Exercise walk-through

7.4
Trophic levels and food security – biology only (4.7.4–4.7.5)

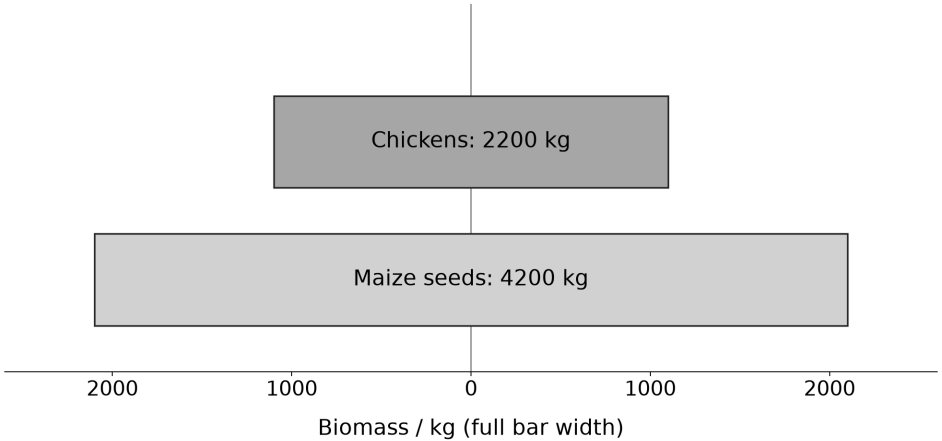
AQA · GCSE · Biology

Trophic levels and biomass (biology only)

- not all of an organism is eaten, such as roots and bones;
- not all the food eaten is absorbed; some passes out as **faeces** ;
- much of the absorbed glucose is used in respiration, releasing carbon dioxide and water, and some is lost as urea in urine.

$$\text{efficiency} = \frac{\text{biomass transferred to the next level}}{\text{biomass available}} \times 100$$

Figure: Trophic levels and biomass (biology only)



- **Pyramid of biomass** for maize and chickens, drawn to scale with producers at the bottom.
- Match each part of the diagram to the text.

Food security (biology only)

- **Food security** means having enough food to feed a **population**.
- It is threatened by a rising birth rate, changing diets in richer countries that need more food from poorer ones, new pests and **pathogens**, environmental changes such as droughts, the cost of farming, and conflicts.

Food security (biology only) (2)

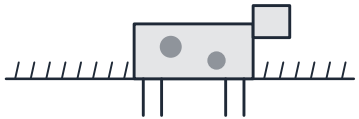
- **Efficient food production.** Farmers can raise animals more efficiently by limiting their movement and keeping them warm, so that less energy is used in respiration for movement and keeping warm, and more goes into growth.
- They are fed high-protein food.

Exercises 2.1·2.2

2.1 In this food chain, give the trophic level of the blue tit and name the apex predator. [2]



2.2 Give **two** reasons why only some of the biomass in grass becomes biomass in a cow. [2]



Exercises 2.1·2.2

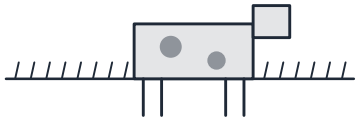
2.1 In this food chain, give the trophic level of the blue tit and name the apex predator. [2]



2.1

- blue tit: trophic level **3**; apex predator: **sparrowhawk**

2.2 Give **two** reasons why only some of the biomass in grass becomes biomass in a cow. [2]



2.2

- any two: not all of the grass is eaten, e.g. the roots; some is egested in faeces; some is used in respiration; some is lost as waste, e.g. CO_2 and urea

Exercises 2.3·3.1

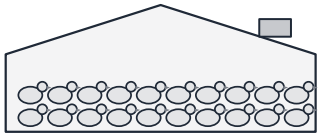
2.3 Calculate the efficiency of biomass transfer from producers to primary consumers. [2]



primary consumers: 180 g/m^2

producers: 2000 g/m^2

3.1 Some farmers keep chickens in warm sheds where they cannot move much. Explain how this gives more meat from the same amount of food. [3]



Exercises 2.3·3.1

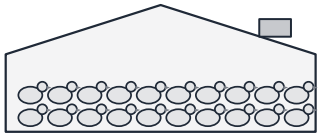
2.3 Calculate the efficiency of biomass transfer from producers to primary consumers. [2]



2.3

- $\frac{180}{2000} \times 100 = \mathbf{9}\%$

3.1 Some farmers keep chickens in warm sheds where they cannot move much. Explain how this gives more meat from the same amount of food. [3]



