

Biology 20 – Unit A
Energy and Matter Flow in the Biosphere

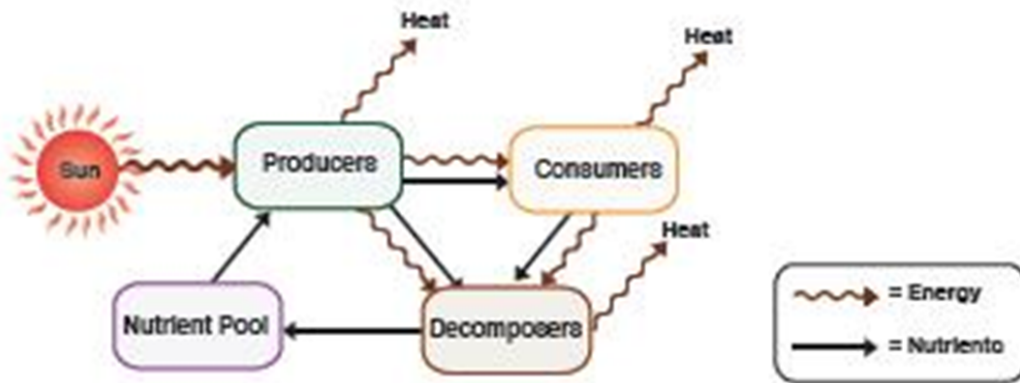
General Outcomes: There are three major outcomes in this unit.

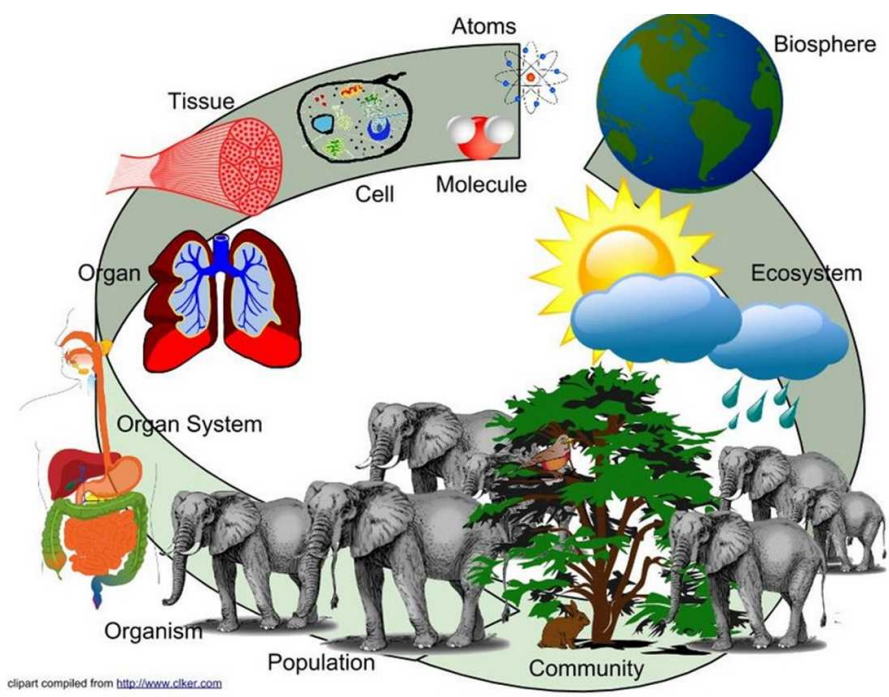
Students will:

1. explain the constant flow of energy through the biosphere and ecosystems
2. explain the cycling of matter through the biosphere
3. explain the balance of energy and matter exchange in the biosphere, as an open system, and explain how this maintains equilibrium.

Key Concepts: The following concepts are developed in this unit and may also be addressed in other units or in other courses. The intended level and scope of treatment is defined by the outcomes.

- biosphere
- equilibrium
- trophic levels
- food chains, food webs and ecological pyramids (energy, biomass and numbers)
- carbon, nitrogen, oxygen and phosphorus cycles
- water properties





Outcome 1 – Energy Flow in the Biosphere

Big Picture: Energy Flows through the Biosphere

All energy entering the biosphere is eventually is lost back to space

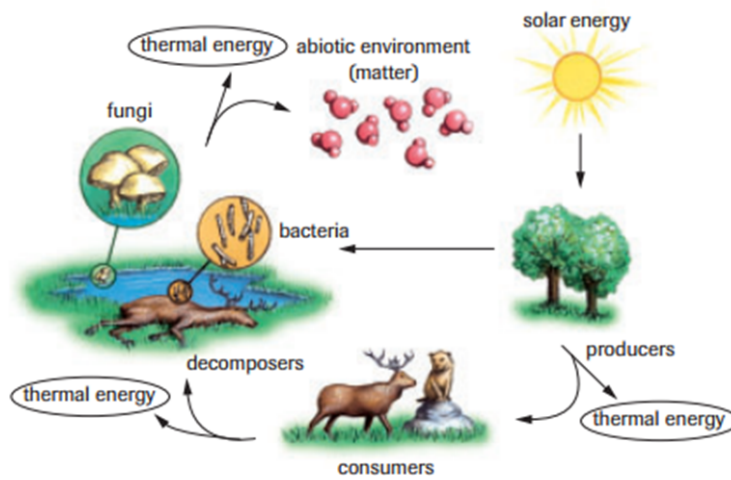


Figure 7
According to the second law of thermodynamics, energy is lost each time energy is transferred from one organism to another, and inside each organism as it uses the energy to survive.

