a garden contains: lettuce → slug → thrush → hawk, and lettuce → caterpillar → thrush.

(d) The lettuces contain 48 000 kJ of energy and the thrushes 290 kJ. Calculate the percentage of energy that reaches the thrushes. [2]

(d)

$$\text{efficiency} = \frac{\text{energy transferred}}{\text{energy available}} \times 100 = \frac{290 \text{ kJ}}{48\,000 \text{ kJ}} \times 100 = \mathbf{0.60\%}$$

Exercise 3.3 (e)

3.3 A food web in a garden contains: lettuce $\rightarrow$ slug $\rightarrow$ thrush $\rightarrow$ hawk, and lettuce $\rightarrow$ caterpillar $\rightarrow$ thrush.

(e) Explain why the answer to (d) is so small.

[3]

Exercise 3.3 (e)

3.3 A food web in a garden contains: lettuce $\rightarrow$ slug $\rightarrow$ thrush $\rightarrow$ hawk, and lettuce $\rightarrow$ caterpillar $\rightarrow$ thrush.

(e) Explain why the answer to (d) is so small. [3]

(e)

- energy is lost at **each of the two transfers**
- as heat from respiration, in faeces and in excretory products
- not all of each organism is eaten, so only a **small fraction** reaches the thrushes