Form 2 Science
Chapter 4 Interdependence among living organisms and the environment

Species, population, community, habitat and ecosystem

I. Species – a group of living organisms with common characteristics that can breed among themselves to produce fertile offspring.
II. Population - made up of a number of living organisms of the same species that live and breed in a particular habitat.
III. Community – made up of many populations living together in a particular habitat.
IV. Habitat – place where it lives for food, shelter, protection and reproduce
V. Ecosystem - community of the organisms living in the same habitat, together with the non-living environment. (consist of biotic component and abiotic components)

Interdependence of living organisms creates a balanced ecosystem

I. Different populations in a community are interdependent on one another and also with the non-living environment
II. Purpose of interaction: to obtain food, shelter and protection
III. Helps in creating a balanced ecosystem
IV. Examples:
    a. plants make their own food by interaction with non-living factors such as sunlight, air , water and mineral salts
    b. animal depend on other organisms for food and oxygen from plant
    c. insects obtain food from pollen and nectar from flower, meanwhile help in pollination of flower
    d. Microorganisms help to decompose dead organism, returning nutrients and minerals back to soil.
V. Slight changes in the number of a species will offset the number of another species. The ecosystem would take time to become balance again

Four factors needed in maintaining balance ecosystem

I. Number of individuals in a different population
II. Number of populations in different communities
III. Composition of gases in the air and quality of the air
IV. Availability of water, soil and nutrients
    - when a population of living organisms grows too large, the living organisms of the same species will compete each other for their basic needs.

Interactions between living organisms

- helps in control the size of populations in a community
- there are three major types of interaction

- Prey-predator
- Symbiosis – commensalism, mutualism, parasitism
- Competition

I. Prey- predator

- Predator: living organisms that eats another living things
- special adaptation: powerful jaws, sharp teeth, sharp claws, good vision and strong beaks
- Prey: living organism which predator eats
- special adaptation: monoscopic vision, ability to move fast
- Eg, Deer- tiger , chicken-snake, rat-owl

II. Symbiosis

- means living together between two organisms
- Three types of symbiosis
  - Commensalisms
    - relationship between two living organisms which one benefits from another without damaging the host
    - eg. remora fish attached under a shark in order to obtain the scraps of food left by the shark without harming the shark
  - Mutualism
    - interaction between two different living organisms that benefits both
    - eg. Lichen consist of fungus and algae, algae provide food and fungus provide oxygen, water and mineral salts
  - Parasitism
    - relationship between two living organisms in which one living organism benefits while the other is harmed
    - eg. tapeworm obtain nutrients and shelter from human, whereas the host loses weight and becomes weak

III. Competition

- interaction among living organisms in the same habitat in which each competes for basic needs
- two types of competition:
  - intraspecific competition
    - competition between living organisms of the same species for same resources in an ecosystem
  - interspecific competition
    - competition between living organisms of different species for a limit resource in the same area

Biological control

- is a method controlling a certain population of living things using prey-predator interaction , parasitism or competition relationship
- eg. owls and snakes used to reduce the number of rats in an oil palm estate because owls and snakes are natural predators of rats
- Advantages of biological control

I. does not affect the health of human
II. pest is not resistant to the predators (unlike using pesticides, pest will resistance after long period using same pesticides)
III. does not affect or kill other organism because predator feeds on specific prey
IV. does not cause pollution
V. low cost

- Disadvantage of biological control
  I. balance of particular ecosystem will change after new species come in
  II. longer time taken compared using pesticides
  III. problem occurs when number of predator is too high when prey is not enough

