

Name: _____

Date: _____

AP BIOLOGY SUMMER ASSIGNMENT :

Study the attached page of notes. Once you feel you have a grasp on the material, answer the essay prompt below. Give yourself 22 minutes to answer the prompt. Then grade your essay using the rubric on the back of this paper. The maximum score is 10, even though there are many different ways to get the 10 points. Make sure that your essay is written in complete sentences.

ESSAY PROMPT

Discuss the trophic levels in a typical ecosystem in terms of

- The types of organisms found at each trophic level and how they obtain energy
- The flow and efficiency of energy transfer through the trophic levels
- Possible factors that could limit the number of trophic levels in the ecosystem

Part a: DESCRIPTION/RELATIONSHIP OF TROPHIC LEVELS (4pts max) 1 point for each for any of the following

- Photoautotrophs obtain energy from sunlight in order to make their own food.
- Chemoautotrophs obtain energy from inorganic chemicals in order to make their own food.
- Primary consumers consume producers to obtain energy.
- Description/Feeding relationship of secondary, tertiary & quaternary consumers.
- Describing the relative biomass of the trophic levels (ex. Producers are usually largest biomass, quaternary smallest, etc.)
- Describing how some organisms can feed on more than one trophic level, as a food web would show.
- Identification of producers as autotrophs that create their own food.
- Identification of consumers as heterotrophs that obtain their food/energy from other organisms.

Part b: ENERGY FLOW (4 points max) 1 point for each for any of the following:

- Discussion of only 10% of energy being passed from one level to next.
- Explaining that 90% of energy is lost as heat between levels.
- Discussing how sun is the ultimate source of energy for photosynthesis.
- Discussing how producers make energy available to all other trophic levels through photosynthesis.
- Discussing the relationship of gross primary productivity and net primary production in terms of energy available to consumers after producers have fed themselves. Gross = All sugars/energy available after photosynthesis but before producers have fed themselves. Net = sugars/energy available after producers have fed themselves.
- Mentioning that energy flows one way through an ecosystem, from producers to higher level consumers.
- Discussing how detritivores or decomposers complete the process by utilizing energy from dead organisms/detritus.

Part c: FACTORS THAT LIMIT THE NUMBER OF TROPHIC LEVELS (2 points max) 1 point for each for any of the following:

- Discussion of the fact that only 10% of energy is available for the next level to create new organisms.
- Availability of sunlight in the ecosystem can limit the number of trophic levels in photosynthetic ecosystems because of decreased productivity by producers.
- Discussing how an ecosystem with fewer producers will produce less energy for the higher trophic levels.
- Discussing how an ecosystem with limited organic material (biomass) will allow for the creation of fewer organisms and therefore fewer trophic levels.

ECOLOGY NOTES FOR SUMMER

***Notes modified from Kelly Reidell's WHAT TO KNOW Handouts

Her web site: <http://kr021.k12.sd.us/>

Ecology = Study of the interactions between organisms and their environment

LEVELS OF ORGANIZATION: (pages 1145, and 1165-1167)

Organism → populations → communities → ecosystems → biomes → biosphere

ORGANISM = Individual member of a species.

POPULATION = Localized group of individuals that belong to the same SPECIES (organisms capable of interbreeding and producing fertile offspring).

COMMUNITY = All the populations of different species that inhabit a particular area.

ECOSYSTEM = All of the **biotic** factors in an area and the **abiotic** factors with which they interact.

BIOTIC	ABIOTIC
Living things; All other organisms- animals, plants, microorganisms	Non-living chemical & physical factors: temperature, light, rocks & soil, water, nutrients; wind; climate

BIOME = Any of the world's ecosystems classified according to dominant vegetation and rainfall.

Examples include tropical rain forests, deserts, tundra, etc.

BIOSPHERE = The portion of the planet in which all life exists.

ECOLOGICAL HABITATS AND NICHE: (page 1195)

HABITAT- "location" - area where a species lives.

