

CHAPTER 19

ORGANISMS AND THEIR ENVIRONMENT

The stuff you need to know in this chapter:

19.1 ENERGY FLOW

Core

- State that the Sun is the principal source of energy input to biological systems

Extended

- Describe the flow of energy through living organisms including light energy from the sun and chemical energy in organisms and its eventual transfer to the environment

19.2 FOOD CHAINS AND FOOD WEBS

Core

- Define a food chain as showing the transfer of energy from one organism to the next, beginning with a producer
- State that energy is transferred between organisms in a food chain by ingestion
- Construct simple food chains
- Define a food web as a network of interconnected food chains
- Define producer as an organism that makes its own organic nutrients, usually using energy from sunlight, through photosynthesis
- Define consumer as an organism that gets its energy by feeding on other organisms
- State that consumers may be classed as primary, secondary and tertiary according to their position in a food chain
- Define herbivore as an animal that gets its energy by eating plants
- Define carnivore as an animal that gets its energy by eating other animals
- Define decomposer as an organism that gets its energy from dead or waste organic material
- Interpret food chains and food webs in terms of identifying producers and consumers
- Use food chains and food webs to describe the impacts humans have through over-harvesting of food species and through introducing foreign species to a habitat
- Draw, describe and interpret pyramids of numbers

Extended

- Describe how energy is transferred between trophic levels
- Define trophic level as the position of an organism in a food chain, food web, pyramid of numbers or pyramid of biomass
- Explain why the transfer of energy from one trophic level to another is inefficient
- Explain why food chains usually have fewer than five trophic levels
- Explain why there is a greater efficiency in supplying plants as human food, and that there is a relative inefficiency in feeding crop plants to livestock that will be used as food
- Identify producers, primary consumers, secondary consumers, tertiary consumers and quaternary consumers as the trophic levels in food webs, food chains, pyramids of numbers and pyramids of biomass



IGCSE Biology (0610) Workbook

- Draw, describe and interpret pyramids of biomass
- Discuss the advantages of using a pyramid of biomass rather than a pyramid of numbers to represent a food chain

19.3 NUTRIENT CYCLES

Core

- Describe the carbon cycle, limited to photosynthesis, respiration, feeding, decomposition, fossilisation and combustion
- Discuss the effects of the combustion of fossil fuels and the cutting down of forests on the carbon dioxide concentrations in the atmosphere
- Describe the water cycle, limited to evaporation, transpiration, condensation and precipitation

Extended

- Describe the nitrogen cycle in terms of:
 - decomposition of plant and animal protein to ammonium ions
 - nitrification
 - nitrogen fixation by lightning and bacteria
 - absorption of nitrate ions by plants
 - production of amino acids and proteins
 - feeding and digestion of proteins
 - deamination
 - denitrification
- State the roles of microorganisms in the nitrogen cycle, limited to decomposition, nitrification, nitrogen fixation and denitrification (generic names of individual bacteria, e.g. *Rhizobium*, are **not** required)

19.4 POPULATION SIZE

Core

- Define population as a group of organisms of one species, living in the same area, at the same time
- Identify and state the factors affecting the rate of population growth for a population of an organism, limited to food supply, predation and disease
- Discuss the increase in human population size over the past 250 years and its social and environmental implications
- Interpret graphs and diagrams of human population growth

Extended

- Define community as all of the populations of different species in an ecosystem
- Define ecosystem as a unit containing the community of organisms and their environment, interacting together, e.g. a decomposing log, or a lake
- Identify the lag, exponential (log), stationary and death phases in the sigmoid population growth curve for a population growing in an environment with limited resources
- Explain the factors that lead to each phase in the sigmoid curve of population growth, making reference, where appropriate, to the role of limiting factors



IGCSE Biology (0610) Workbook

FOOD CHAINS AND WEBS

1. Name input of energy into most biological systems

2. Name a type of ecosystem that doesn't rely on the sun for energy

(You don't need to know about these for IGCSE bio, but it's good to know why we say "most" ecosystems rely on the sun)

3. Complete the table to define the following words:

Word	Definition
Food chain	
Food web	
Producer	
Consumer	
Herbivore	
Carnivore	
Decomposer	
Trophic level	



IGCSE Biology (0610) Workbook

4. Explain what is meant by term primary, secondary, tertiary and quaternary when discussing consumers

5. a) Draw a food chain based on the following information:

A hawk eats field mice. Mice are herbivores. In this food chain, grass is the producer

b) Draw a food web based on the following information

Grass is the only producer. Grasshoppers, mice and rabbits are primary consumers. Lizards and hawks eat grasshoppers but the hawk will also eat lizards, rabbits, mice and snakes. Snakes feed on mice.

c) For the food web you have drawn, describe the possible results on other organisms if there is an outbreak of a disease that only affects snakes.