Food Webs

I. **Producers**
- green plants make their own food

II. **Consumers**
- living organisms that eat other living organisms

a. **primary consumers**
- usually herbivores which feed on plants

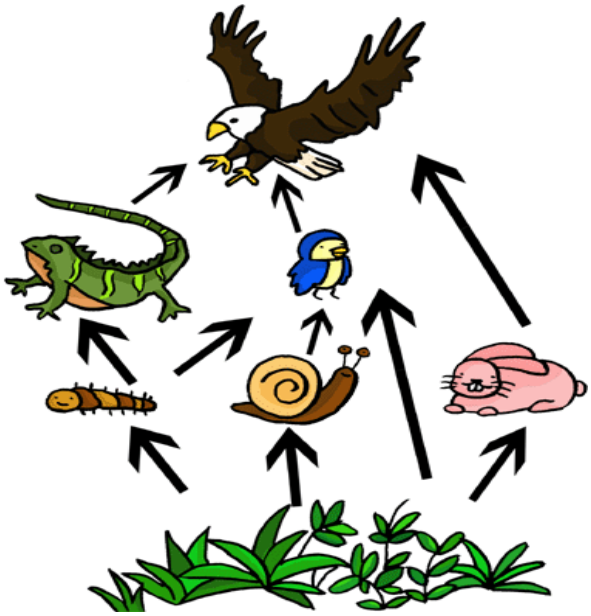
b. **secondary consumers**
- feed on primary consumers, usually carnivores or omnivores

c. **tertiary consumers**
- feed on secondary consumer

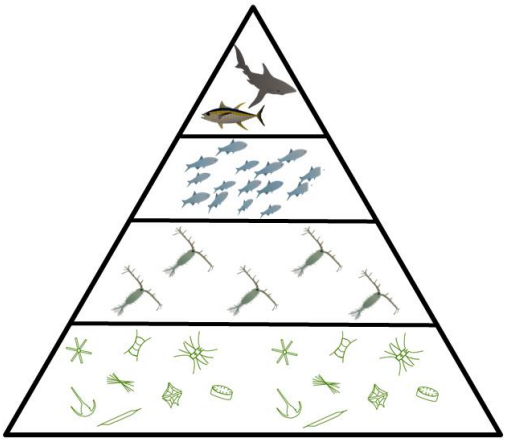
III. **Decomposer**
- break down dead animals and plants into simpler substance and used b plants for growth

IV. **Food chain**
- feeding relationship between living organisms

V. **Food web**
- complex interlink of food chains



Feeding relationship between the living organisms in a food chain can be represented in the form of pyramid of numbers

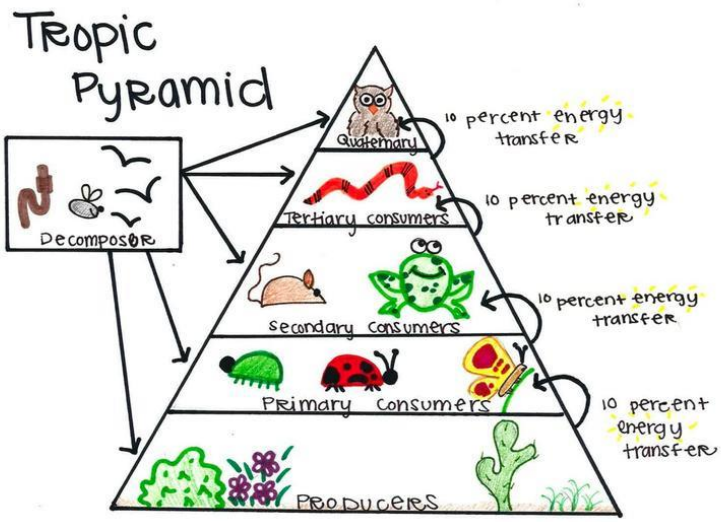


Pyramid numbers

-when one population of living organisms in a food web is missing or decreases un a number, it will affect the other living organisms become imbalance to
- if new living organisms are introduced into a food web, the food web will also become imbalance
- therefore, the number of organism in which level of pyramid can be predicted for any increase or decrease number in certain population
-it would take a long time for the ecosystem to become balance again