NICHE- "occupation" - where a species lives PLUS its interactions with biotic and abiotic factors in that place.

FUNDAMENTAL NICHE = The niche that a species could potentially occupy without competition from other species.

REALIZED NICHE = The portion of the fundamental niche that the species actually occupies with competition occurring.

TROPHIC STRUCTURE AND FOOD WEBS: (pages 1218-1226)

AUTOTROPHS = **PRODUCERS** (can make their own food):

PHOTOAUTOTROPHS: Covert light energy into chemical energy through the process of photosynthesis.

***SUNLIGHT is the original source of all energy in food chains with photoautotrophs as their producers.

CHEMOAUTOTROPHS: Covert inorganic substances into chemical energy. Don't need light.

HETEROTROPHS = **CONSUMERS** (obtain food by consuming other organisms):

HERBIVORES- eat only plants

CARNIVORES- eat only animals

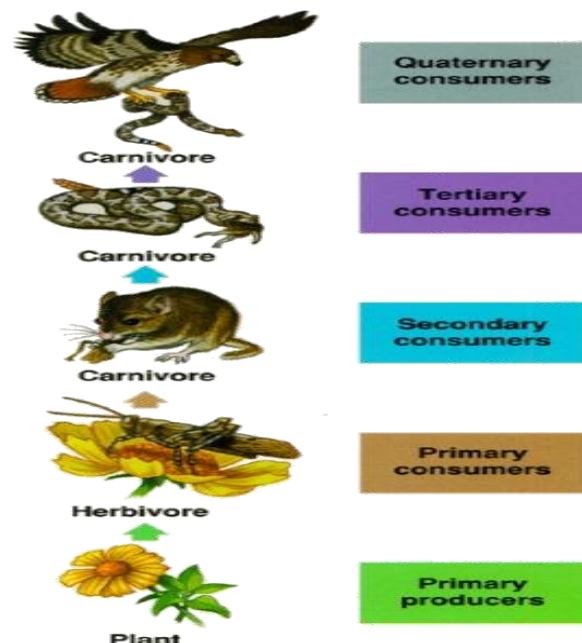
OMNIVORES- eat both plants and animals

DETRITIVORES- feed on dead plant and animal remains

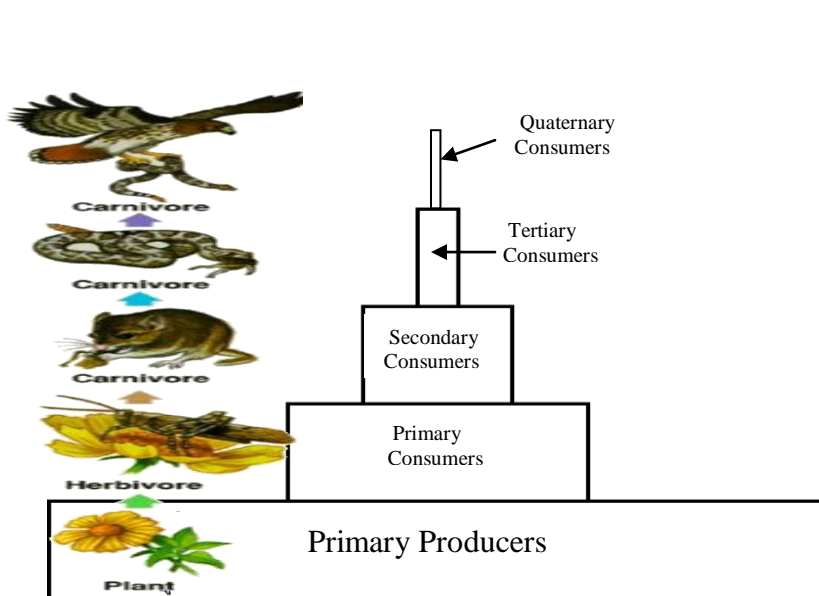
Examples: mites, earthworms, snails, crabs

