

## CH 3.4 Cycles of Matter-Biology

### **SC.912.L.17.10: Diagram and explain the biogeochemical cycles of an ecosystem, including water, carbon, and nitrogen cycle.**

Living organisms-made of C, H, O, & N

Cannot manufacture-so get from biosphere

Matter is recycled through within & between ecosystems (not 1 way like food web).

Biogeochemical cycle-matter cycles through life, earth, & through chemical reactions.

- Biological-eating, digestion, elimination of waste
- Geological-volcanic eruptions, rock cycle, movement of E. surface
- Chemical & Physical-clouds, precipitation, running water, lightening
- Human-mining, burning fossil fuels, land clearing, building, farming

**Matter is never created or destroyed. Just changes form (rearrange atoms).**

Ex. C atom → volcanic gas → blueberry leaf absorbs → photosynthesis forms carbohydrate → caribou eats fruit → eliminates waste → dung beetle eats waste (C) → shrew eats beetle → shrew body tissue is eaten by owl → owl exhales and releases CO<sub>2</sub> → C dissolved in rain → runoff into river → flow to ocean (continues as C Cycle).

#### **Water Cycle**

- Water moves continuously through biosphere, hydrosphere, atmosphere, and geosphere.
- Living organisms-sometimes inside or outside

Oceans evaporates → water vapor (gas) in air → wind transports over distance → air cools & vapor condenses → clouds form → droplets enlarge & precipitation occurs → water flows on land (runoff) → enters stream, river, or ocean → some absorbed by soil → enters aquifer (groundwater) → roots absorb water → plants use water for photosynthesis → plant leaves release water into air (transpiration) → cycle repeats.

#### **Nutrient Cycles**

Organisms need nutrients to build tissue and carry out life functions.

Oxygen-used in respiration by all aerobic organisms (animals, plants, fungus, protists, some bacteria).

- Carbon Cycle
- Nitrogen Cycle

#### **Carbon Cycle**

Major component of carbohydrates, protein, lipids, & nucleic acids

C-based life on earth.

CaCO<sub>3</sub> is found in animal bones & rocks.

CO<sub>2</sub> found dissolved in air and oceans.

Ancient forests that are buried and transformed into coal.

Marine organism bodies are transformed into oil and natural gas.

Fossil fuels are fossilized C.

C reservoirs are found in atmosphere, geosphere, hydrosphere, and biosphere.

C released in air by humans burning fossil fuels, burning forests, & volcanic eruptions.

Draw C Cycle-page 83.

### **Nitrogen Cycle**

N is required to make amino acids → proteins & nucleic acids (DNA/RNA).

78% N in atmosphere.

NH<sub>3</sub> (ammonia), NO<sub>3</sub> (nitrates), and NO<sub>2</sub> (nitrites) found in soil, wastes, and decaying bodies.

Dissolved N in oceans & water.

N-fixing bacteria convert atmospheric N to ammonia. N-fixing bacteria live in soil & roots of legumes (soybeans, peanuts, clover, etc). These plants are high in protein. Consumers use protein to make N compounds.

Decomposers release N from waste & dead organisms. Other bacteria obtain energy from converting NO<sub>3</sub> into N gas which goes back to atmosphere (denitrification). N is added through fertilizers which can be pollution if excessive in runoff.

Draw N Cycle-p.84

**Ecosystem productivity may be limited by the availability of nutrients.** The nutrient that limits the productivity is called limiting nutrient. This is why farmers use fertilizers (N-P-K and Ca, Mg, Fe, S, Mn).

Oceans are nutrient poor compared to land. Nitrogen is usually the limiting nutrient.

Freshwater-P is usually limiting nutrient.

Nutrients in runoff can cause algal blooms in water ecosystem. If there are not enough consumers, ecosystem may be disrupted when algae covers surface.

### **Effects of Fertilizer on Algae Lab**

**CH 3 Assessment: 1-5, 8-11, 12, 14-19, 20-24, 33-34**