FOOD CHAINS AND WEBS

1. Use the following diagrams to answer the questions

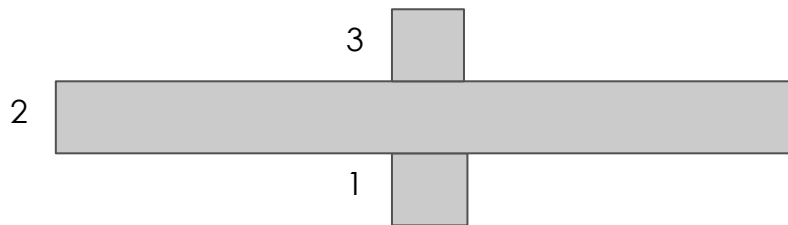


Figure 1.1

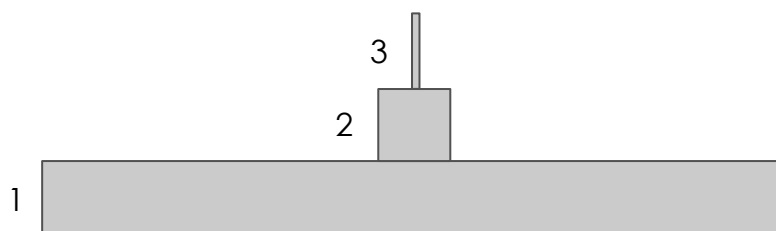


Figure 1.2

Key:
1 = Mango tree
2 = Ant
3 = Bulbul

Note: A bulbul is a type of bird

a) One of the diagrams above is a pyramid of numbers, the other is a pyramid of biomass. Which is which?

Diagram 1.1 is a pyramid of _____

Diagram 1.2 is a pyramid of _____

b) Explain how you decided on your answer to part a:

IGCSE Biology (0610) Workbook

c) State the efficiency of transfer of biomass in this food chain from the tree to the ants. **SHOW YOUR WORKING**

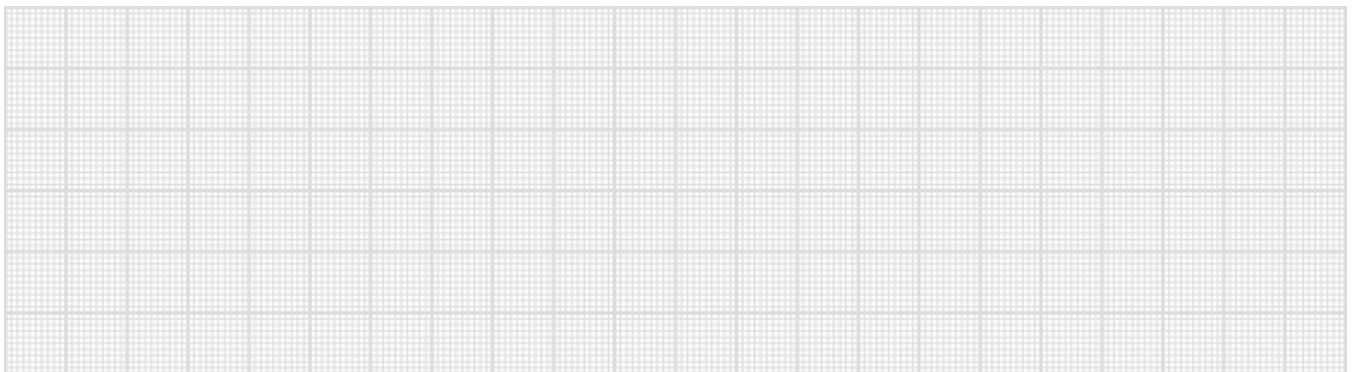
(Hint: you will need to measure the bars)

