

## The Flow of Energy Instructions and Answers for Teachers

- Venue(s): Water Lily Pond and Sun Pavilion
- Estimated duration to complete all questions: 1 hour

### Level / Subject:

- Lower Secondary (Science, Express & Normal Academic): Energy and Work Done
- Lower Secondary (Science, Express & Normal Academic): Interactions within Ecosystem

### Learning Objectives:

- Learn that energy is transferred when work is done
- Recognise that respiration and photosynthesis are related to energy flow with the aid of selected examples
- Describe how nutrients trapped in living organisms are recycled within the environment



## ACTIVITY 1: Energy Around You (30 mins)

### Note to Teacher:

Bring the students on a walk through the following locations in the Gardens and ask them to observe the flora, fauna and structures in the environment.

Coach Drop-off point > Water Lily Pond > Sun Pavilion > Big Fish Aquarium

They should attempt the question below while observing the environment.

Observe the environment around you. Identify three different types of work done and their corresponding examples of energy conversion.

Answers:

No.	Work Done	Energy Conversion
1	People walking from point A to B, or movement of birds, insects, lizards, fishes and other animals in the environment	Chemical energy is converted to kinetic energy + heat energy
2	People talking	Chemical energy is converted to kinetic energy to sound energy
3	Vehicles moving	Chemical energy (fuel) is converted to kinetic + heat energy
4	Presence of street lights	Electrical energy is converted to light energy + heat energy
5	Movement of fountain water (at Water Lily Pond); Movement of electric fan (at Sun Pavilion)	Electrical energy (electric pump) is converted to kinetic energy + heat energy
6	Photosynthesis in plants	Solar energy is converted to chemical energy

Accept any other reasonable answers

## ACTIVITY 2: The Flow of Energy (30 mins)

(a) Chemical energy stored in living organisms allows them to perform work. Explain the process where energy is converted and stored by producers in a food chain. What is the ultimate source of this energy?

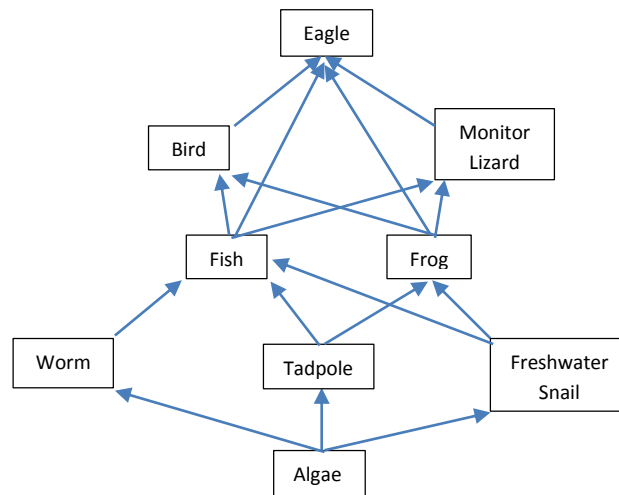
Answer: Solar energy is converted to chemical energy (in the form of sugar / glucose / carbohydrates) by plants through photosynthesis. Sunlight is captured by chlorophyll in the leaves to produce sugar / glucose / carbohydrates using carbon dioxide and water, and oxygen is released as a by-product in the process of photosynthesis. Hence, the Sun is the ultimate source of this energy.

(b) In the ecosystem, consumers are not able to produce their own energy like producers. They obtain it from the food they consume. Explain the process where energy is released from food consumed, to do work.

Answer: Food is broken down in the presence of oxygen, to release energy in the respiration process. Carbon dioxide and heat is released as by-products.

(c) Energy is passed on from one organism to another in a food chain and food web. Draw a food web with the organisms that you have observed in the environment.

Answers:



Accept any other reasonable answers

(d) The flow of energy between organisms can be better represented with an energy pyramid with different trophic levels. Does all energy in one trophic level get passed on to the next? Explain your answer.

Answer: No, not all energy in a trophic level is passed on to the next.

Consumers can only obtain energy by eating what is stored in the body of their prey as biomass. A large amount of energy is not passed on but lost from the organism as heat or faecal matter to the environment. Energy is also lost from parts of the organism that are not consumed or cannot be digested e.g. bones, fibre, feathers, etc.

Dead and / or faecal matter that is not digested by organisms may be broken down by decomposers. Some of the nutrients released will be consumed by the decomposers or returned to the soil, and absorbed by plants. The rest may be stored in the earth as biomass fuel.

**Note to Teacher:**

For more on Interactions within Ecosystem, check out these Secondary School programmes:

- Exploratory Journey of the World of Plants
- Life in the Pond
- Protecting our Green Gems
- A Breath of Fresh Air
- A Blue Future
- It's Complicated