

BIOLOGY SS 1: WEEK TEN

Energy Transformation in Nature

Energy Loss in the Ecosystem (i) Solar Radiation (ii) Energy Loss in the Biosphere (iii) Measure of Primary Production

Laws of thermodynamics

The largest source of energy for an ecosystem is the sun. The energy that is not used in an ecosystem is eventually lost as heat. Energy and nutrients are passed around through the food chain when one organism eats another organism. Any energy remaining in a dead organism is consumed by decomposers. Energy decreases as it moves up trophic levels because energy is lost as metabolic heat when the organisms from one trophic level are consumed by organisms from the next level. Living organisms cannot convert heat to other forms of energy.

Heat is lost from ecosystems. Not all energy stored in organic molecules is transferred via heterotrophic feeding – some of the chemical energy is lost by:

- Being excreted as part of the organism's faeces
- Remaining unconsumed as the uneaten portions of the food

Solar radiation

Solar radiation is radiant (electromagnetic) energy from the sun. It provides light and heat for the Earth and energy for photosynthesis. This radiant energy is necessary for the metabolism of the environment and its inhabitants. During photosynthesis, the energy from solar radiation captured by the plant is used in the production of food, which is then eaten and transferred within the food web. Hence, the primary source of energy is the sun.

Energy loss in the biosphere

The energy from plant is lost as heat when it spreads back out from Earth's surface, beyond Earth's atmosphere. Earth's atmosphere can trap some of the heat, warming the atmosphere and making Earth habitable. The matter is used over and over as it moves through Earth's four spheres.

A measure of primary production

In ecology, primary production is the synthesis of organic compounds from atmospheric or aqueous carbon dioxide. It principally occurs through the process of photosynthesis, which uses light as its source of energy, but it also occurs through chemosynthesis, which uses the oxidation or reduction of inorganic chemical compounds as its source of energy.

Primary productivity can be measured in three ways:

- The amount of carbon dioxide used;
- The rate of sugar formation;
- The rate of oxygen production.

Laws of thermodynamics

Energy transformations in nature are governed by the laws of thermodynamics.

The first law of thermodynamics:

States that when one form of energy is converted into another, the total quantity of energy is constant (there is no net loss or gain in energy) that is to say that energy is neither created nor destroyed. Hence, in the process of burning, the chemical energy of wood changes into heat and light. In a motor vehicle, energy in the form of fuel changes into mechanical energy. So, energy can only be converted from one form to the other.

The second law of thermodynamics:

The law states that when one form of energy is converted into another, a proportion of it is converted into heat.

The second law shows that when energy flows through a food chain, only a small proportion of the energy taken up by each link is transferred to the next step. This is because, at each transfer, most of the energy is lost as heat.

ASSIGNMENT

1. What do you understand by energy transformation in nature?
2. State the first law of thermodynamics
3. State the second law of thermodynamics