DECOMPOSERS- break down and absorb dead organic matter

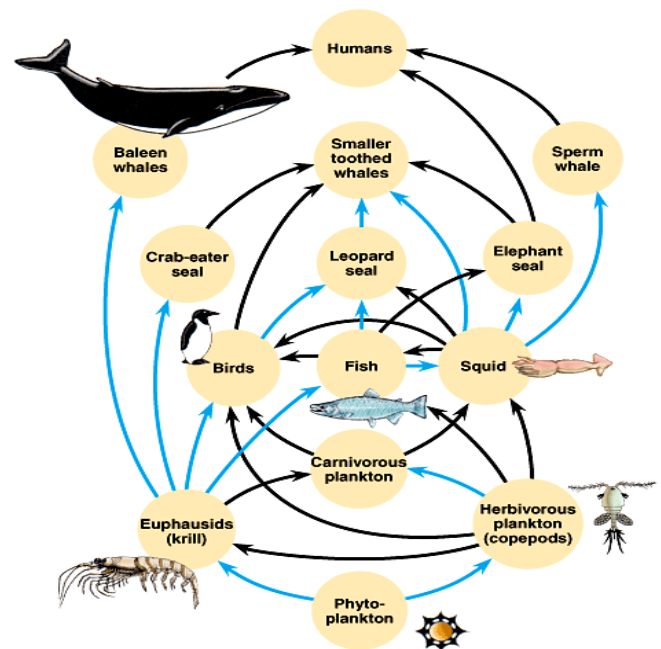
Examples: bacteria and fungi



MATTER recycles within an ecosystem and <u>is reused</u>	Carbon cycle Nitrogen cycle Water cycle Phosphorus cycle
ENERGY flows one way THROUGH ecosystem and <u>is used up</u>	Food chains/webs- Energy passes to next TROPHIC level as organisms are eaten; -1st level always = producers (autotrophs) -2nd level = primary consumers (heterotrophs) eat producers -3 rd level = secondary consumers eat primary consumers -4 th level = tertiary consumers eat secondary consumers -5 th level = quaternary consumers eat tertiary consumers Only 10% of energy at each level is passed on to next trophic level. 90% of the energy is lost as heat. -This limits # of levels possible, since the amount of energy available to grow new organisms is limited. -Some species can feed at more than one trophic level.



In the energy/biomass pyramid above, let us assume that the primary producers generate 10,000 joules of energy. Only 10% of this energy (1000 joules) will be transferred to the primary consumers. Furthermore, only 10% of the 1000 joules that the primary consumers receive will be transferred to the secondary consumers, who receive only 100 joules (10% of 1000). This rule of 10% can usually be applied to biomass (total mass of individuals in a population) as well. So if the producer level was made up of 1000kg of plant material, it could support approximately 100kg of primary consumers (herbivores).



In the marine food web above, phytoplankton are the primary producers. Since the herbivorous plankton feed on phytoplankton, they are primary consumers. On the other hand, krill feed on both phytoplankton and herbivorous plankton. This means that krill feed on more than one trophic level as both primary consumers (eating phytoplankton) and secondary consumers (eating herbivorous plankton).

DOMINANT SPECIES: Most abundant species or highest biomass (total weight) in community.

KEystone SPECIES- Exert an important regulating effect on other species in a community. **See figure 54.18 on page 1205 of the book.** Sea otters are a keystone species because they eat sea urchins. If not eaten/controlled, sea urchins will destroy kelp forests, which are the primary producers that support the whole food web.

PRIMARY PRODUCTIVITY = amount of energy from light (or chemicals when dealing with chemoautotrophs) converted to chemical energy

-**GROSS primary productivity (GPP)** = Total amount of chemical energy produced by the producers (autotrophs).

-**NET primary productivity (NPP)** = GROSS productivity minus the energy used by the producers (autotrophs) themselves.