Key Terms:

Biosphere	Decomposers	First Law of Thermodynamics
Producers	Biotic	Second Law of Thermodynamics
Consumers	Abiotic	
Conduction	Photosynthesis	Food Web
Convection	Chemosynthesis	Tropic Levels
Radiation	Food Chain	

Concept 1 - Energy Flow in the Biosphere and the Balance between Photosynthesis and Cellular Respiration

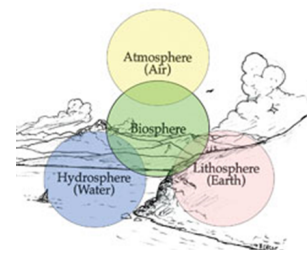
Curriculum Connection

20-A1.1k explain, in general terms, the one-way flow of energy through the biosphere and how stored energy in the biosphere, as a system, is eventually “lost” as heat;

20- A1.2k explain how energy in the biosphere can be perceived as a balance between both photosynthetic and chemosynthetic activities and cellular respiratory activities

Concept 1 – Main Questions

1. **What is the biosphere?**
2. **Where does the biosphere receive its energy from?**
3. **What happens to energy entering the biosphere?**
4. **What are photosynthesis, chemosynthesis and cellular respiration?**

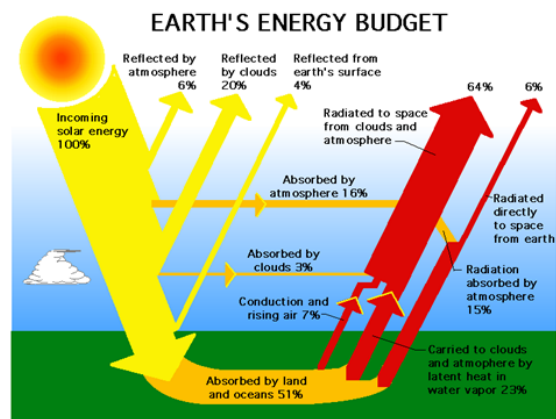
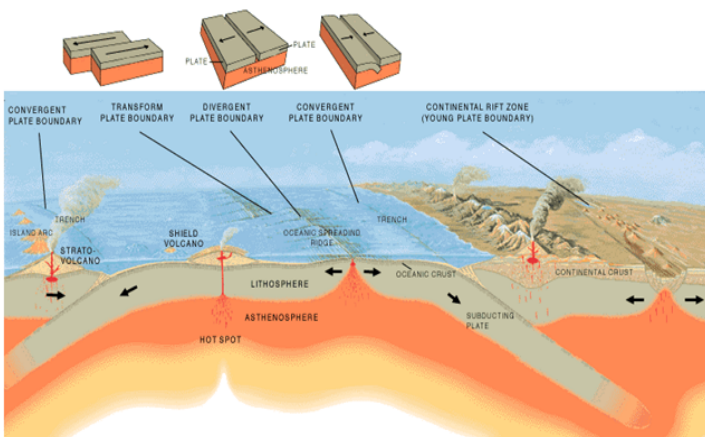


Question 1: What is the biosphere?

- **Biosphere - narrow zone around Earth that harbors life**
 - o Where the lithosphere, atmosphere, hydrosphere and living things interact
- The biosphere can be broken into smaller ecosystems, areas that share common abiotic and biotic characteristics

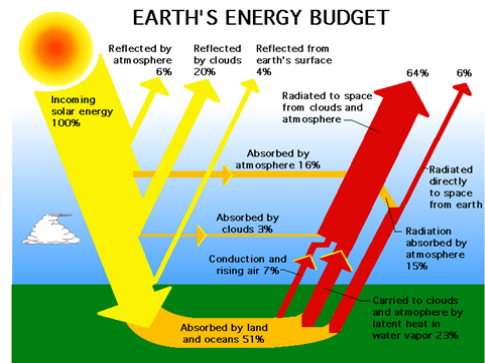
Question 2: Where does the biosphere receive its energy from?

- All the energy that enters the biosphere comes from one of two sources
 - o **The sun (major source)**
 - o **The earth’s core (minor source)**
- All of the energy that enters the biosphere...leaves the biosphere.
 - o **Energy in = energy out**

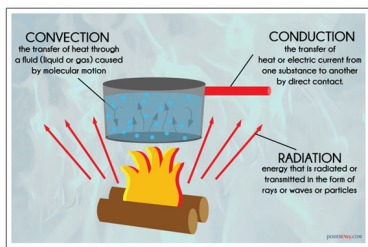


Question 3: What happens to energy entering the biosphere?

