

SCIENCE 1206 UNIT 4: SUSTAINABILITY OF ECOSYSTEMS
Worksheet #4: Energy Flow In An Ecosystem



The sun is the source of energy for Earth.

It is a one-way flow. Energy enters food chains through the process of photosynthesis carried out by primary producers

Albedo is a measurement of the percentage of light that an object reflects. The higher the albedo, the greater the object's ability to reflect sunlight. For the Earth, the higher its overall albedo, the less energy will be absorbed and available for maintaining global temperatures

All energy produced by the sun does NOT reach the Earth's surface. -

- 30% is reflected by clouds or surface
- 44% heats atmosphere/land
- 25% heats water/evaporation
- 1% generates wind
- 0.023% is used for photosynthesis

Trophic Levels a way of organizing living things according to how they gain their energy. It is estimated that 10% of the potential energy at any given trophic level is available to the next higher trophic level in the food chain. In general, the overall loss of energy at each step sets a limit on the number of trophic levels in a food chain at about five. The actual number of trophic levels in ecosystems varies greatly.

Food chain – Series of steps by which energy is obtained, used, and changed by living things.

- It indicates the flow of:
- Energy
- Nutrients
- Pesticides

Arrows are used in a food chain to indicate the flow of energy.

Sample Food Chains

Trophic Level	Grassland Biome	Pond Biome	Ocean Biome
Primary Producer	grass	algae	phytoplankton
Primary Consumer	grasshopper	mosquito larva	zooplankton
Secondary Consumer	rat	dragonfly larva	fish
Tertiary Consumer	snake	fish	seal
Quaternary Consumer	hawk	raccoon	white shark

Producer(autotrophs) – Organism that takes non-living matter (energy from the sun, water, minerals, carbon dioxide) and uses it to produce food (energy) for itself with surplus for other organisms.
Example – plants

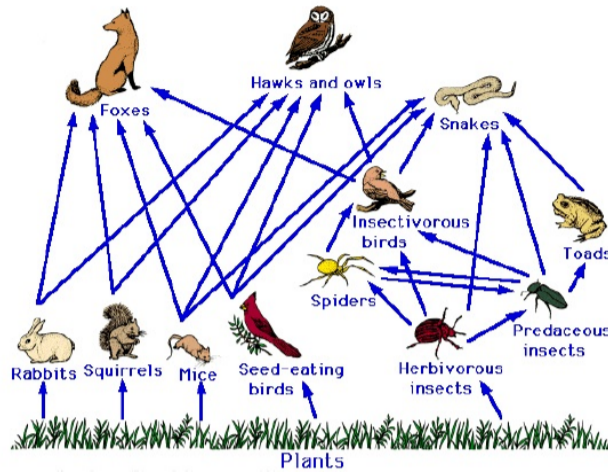
Consumers (heterotrophs) that directly or indirectly depend on the photosynthetic output of producers

- 1. **Primary consumers:** Herbivores which eat producers.
- 2. **Secondary consumers:** Carnivores that eat herbivores.
- 3. **Tertiary consumers:** Carnivores that eat other carnivores
- 4. **Decomposers** constitute another major group of consumers, often referred to as **saprobies**. They derive their energy from “**detritus**”, which is organic waste such as feces or fallen leaves and the remains of dead organisms from all trophic levels.

Carnivores may be divided into a number of different subdivisions:

- **Omnivore:** Carnivores which eat both plant and animal material.
- **Predators:** Carnivores that capture and eat prey.
- **Scavengers:** Consumers that feed on dead organisms.

Food Web: a series of interconnected food chains, showing many feeding relationships among organisms.



PART A: MULTIPLE CHOICE

1. All the energy in a food chain originates from:
(A) A plant
(B) Farmers
(C) The Sun
(D) An electric outlet
2. Which of these is a correct food chain?
(A) Fish→fries→ketchup
(B) Man ←cow ←grass
(C) Cow ←slaughterhouse ←supermarket
(D) Cow ←Milk← Man
3. The arrows in a food chain show:
(A) Who eats who
(B) The route of food to the shops
(C) The movement of energy between organisms
(D) Heat energy being lost
4. What are organisms that manufacture their own food by using energy provided by sunlight?
(A) Autotrophs
(B) Herbivores
(C) Omnivores
(D) Carnivores
5. Most humans eat a well balanced diet made up of a combination of meat and vegetables. How would you describe a human?
(A) Autotrophs
(B) Herbivores
(C) Carnivores
(D) Omnivores