Energy flow in a food web

- movement of energy starting with the sun, passing from one living organism to another
- when primary consumer eats the plants, some chemical energy stored in the plants passed on to the primary consumers, which later pass its energy to secondary and tertiary consumer
- not all of the energy is passed on each level, some energy is used to maintain body heat, which escape into environment as energy loss


Tropic Pyramid
Decomposer
Quaternary
10 percent energy transfer
Tertiary consumers
10 percent energy transfer
secondary consumers
10 percent energy transfer
Primary consumers
10 percent energy transfer
Producers

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(Part 2)

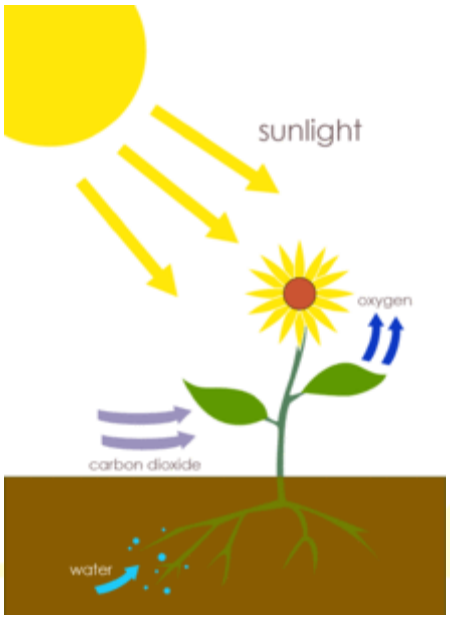
Photosynthesis

- process in which green plants absorb solar energy to make food from carbon dioxide and water

sunlight /chlorophyll

carbon dioxide + water ----------→ glucose + oxygen

- chlorophyll : green pigment present in leaves which can absorb sunlight
- glucose: products of photosynthesis, usually converted into starch and stored in stems, fruits, roots
- oxygen : released as by- products



Four factors required for photosynthesis

- photosynthesis will not carry out if any one of the factors is absent

i. Carbon Dioxide
ii. Sunlight
iii. Chlorophyll
iv. water

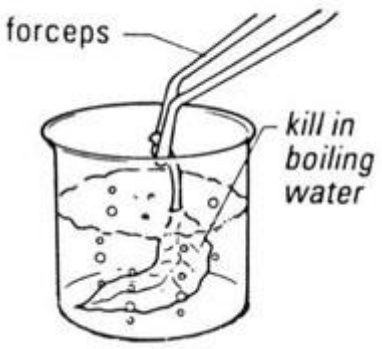
Uses of Glucose

- Some of the glucose produced is used by the plant for respiration.
- The energy released is used to build up smaller molecules into larger ones:

- Excess glucose may be converted into insoluble starch for storage
- Sugars are converted into cellulose for cell walls
- Sugars, nitrates and other nutrients are converted into amino-acids to make proteins
- Sugars are converted into lipids (fats and oils) for storage in seeds

Test for the presence of starch in leaf

a Collect leaves from the plants to be tested.



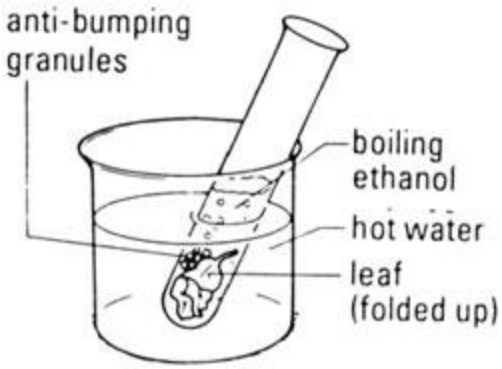
b At your desk, pour some boiling water from a kettle into a large beaker.

c Using forceps, pick up one of your leaves and hold it in the hot water for about one minute.

d Using forceps, remove the leaf from the boiling water and note how it has changed.

e Drop the leaf into a boiling tube and push it to the bottom with a glass rod. Add some anti-bumping granules (optional). Label this tube with your initials if you will be placing it in a hot water bath.

f Put on your eye protection.