Efficiency of biomass transfer _____%

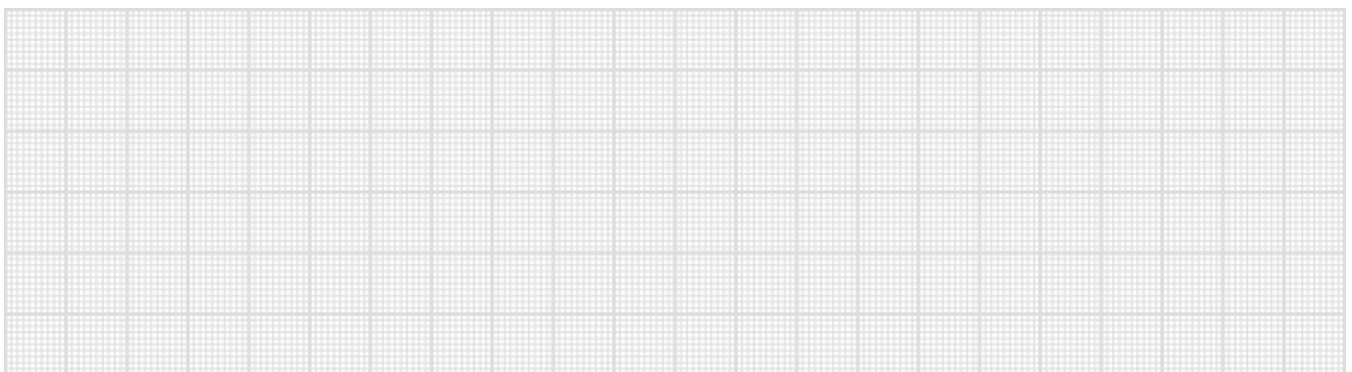
2. Draw ecological pyramids to represent the following data:

Remember to label your diagrams with the species, numbers (and units if relevant)

a) A pyramid of numbers: 100 plants in an ecosystem with 30 rabbits, and 2 foxes.

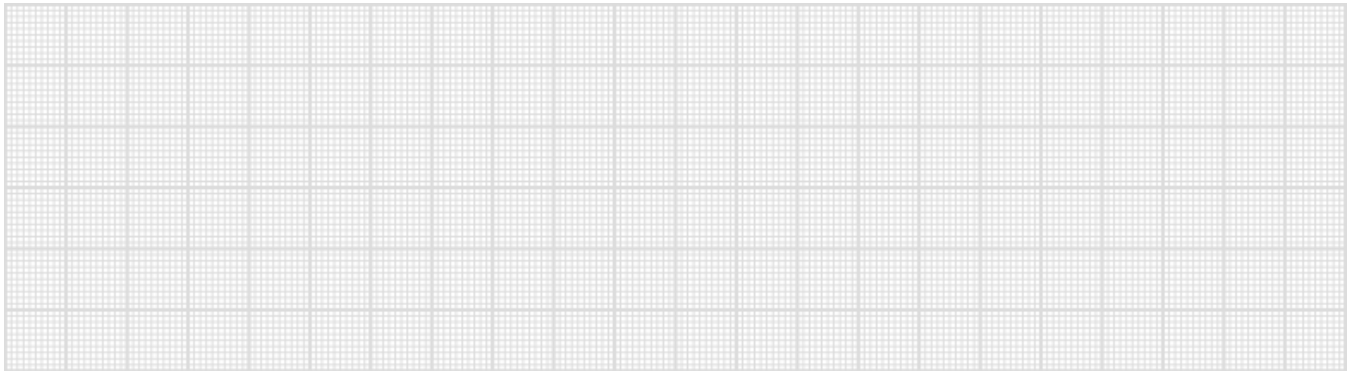


b) A pyramid of numbers: one tree is consumed by 100 caterpillars, which are eaten by 20 birds.



