Biology **Name**_____

Chapter 1-2: Ecology **Date**_____

- Learning Goals
  - You will give examples of how an organism meets the definitions of "living"
  - Describe and identify the levels of organization in Ecology
  - Know the difference between abiotic and biotic factors
  - Recognize the relationships between producers and consumers, including feeding and habitat relationships
  - Describe the flow of energy in trophic levels using food webs and/or pyramids
  - Give methods and reasons for the recycling of nutrients in the Biosphere
- What is Biology?
  - In ancient Greece, philosopher Aristotle came up with an idea for where living things come from
    - Mice came from hay piled up in the barn
    -
    - Worms came from horsehair
    -

- Diversity of Life
  -
  - Biologists study the interactions of organisms with their surroundings.
    - Organisms, including humans, are affected by:
      - Whether or not enemies are present
      - Who is responsible for providing for you and others
      - The weather
      - The terrain/habitat in which we live
    - It's important to study these relationships organisms have in order to help figure out how living things manage to live
  - What falls under the realm of biology?
    -
    - Disease prevention (vaccines)
    -
    - Knowledge research (Tonsils)
    - Things we don't even know we'll need
      - What do chocolate chips, gunpowder, Champaign, Teflon, penicillin, photography and HIV all have in common?
      - Answer:
      - George Divoky spent 35 years on Cooper Island on the north coast of Alaska studying black Guillemots, where he discovered….?
      -

- The Scientific Method
    -
    - Prior to this, science was whatever the investigator felt it should be
    - Small sample sizes, loaded questions, no controls, and no accountability.
    - The scientific method is simple, universal, and unbiased (if done right)
- Setting up the Experiment
    -
    - Then the experimenter identifies the variables (parts of an experiment that can be changed).
        - A manipulated variable is
        - A responding variable is
    - Whatever variables remain are the controls
    -
    - Since controls always stay the same in each trial, if there is any difference in results (responding variables) it must be due to the manipulative variables.
    - Hypotheses' have a standard formula that must be followed.

    IF: _____ _____
    Name the manipulated variable Performs this action/is in this state
    THEN: _____ _____
    Name the responding variable Will respond in this way
    BECAUSE: _____
    Provide the reason for why you think so (it's just a guess)
    - Example: IF two balls of different weights are thrown in the air, THEN the heaviest one will land first BECAUSE it has less air resistance
- Characteristics of Living Things
    - How do you know if something is alive?
    - What characteristics are required to be considered alive?
    - Biologists have developed a list of characteristics that are required for something to be considered "living."
    - Anything that possesses these characteristics is called an organism
    - #1:
        - Living things are made of between 1 and 1 trillion cells.
        - These cells must all work together without failure for the organism to remain alive.
        - For this to work, there must be organization and each cell must have a role or purpose.
    - #2:
        - Living things simply can't live forever.
        -
        - If a species is going to survive, they must reproduce offspring for the future.

        -
            - An eagle and a hawk? An elephant and a mouse? A beagle and a pug?
    - #3:
        -
            - Example: Muscle cells
        - Sometimes growth occurs to be better equipped to survive
            - Adults are generally stronger, faster, and bigger than children.
        - Sometimes growth occurs to aid in survival
            - Animals grow winter coats, snakes shed old skin
        - All of the changes an organism undergoes in a lifetime is called development.
    - #4:
        -
        - Throughout their lives, organisms will experience various stimuli from their environment. These stimuli cause organisms to respond in some way.
            - Do you have any smell, sound, food, etc that always triggers a memory and/or an emotion?
            - Tree's have sensors that detect temperature and humidity levels to know when rain is coming. What's their response?
        - Organisms need to adjust so that their bodies stay the same.
            - What happens if your body temperature reaches above 98.6 degrees? We need to maintain this temperature
            - During heat waves, we will sweat and burn extra fat to help maintain this temperature. Otherwise…?
        -
    - #5:
        -
            - "Adaptations" are species-wide and permanent; "adjusting to the environment" is individual and temporary.
        - Name that Adaptation!
            - Camels to the desert
            - Walruses to the Arctic Ocean
            - Badgers to living underground.
- Ethics
    - Throughout history, science and society have sometimes come at odds.
    - Science changes the way we understand the world.
    -
        - Developing the atomic bomb
        - Factories that run entirely on machines

        - Biggest scientific controversy in history?
            - Answer:
- Ecology
    - A major portion of biology is the science of ecology.
    -
        - How do organisms rely on each other to survive?
        - How do things like the weather and land formations affect organisms?
        - How do nutrients cycle throughout the earth so that they don't go to waste?
- Abiotic Factors
    -
        - Temperature
        - Weather patterns
        - Presence of light
        - Soil composition
    - Abiotic factors can be both helpful and detrimental to an organism, even to the point where the presence of an abiotic factor determines whether or not a species survives.
        - Ex. What is the impact on bumblebees if a late frost occurs?
- Biotic Factors
    -
    - All organisms require at least one other organism
        - Food: Animals eat other organisms (plant or animal)
        - Shelter: Birds use the heights of trees to protect against ground predators
        - Reproduction: Flowers rely on insects to pollinate and reproduce
        - Protection: Remoras, tiny sucker-fish, live attached to larger marine animals for defense.
- Levels of Organization
    - Biology and ecology are described in different levels of organization.
    - These levels are based on what organisms are present and what interactions occur.
    - Levels of organization help scientists identify different interactions and what the consequences of these interactions are
    - Level #1:
        - Every individual is it's own level of organization
    - Level #2:
        -
        - Members of the same population work together for protection
        - Members also compete for food, mates, and places to live