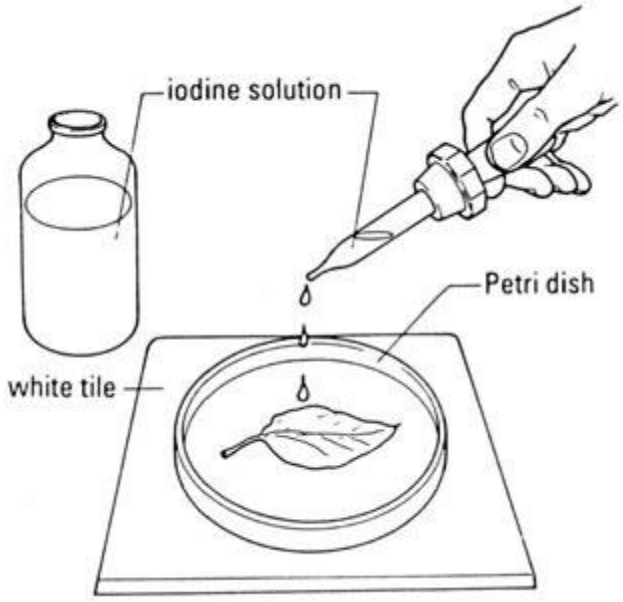


g Add enough ethanol to cover the leaf, and stand the boiling tube in your beaker of hot water, or in the hot water bath.

h Watch as the ethanol boils and the green colouring (chlorophyll) is removed from the leaf. This will take a few minutes.

i Replace the hot water with freshly-boiled water from the kettle after 5 minutes if there is still some green colour in the leaf.

j Using forceps, remove the leaf from the boiling tube and rinse the leaf in cold water.



k Put the leaf in a Petri dish on a white tile.

l Add iodine solution to the leaf from the dropper bottle. Make sure the leaf is completely covered with iodine.

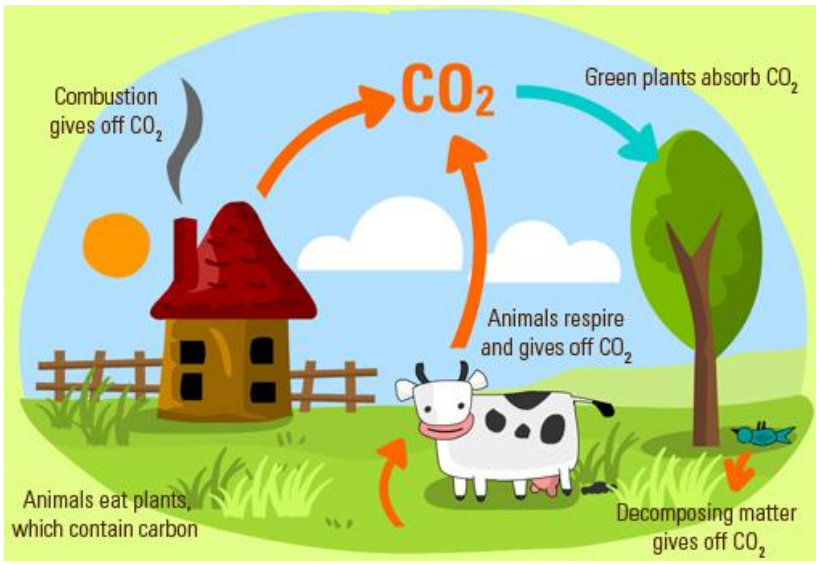
m Watch for a few minutes to see if a blue-black colour develops in any part of the leaf. A blue-black colour with iodine solution indicates that starch is present.

The importance of photosynthesis

- green plant are the producers manufactures food for all organisms on earth
- only green plant are capable of trapping solar energy to manufacture food from simple substances
- photosynthesis helps in maintaining balance carbon dioxide and oxygen in the atmosphere.

