**19. Organisms & their environment**

**19.1 Energy flow**

**Define *variation*** - differences between individuals of the same species

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

* The Earth receives two main types of energy from the sun: light (solar) and heat;
* Photosynthetic plants and some bacteria can trap light energy and convert it into chemical energy;
* Heterotrophic organisms obtain their energy by eating plants or animals that have eaten plants;
* So all organisms, directly or indirectly, get their energy from the sun;
* This energy is passed from one organism to another in a food chain;
* This energy does not return in a cycle but is lost to the environment.

**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 & food webs**

**Define a *food chain*** - showing the transfer of energy from one organism to the next, beginning with a producer

E.g. Mahogany tree caterpillar songbird hawk

**State that energy is transferred between organisms in a food chain by ingestion**

**Construct simple food chains**

**Define a *food web*** - a network of interconnected food chains



**Define *producer*** - an organism that makes its own organic nutrients, usually using energy from sunlight, through photosynthesis

**Define *consumer*** - an organism that gets its energy by feeding on other organisms**. Consumers may be classed as primary, secondary and tertiary according to their position in a food chain**

**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**

**Define *herbivore*** - an animal that gets its energy by eating plants

**Define *carnivore*** - an animal that gets its energy by eating other animals

**Define *decomposer*** - 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**

**Define *trophic level*** - the position of an organism in a food chain, food web, pyramid of numbers or pyramid of biomass

**Describe how energy is transferred between trophic levels**

**Explain why the transfer of energy from one trophic level to another is inefficient**



* Energy is lost at each level in the food chain;
* Energy is lost through the process of respiration (as heat);
* Energy used up for movement;
* Warm-blooded animals lose heat energy in faeces and urine;
* Some of the material in the organism being eaten is not used by the consumer e.g. a locust (insect) does not eat the roots of the maize, and some of the parts eaten are not digestible.

**Explain why food chains usually have fewer than five trophic levels**

* As energy is passed along the chain, each organism uses some of it in;
* On an average, about 90% of the energy is lost at each level in a food chain;
* So the further along the chain you go, the less energy there is;
* There is plenty of energy available for producers, so there are usually a lot of them;
* There is less energy for primary consumers, and least in secondary consumers;
* Thus towards the end of food chain the organisms get fewer in number.
* The loss of energy along the food chain thus limits the length of it.

**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**

**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**

**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**

**Describe the carbon cycle, limited to photosynthesis, respiration, feeding, decomposition, fossilisation and combustion**



* Carbon moves into and out of the atmosphere mainly in the form of carbon dioxide;
* Plants take carbon dioxide out of the air by photosynthesis;
* Plants convert carbon dioxide into organic materials (carbohydrates, fats and proteins);
* Herbivores obtain carbon compounds by eating plants**;**
* Carnivores gain carbon compounds by eating other animals;
* Animals and plants release carbon dioxide back into the air through respiration;
* When organisms die they usually rot (decompose);
* Decomposers breakdown the organic molecules through the process of respiration to release energy. Thus decomposers also release carbon dioxide;
* If a dead organism does not decompose, the carbon compounds are trapped in its body. Over a long period this can form fossil fuels;
* Combustion of fossil fuels releases carbon dioxide back into the air.

**Discuss the effects of the combustion of fossil fuels and the cutting down of forests on the carbon dioxide concentrations in the atmosphere**

* Photosynthesis takes carbon dioxide out of the atmosphere and replaces it with oxygen;
* Respiration and combustion use up oxygen from the atmosphere and replace it with carbon dioxide;
* When fossil fuels are burnt, the carbon in them combines with oxygen from the air, and forms carbon dioxide. This process is called combustion;
* Combustion of fossil fuels is thought to be having an effect on the balance of carbon dioxide;
* The extra carbon dioxide may be causing the percentage of carbon dioxide in the air to increase;
* The loss of the trees may reduce the amount of photosynthesis taking place;
* As a result the concentration of carbon dioxide increases and oxygen decreases in the atmosphere;
* The rise in the levels of carbon dioxide levels in the atmosphere could be dangerous as it may cause global warming.

**Describe the water cycle, limited to evaporation, transpiration, condensation and precipitation**

**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**

**Define *population*** - a group of organisms of one species, living in the same area, at the same time

**Define *community*** - all of the populations of different species in an ecosystem

**Define *ecosystem*** - a unit containing the community of organisms and their environment, interacting together, e.g. a decomposing log, or a lake

**Identify and state the factors affecting the rate of population growth for a population of an organism, limited to food supply, predation and disease**

**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**

**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**