- Level #3:
  -
  - The individual populations in the community may directly or indirectly interact with each other, but some interaction does occur.
  - The populations may compete with each other (sharks and dolphins), help each other (clownfish and anemones), or have no effect on each other.
- Level #4:
  -
  - Ecosystems can be both terrestrial and aquatic
  - 70% of the earth's surface are salt-water ecosystems
- Level #5:
  -
  - In general, there are 14 recognized terrestrial biomes, 12 freshwater biomes, and 5 marine biomes
    - Desert, temperate rainforest, tundra, upland river, etc.
- Level #6: The Biosphere
  -
  - Ranges from the bottom of the ocean to the top of the sky
  - Does not include below the surface of the earth, so it's not just another word for "the earth"
  -

- Habitats and Niches
  -
  - Habitats can change, move, or even disappear.
  - A habitat can be as big as a desert or as small as a tree stump
  - If a habitat is like an organism's address, a niche is like an organism's profession
  -
  -
  - Example of Niche's: The Horned Owl and Red Fox
    - Both owls and foxes live in low lying forests. Both eat small rodents off the forest floor. But the foxes feed at day and the owls feed at night, so they don't compete with each other.
- Symbiosis
  - Some organisms are so dependent on interacting with other species that they are in life-long coordination with those species. This is called symbiosis.

- Mutualism:
  - Butterflies and Flowers
- Commensalism:
  - Whales and barnacles
- Parasitism:
  - Ticks and Dogs

- Autotrophs
  - Autotrophs are also known as producers
  -
  -
    - Plants and some bacteria are able to absorb sunlight.
    - The sunlight is used by these organisms to produce food.
    - Of all the sun's energy that reaches the earth, less than 3% is used by living things
- Consumers
  - If you're not a producer, you're a consumer.
  -
  - There are five types of consumers
    - 1) Herbivores:
      - Cows, deer, caterpillars
    - 2) Carnivores:
      - Snakes, dogs, owls
    - 3) Omnivores:
      - Humans, bears, crows
    - 4) Scavengers:
      - Mites, earthworms, snails, crabs.
    - 5) Decomposers:
      - Bacteria, mushrooms
- Flow of Matter and Energy
  - Energy flows through an ecosystem in one direction
    -
    - Energy never goes from consumers to producers
  - Food Chains
    - Food chains typically show 3-4 organisms only
  - Food webs
    - Most ecosystems are represented by food webs
- Trophic Levels
  - Trophic Levels
    - 1^{st} level
    - 2^{nd}, 3^{rd}, 4^{th} levels

        - (By the time you get to a 5th level, there's almost never enough energy left.)
        -
    - The highest level is the top carnivore/omnivore of an ecosystem
  - A food chain typically takes you through all four trophic levels once.
- Ecological Pyramids
  - Ecological pyramids are diagrams that show the relative amounts of energy or matter contained within each level in a food chain or food web.
  - There are three ecological pyramids
  - Pyramid #1:
    - Energy pyramids show the amount of available energy (in any form) at each trophic level.
    -
  - Pyramid #2:
    -
    - A biomass pyramid represents the amount of potential food in a given area
  - Pyramid #3:
    - Shows the number of individuals feeding off of other individuals in a trophic level
    - Can be either a normal pyramid (1 shark feeding on thousands of fish) or an upside-down pyramid (thousands of termites feeding on one tree)
- Cycles of Matter
  - Recycling in the biosphere
    -
    - The sun provides energy, so the sun is a constant source. But we have a finite source of matter on Earth. Therefore, we need to recycle it
    - Matter can pass from organism to organism, from the earth to organisms, or from organisms to the earth.
- The Carbon Cycle
  - Carbon is the key ingredient to earth. It is found in all living organisms, as well as the air, rocks, water, etc.
  - There are four different kinds of processes involved in the carbon cycle
  - #1:
    - Photosynthesis, respiration, decomposition
  - #2:
    - Release of CO_2 by volcanoes, geysers
  - #3:
    - Conversion of organisms into coal and petroleum (fossil fuels) by the pressure of the earth over time
  - #4:
    - Mining, burning fossil fuels, deforestation

- The Nitrogen Cycle
    -
    - Nitrogen is essential for making amino acids (amine=nitrogen)
    - Nitrogen, in the form of nitrate (NO^-), is essential for plant growth.
    - Bacteria also use nitrogen in the soil by converting nitrogen into ammonia, NH_4
- The Phosphorus Cycle
    - Phosphorus is not common in our atmosphere, but is of great biological importance
        - Phosphorus does not enter the atmosphere. It is found in soil minerals, rocks and ocean sediments
        -