IGCSE Biology (0610) Workbook

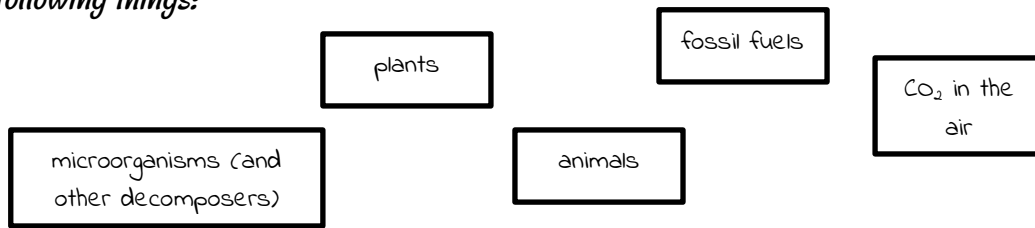
c) A pyramid of biomass: one tree is consumed by many caterpillars, which are eaten by a few birds. (You should estimate the mass. Remember that transfers in a food chain are roughly 10% efficient)



THE CARBON CYCLE

1. Draw a diagram of the carbon cycle.

Include the following things:



Explain how the combustion of fossil fuels alters carbon dioxide concentration in the atmosphere. Refer to your diagram if necessary.



IGCSE Biology (0610) Workbook

Deforestation can affect the atmospheric carbon dioxide levels. Using the following points as guidance, explain these effects.

Reduced photosynthesis

Burning wood

Rotting wood



THE WATER CYCLE

1. Draw a diagram of the water cycle.

Your diagram should include the following processes:

evaporation

transpiration

condensation

precipitation



THE NITROGEN CYCLE

1. Complete the words to list the main storages of nitrogen in the nitrogen cycle:

- i) A_____ nitrogen
- ii) P_____ in plants
- iii) P_____ in animals
- iv) A_____
- v) N_____s

1. Draw a diagram of the nitrogen cycle.



IGCSE Biology (0610) Workbook

POPULATION SIZE

1. Define "Population"

2. State three factors that limit population growth rates.

i) _____

ii) _____

iii) _____

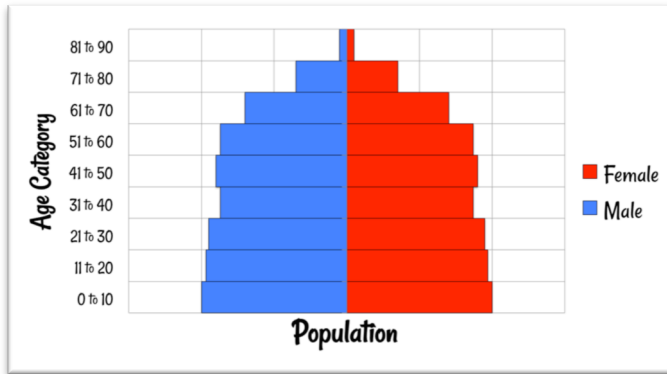
3. Describe and explain the change in human population over the past 300 years.



IGCSE Biology (0610) Workbook

4. a) Outline the information that is presented in a population pyramid

b) Look at the population pyramids below and answer the questions



Country A



Country B

i) Complete the sentences based on the age pyramids

In country A, the birth rate is significantly higher than / is significantly less than / is about equal to the death rate.

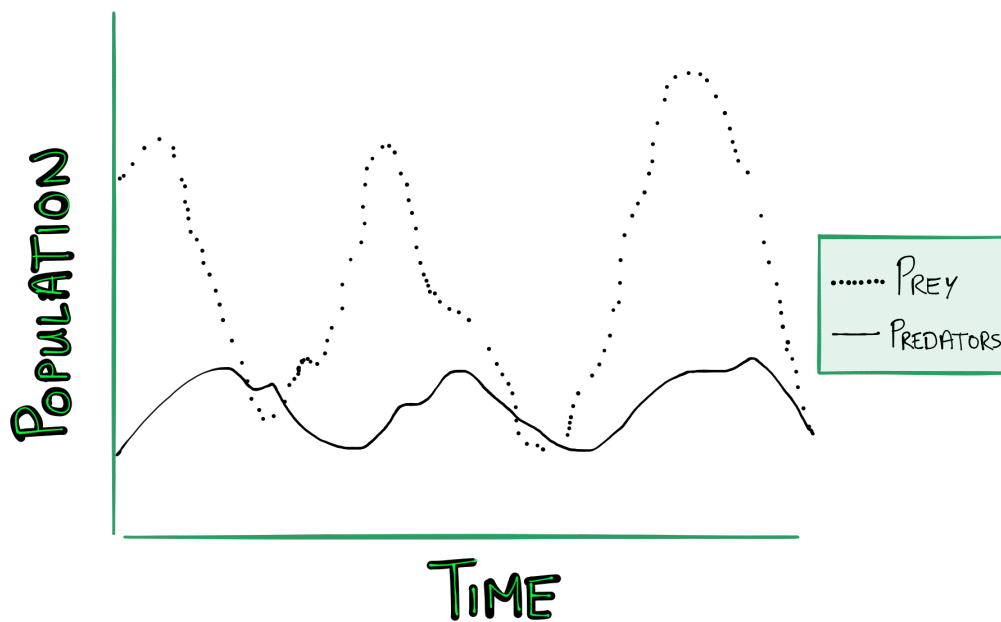
In country B, the birth rate is significantly higher than / is significantly less than / is about equal to the death rate.