The Carbon Cycle

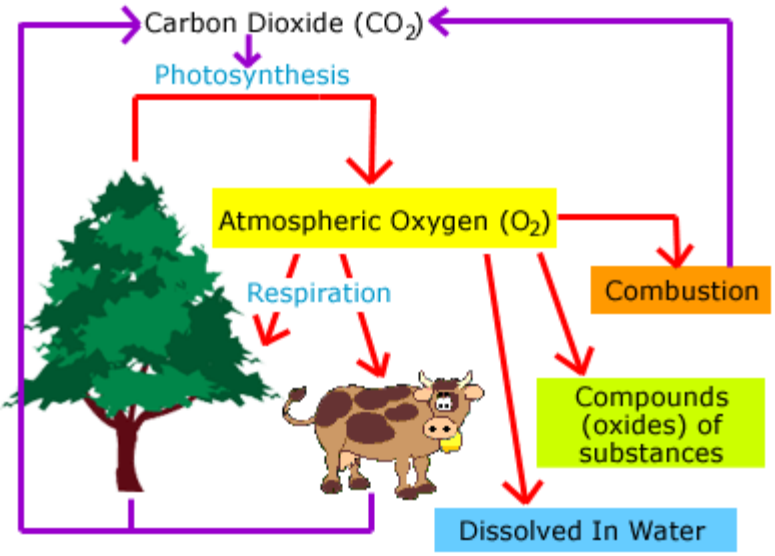
-The carbon cycle is very important to all ecosystems, and ultimately life on earth.
-The carbon cycle is critical to the food chain.
-Living tissue contain carbon, because they contain proteins, fats and carbohydrates. The carbon in these (living or dead) tissues is recycled in various processes.



- Human activities like heating homes and cars burning fuels (combustion) give off carbon into the atmosphere.
- During respiration, animals also introduce carbon into the atmosphere in the form of carbon dioxide.
- The Carbon dioxide in the atmosphere is absorbed by green plants (producers) to make food in photosynthesis.
- When animals feed on green plants, they pass on carbon compounds unto other animals in the upper levels of their food chains.
- Carbon dioxide is also given off when plants and animals die. This occurs when decomposers (bacteria and fungi) break down dead plants and animals (decomposition) and release the carbon compounds stored in them.
- Very often, energy trapped in the dead materials becomes fossil fuels which are used as combustion again at a later time.

The Oxygen Cycle

- oxygen produced during photosynthesis and released into the air
- oxygen is then used for respiration, combustion, compounds of substances and dissolved in water