- All of the solar energy that enters the biosphere is either
 - o **Absorbed**
 - By land, water, plants, gases
 - o **Reflected**
 - By land, water, plants, gases
- Solar energy that is absorbed heats up the object that absorbed it
- Solar energy that is reflected is lost back to space
- **Absorbed energy can be used by plants for photosynthesis**



- Energy absorbed by other objects can be moved around the biosphere by:
 - o **Conduction – air heated by land/water**
 - o **Convection – wind/water currents**
 - o **Radiation – eventually all energy absorbed is lost as radiation**

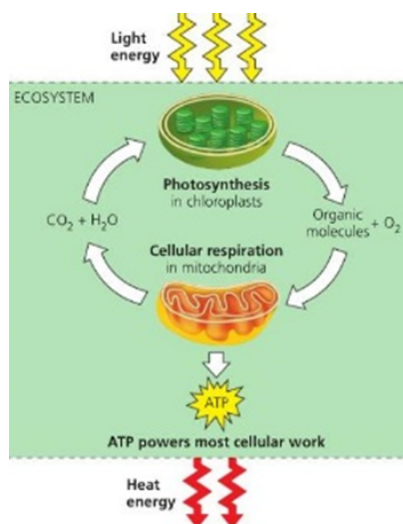
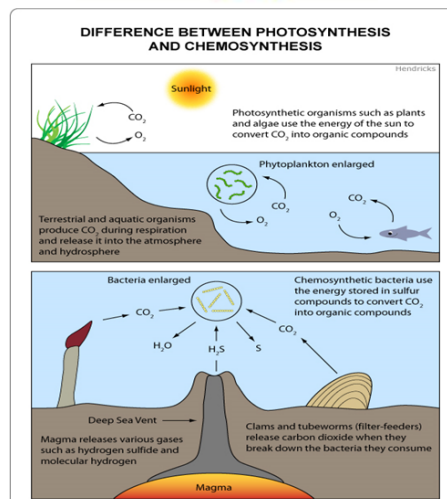
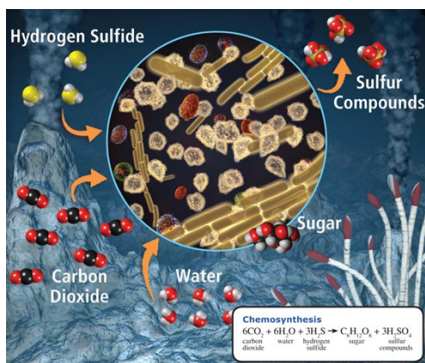
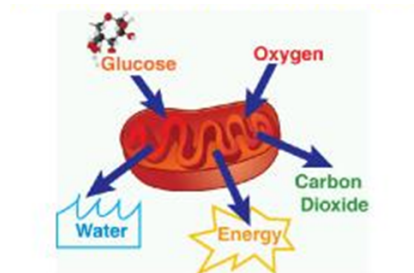
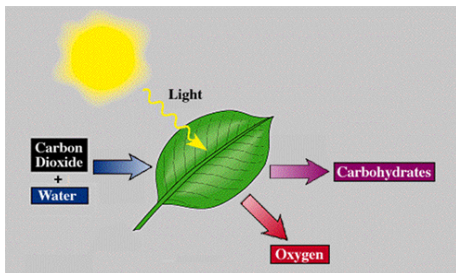


Question 4: What are photosynthesis, chemosynthesis and cellular respiration?

- **Photosynthesis** – conversion of carbon dioxide and water into glucose and oxygen using the light energy from the sun
 - o Occurs in **plant and algae**
 - o Requires **chloroplast organelle**
 - o <http://www.wonderville.ca/asset/photosynthesis>

- **Chemosynthesis** – conversion of carbon dioxide and water into sugars using chemical energy found in chemicals from earth's crust
 - o Occurs in **specialized bacteria**
 - o <http://oceanexplorer.noaa.gov/edu/learning/player/lesson05.html>

- **Cellular Respiration** – conversion of glucose and oxygen into carbon dioxide, water and usable energy for the cell
 - o Occurs in **all living things**
 - o Releases the energy stored by sugars made in photo/chemosynthesis
 - o Requires the **mitochondria organelle**
 - o <http://www.sumanasinc.com/webcontent/animations/content/cellularrespiration.html>



Outcome 1 – Concept 1 – Review Questions

Read pages 8-10

1. Name the levels of organization in the biosphere.
2. What are the 4 interacting components of the biosphere?
3. (a) In your own words define the term biodiversity.

(b) Explain why diversity is important for ecosystems.

(c) Give two examples of ecosystems that have high biodiversity, and two that have low biodiversity. Explain your classification.
4. What are the abiotic and biotic components of the biosphere?
5. In what way does a community differ from an ecosystem?
6. Identify the reactants and products for the chemical reaction of photosynthesis.
7. Identify the reactants and products for the chemical reaction of cellular respiration.
8. What source of energy is used by chemosynthetic bacteria to make organic compounds?