6. What is the process in which materials and nutrients are broken down by micro-organisms so that the nutrients are available to be re-used?
- (A) Rotting
 - (B) Scavenging
 - (C) Decomposition
 - (D) Recycling
7. Which organism is paired with its role?
- (A) Black bear - omnivore
 - (B) Coyote - herbivore
 - (C) Earthworm - tertiary consumer
 - (D) Moose - autotroph
8. Approximately what percentage of the energy in one trophic level becomes incorporated into the next level as secondary productivity?
- (A) 1%
 - (B) 10%
 - (C) 30%
 - (D) 60%
9. Which may be a secondary or tertiary consumer?
- (A) omnivore
 - (B) herbivore
 - (C) detritivore
 - (D) carnivore
10. Which animal is a scavenger?
- (A) crow
 - (B) fox
 - (C) hawk
 - (D) owl
11. What is the correct order of the levels in a food chain?
- (A) Consumer → Producer → Decomposer
 - (B) Decomposer → Producer → Consumer
 - (C) Decomposer → Consumer → Producer
 - (D) Producer → Consumer → Decomposer

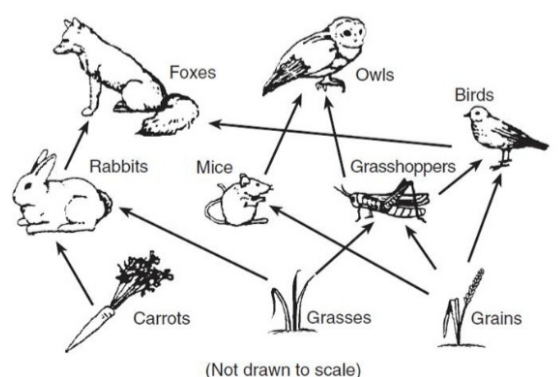
Use the food chain below to answer questions 12-14.

Sun – Plants – Mice – Snakes – Hawks

12. Which organism's population would most likely decrease soon after the number of mice greatly increased?
- (A) hawks
 - (B) mice
 - (C) plants
 - (D) snakes

13. Which best describes the hawk?
- (A) decomposer
 - (B) predator
 - (C) prey
 - (D) scavenger
14. Which best describes the mice?
- (A) decomposer
 - (B) predator
 - (C) prey
 - (D) scavenger
15. Producers are an important part of the food chain. What are producers?
- (A) animals
 - (B) humans
 - (C) insects
 - (D) plants
16. Plants and animals are very important to each other. Animals provide plants carbon dioxide. What do plants provide animals?
- (A) chlorophyll
 - (B) oxygen
 - (C) photosynthesis
 - (D) water
17. Which kind of organism would be most likely to perform photosynthesis?
- (A) omnivore
 - (B) herbivore
 - (C) detritivore
 - (D) autotroph
18. Which eats only plant foods?
- (A) omnivore
 - (B) herbivore
 - (C) detritivore
 - (D) autotroph
19. Humans and animals such as bears are biologically adapted to be
- (A) omnivores
 - (B) herbivores
 - (C) detritivores
 - (D) autotrophs
20. Energy flow in an ecosystem begins with
- (A) omnivores
 - (B) herbivores
 - (C) detritivores
 - (D) autotrophs
21. The only heterotrophs required in an ecosystem are
- (A) omnivores
 - (B) herbivores
 - (C) detritivores
 - (D) autotrophs

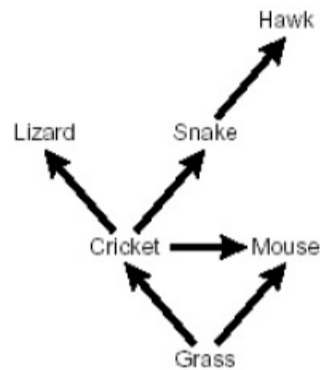
22. The angler fish is a deep sea fish which uses light to attract its prey? Which best describes the angler fish?
- (A) Carnivore
 (B) Decomposer
 (C) Herbivore
 (D) Producer
23. If you were trapped on an island with only corn and chickens to eat. In terms of getting the most energy from your food sources, what would be your best strategy?
- (A) Eat the chickens first, then the corn.
 (B) Eat the corn first, then the chickens.
 (C) Feed the corn to the chickens, and then eat the chickens.
 (D) Feed the corn to the chickens, eat the chickens' egg, then eat the chickens.
24. Which relationship best describes the interactions between lettuce and a rabbit?
- (A) Decomposer — scavenger
 (B) Herbivore — carnivore
 (C) Parasite — host
 (D) Producer — consumer
25. Why is a food web more stable than a food chain ?
- (A) It includes alternative pathways for energy flow
 (B) It includes more consumers than producers
 (C) It reduces the number of niches in the ecosystem
 (D) It transfers all of the producer energy to herbivores
26. The chief food producers in the ocean are
- (A) plants.
 (B) zooplankton.
 (C) phytoplankton.
 (D) fish.
27. A food web:
- (A) Is made by a food spider
 (B) Shows how feeding relationships are interlinked
 (C) Shows the number of organisms in a habitat
 (D) Only shows important animals
28. Herbivores, carnivores, and omnivores are all
- (A) decomposers.
 (B) producers.
 (C) predators
 (D) consumers.
29. What is represented in the diagram below?
- (A) Food Chain
 (B) Food Web
 (C) Feeding diagram
 (D) Pyramid of Energy