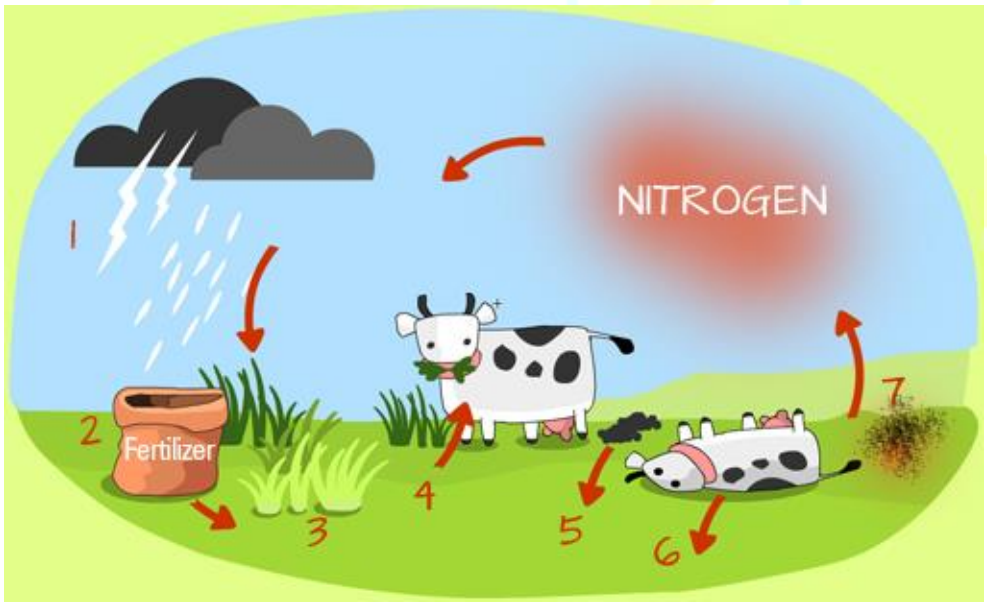


The Nitrogen Cycle

-Nitrogen is also key in the existence of ecosystems and food chains. Nitrogen forms about 78% of the air on earth.

-But plants do not use nitrogen directly from the air. This is because nitrogen itself is unreactive, and cannot be used by green plants to make protein.

-Nitrogen gas therefore needs to be converted into nitrate compound in the soil by nitrogen-fixing bacteria in soil, root nodules or lightning.



1. Nitrogen is introduced to the soil by precipitation (rain, lightling).

2. Nitrates don't only come from Nitrogen in the air. They can also be obtained by the conversion of ammonia, commonly used in fertilizers by nitrifying bacteria in the soil. Some root nodules can also convert nitrogen in the soil into nitrates.

3. Plants build up proteins using nitrates absorbed from the soil.

4. When animals like cows, eat these plants, they in turn use it to build animal protein.

5-6. When these animals (cows) poop, pee or die, the urea, excreta or carcass are broken down by decomposers and the nitrogen is re-introduced into the soil in the form of ammonia.

7. Nitrates in he soil can also be broken down by denitrifying bacteria (in specific conditions) and sent into the air as nitrogen. This process can help make the soil infertile, because it will lack the nitrates needed for plant use.

Once nitrogen gets back into the air, the cycle continues.

Importance of conservation and preservation of living organisms

- environmental problems arise as a results of activities in various fields of human endeavour
- therefore, conservation and preservation of living organisms is necessary to avoid any destruction of living resources which sustain life
- Conservation: wise use of natural resources with the least disturbance to living things and their environment (eg. protection, management and renewal of natural resources)
- Preservation: measures or steps taken to maintain living things and the environment in its natural balanced states

Steps to conserve and preserve living organisms

A: pollution control

- to minimise destruction of habitat caused by pollution

B: legislation on wildlife protection

- to control commercial hunting
- prevent overfishing
- protect endangered species

C: renewal of natural resources

- to store damaged or destroyed habitats due to logging, overfishing and mining

D: Forest management

- to minimise deforestation and illegal logging
- to prevent the occurrence of forest fire

E: Natural resources management

- to protect flora and fauna by setting up forest reserves and animal sanctuaries

F: Education

- to increase public awareness of the importance of conservation and preservation of living organisms and their environment

Importance of conservation and preservation

- for life to continue existing on the planet
- to ensure native plants and animals are well protected and preserved
- to prevent extinction of any species on Earth
- to preserve biodiversity
- to preserve the forest
- to reduce the depletion of renewable and non-renewable source

- to provide places for recreation
- to boost county economy

Science and technology

- play an important part in conservation and preservation of living organism
- artificial insemination and tissue cultured used to increase the population of endangered animals and plants
- satellites images are used to detect fires in the ecosystem

Role of Man in maintaining the balance in nature

- the main reason human destroyed so many ecosystems because there are many of us to feed, clothes and house
- increase in human population cause increase needs in food, clothes and housing
- human activities which are harmful to the environment :
    I. deforestation
    II. overhunting and overfishing
    III. industrialisation
    IV. excessive use of pesticides and fertilisers in agriculture
    V. excessive use of fossil fuels
    VI. mining
    VII. excessive use of land

- the long term effects of the ecosystem:
    I. pollution
    II. destruction of habitat
    III. extinction of species
    IV. global climatic changes (global warming)
    V. acid rain