3.1

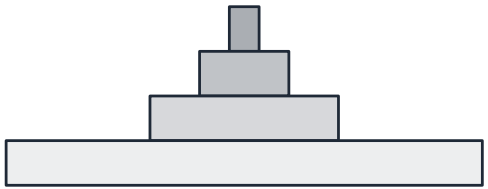
- the chickens move less, so less energy is used in respiration for movement
- the shed is warm, so less energy is used to keep warm
- so more of the biomass in the food becomes biomass in the chickens; the transfer is more efficient

Exercise 3.2 (a)

3.2 The table gives the biomass at each trophic level in a pond.

trophic level	organism	biomass / g per m^2
1	algae	800
2	water fleas	72
3	sticklebacks	7.2
4	pike	0.6

(a) Calculate the efficiency of biomass transfer from water fleas to sticklebacks. [2]

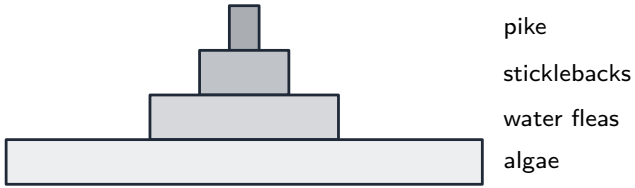


Exercise 3.2 (a)

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trophic level	organism	biomass / g per m^2
1	algae	800
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3	sticklebacks	7.2
4	pike	0.6

(a) Calculate the efficiency of biomass transfer from water fleas to sticklebacks. [2]



(a) $\frac{7.2}{72} \times 100 = \mathbf{10}\%$

Exercise 3.2 (b)

3.2 The table gives the biomass at each trophic level in a pond.

trophic level	organism	biomass / g per m^2
1	algae	800
2	water fleas	72
3	sticklebacks	7.2
4	pike	0.6

(b) Explain why food chains rarely have more than four or five trophic levels. [3]

Exercise 3.2 (b)

3.2 The table gives the biomass at each trophic level in a pond.

trophic level	organism	biomass / g per m^2
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4	pike	0.6

(b) Explain why food chains rarely have more than four or five trophic levels. [3]

(b) only about 10% of the biomass passes from one level to the next; the rest is not eaten, egested, lost as waste or used in respiration; after four or five levels there is too little biomass left to support another level

Exercise 3.2 (c)

3.2 The table gives the biomass at each trophic level in a pond.

trophic level	organism	biomass / g per m^2
1	algae	800
2	water fleas	72
3	sticklebacks	7.2
4	pike	0.6

(c) Calculate the percentage of the biomass of the algae that ends up in the pike. [2]

Exercise 3.2 (c)

3.2 The table gives the biomass at each trophic level in a pond.

trophic level	organism	biomass / g per m^2
1	algae	800
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3	sticklebacks	7.2
4	pike	0.6

(c) Calculate the percentage of the biomass of the algae that ends up in the pike. [2]

(c) $\frac{0.6}{800} \times 100 = \mathbf{0.075}\%$

Exercise 3.2 (d)

3.2 The table gives the biomass at each trophic level in a pond.

trophic level	organism	biomass / g per m^2
1	algae	800
2	water fleas	72
3	sticklebacks	7.2
4	pike	0.6

(d) Evaluate ways of producing more food sustainably, such as fishing quotas, factory farming and mycoprotein. [6]

Exercise 3.2 (d)

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trophic level	organism	biomass / g per m^2
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(d) Evaluate ways of producing more food sustainably, such as fishing quotas, factory farming and mycoprotein. [6]

(d) points to include:

- fishing quotas and larger net holes let young fish grow and breed, so fish stocks stay up; but catches and jobs fall at first
- factory farming makes meat cheaply and efficiently; but there are welfare concerns,

Full solution on next slide

Full solution 3.2 (d)

(d) points to include:

- fishing quotas and larger net holes let young fish grow and breed, so fish stocks stay up; but catches and jobs fall at first
- factory farming makes meat cheaply and efficiently; but there are welfare concerns, and diseases spread fast
- mycoprotein is grown from a fungus in fermenters, is high in protein and needs little land; but the fermenters need energy and sugar
- eating less meat means fewer trophic levels and more food per hectare
- a conclusion that weighs these points

Levels: **5–6** a full, logical answer with correct biology and correct terms; **3–4** several correct points, partly linked; **1–2** one or two relevant points.