ii) Predict the future changes in population for countries A and B.



IGCSE Biology (0610) Workbook

5. The following diagram shows the change in population over time of a predator and its prey. Explain the population changes for both organisms.



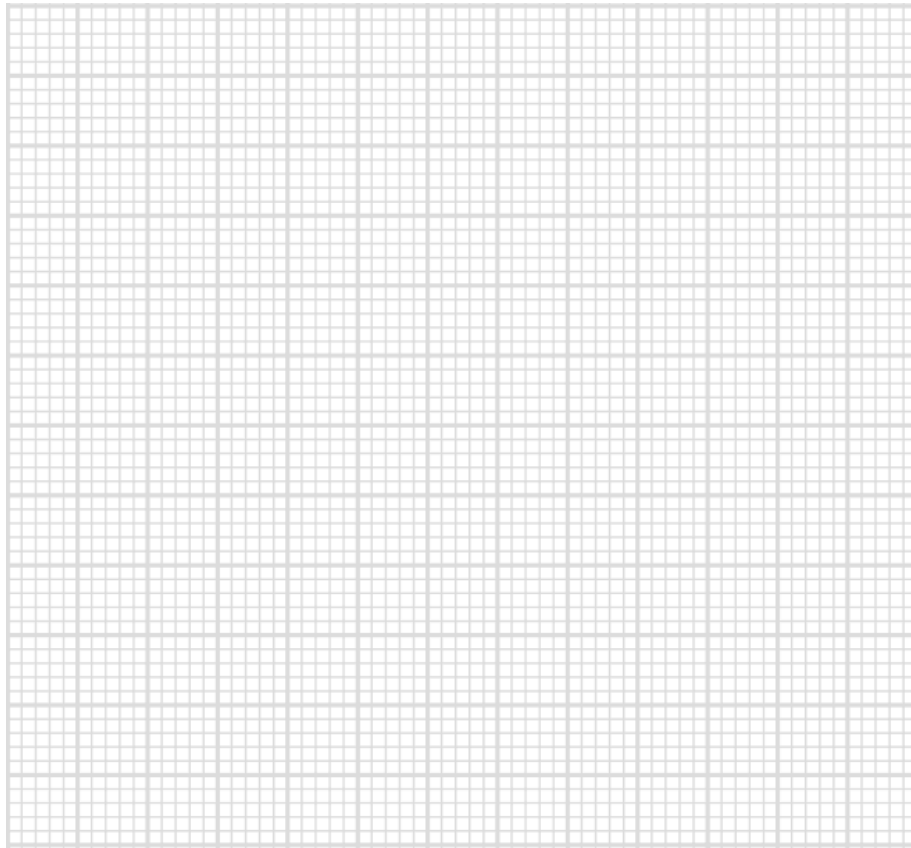


IGCSE Biology (0610) Workbook

6. Define the term "community"

7. Define the term "ecosystem"

8. Draw a graph of idealized population growth and decline of yeast. Label the lag, log, stationary and death phase on your diagram



9. Outline what is meant by a "sigmoidal" growth curve



IGCSE Biology (0610) Workbook

10. Complete the sentences below to explain the shape of the sigmoidal growth curve of yeast. Use the words listed to help.

log lag limiting factors rapid exceeds death few exponential food
decreases stationary

In the beginning there is a _____ phase in which there are _____ cells reproducing. After this, growth becomes very _____. This is known as the _____ phase and _____ growth is observed. After time there may be _____ present, such as the limited amount of _____ which limits population growth. Soon, the number of deaths of cells _____ the number of new cells produced. This is the _____ phase. The _____ phase is observed when the number of deaths _____ the number of new cells produced, and the population _____.