30. If you made a chart showing all of the organisms living in the local lake, with arrows drawn between the various organisms showing who ate what, what kind of chart would you have made?
- (A) energy pyramid
 - (B) food chain
 - (C) food web
 - (D) ecosystem chart

31. In the figure to the right, which organism in the food web is in the third trophic level?

- (A) grass
- (B) cricket
- (C) snake
- (D) hawk



32. Which of these is a correct depiction of a food chain?

- (A) mice → cat → rabbit
- (B) human → fish → chips
- (C) grain → mice → cat
- (D) cougar → cat → mice

33. The arrows in a food chain show

- (A) who eats whom
- (B) the route of food through the digestive system
- (C) how food travels
- (D) the movement of energy through different organisms

34. Which of the following could be the beginning of a detritus food chain?

- (A) bacteria
- (B) fungus
- (C) dead leaves
- (D) worms

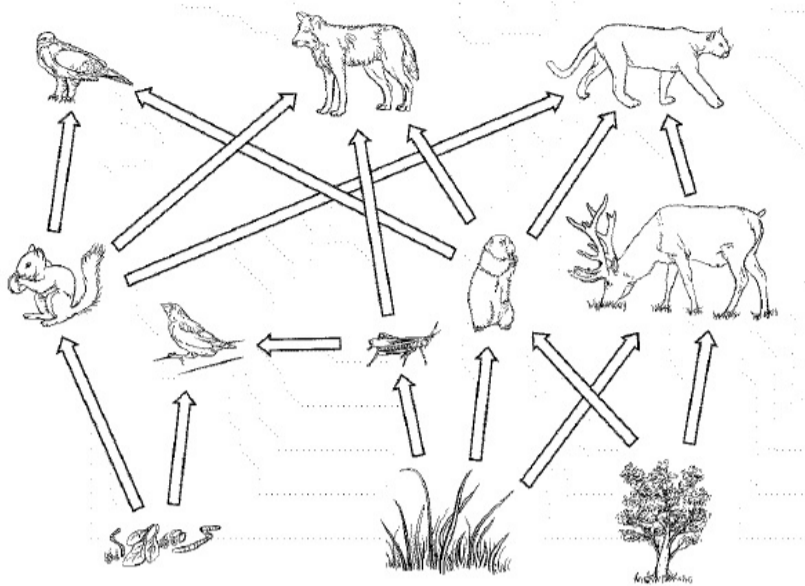
35. Primary consumers can also be called

- (A) carnivores
- (B) herbivores
- (C) omnivores
- (D) autotrophs

36. In a food chain, which of the following organisms would belong to the second trophic level?

- (A) hawk
- (B) human
- (C) grass
- (D) squirrel

Use the chart below to answer questions 37-40.



37. Three organisms on the food web have arrows pointing away from them and no arrows pointing toward them. They are
- (A) omnivores.
 - (B) herbivores.
 - (C) decomposers.
 - (D) producers.
38. Four organisms on the food web have arrows pointing toward them but no arrows pointing away from them. This is because
- (A) they make their own food.
 - (B) they give energy to others.
 - (C) nothing shown eats them.
 - (D) they need no energy.
39. The arrows on the food web show that
- (A) prairie dogs eat grass..
 - (B) deer eat prairie dogs.
 - (C) squirrels eat grass
 - (D) squirrels eat coyotes.
40. What does the arrow between the grasshopper and the coyote represent?
- (A) energy flowing from producers to consumers
 - (B) energy flowing from consumers to producers
 - (C) energy flowing from the coyote to the grasshopper
 - (D) energy flowing from the grasshopper to the coyote