Law of Conservation of Mass & Energy & The Carbon Cycle

SC.8.L.18.4 Cite evidence that living systems follow the Laws of Conservation of Mass and Energy.

- **Essential Question:** How do living systems obey the Law of Conservation of Mass?
Bell Ringer

A diagram of the carbon cycle is shown to the right. Each arrow represents a process in the cycle.

Which of the following best describes the process that occurs at arrow X?

A. Bacteria break down molecules in animals into carbon-based soil nutrients.
B. Animals release oxygen that is used by bacteria to produce carbon dioxide.
C. Animals release carbon dioxide that is used by bacteria for growth and reproduction.
D. Bacteria combine carbon-based nutrients from plants and animals to produce glucose.
I Do Guided Notes

Conservation of Mass/Energy I Do:

- **The Law of Conservation of Matter:**
  - Matter is ______ created or destroyed, only ______ recycled.

- **The Law of Conservation of Energy:**
  - Energy is ______ created or destroyed, only ______ recycled.
  - Energy may ______ form but the total amount remains the same.

- **Photosynthesis**
  - Carbon Dioxide ($CO_2$) + Water $\rightarrow$ glucose + ______
  - Carbon Dioxide ($CO_2$) is taken out of the ______ by plants through photosynthesis.
  - Plants take in ______ and release ______.
  - Chlorophyll ______ sunlight for photosynthesis.

- **Cellular Respiration**
  - Oxygen + Carbon Dioxide $\rightarrow$ ______ + Energy
  - Both plants and animals release ______ into the air through cellular respiration (in the mitochondria).
  - For example: Humans and other animals breathe in ______ and breathe out ______.

- **The Carbon Cycle**
  - The carbon cycle is a complex series of processes through which all of the ______ atoms in the world ______.
  - Carbon can be found in carbon ______.
    - Atmosphere
    - Fossil Fuels & Rocks
    - Organisms
  - Photosynthesis and cellular respiration help move carbon through the ______ cycle.
  - ______ break down dead organisms.
  - Millions of year old plants, animals and waste ______ and turn into ______.
  - ______ can be burned by planes, automobiles, and power electricity plants releasing carbon back into the atmosphere.
  - ______ removes trees that ______ carbon dioxide from the atmosphere. Fewer trees means less carbon dioxide is being absorbed.
The Law of Conservation of Matter states that matter is not created or destroyed, only rearranged or recycled.
Law of Conservation of Energy

- The Law of Conservation of Energy states that energy is not created or destroyed, only rearranged or recycled.

- Energy may change form but the total amount remains the same.
Photosynthesis

- Carbon Dioxide (CO₂) is taken out of the air by plants through **photosynthesis**.
- Plants take in carbon dioxide (CO₂) and release oxygen (O₂).
- Chlorophyll absorbs sunlight for photosynthesis.
**Cellular Respiration**

- BOTH plants and animals release **carbon dioxide** (CO$_2$) into the air through cellular respiration (in mitochondria)
- For example: Humans and other animals breathe **in oxygen** and breathe **out carbon dioxide** (CO$_2$)
Think Pair Share
Photosynthesis & Cellular Respiration
Interrelatedness

- How are the two processes related?
- How do the processes demonstrate the law of conservation of matter / energy?
The Carbon Cycle

- The Carbon Cycle is a complex series of processes through which all of the carbon atoms in the world recycle.

- Carbon can be found in carbon reservoirs:
  - Atmosphere
  - Oceans/Water
  - Fossil Fuels & rocks
  - Sediments
  - Organisms

*All life on earth is based on carbon*
The Carbon Cycle

- Photosynthesis and Cellular respiration help move carbon through the **carbon** cycle.
Decomposers break down dead organisms.

Millions of years old plants, animals, and waste decompose and turn into fossil fuels.
Carbon Cycle: Human Impact

- **Fossil fuels** can be burned by planes, automobiles, and power electricity plants releasing carbon back into the atmosphere.
- **Deforestation** removes trees that absorb carbon dioxide from the atmosphere. Fewer trees means less carbon dioxide is being absorbed.
**Carbon dioxide**

1. **Atmosphere** Carbon dioxide gas is one form of carbon in the air.

2. **Photosynthesis** Autotrophs use carbon dioxide in photosynthesis. In photosynthesis, the sun’s energy is used to make high-energy carbon molecules.

3. **Wastes** Autotrophs and heterotrophs break down the high-energy carbon molecules for energy. Carbon dioxide is released as a waste.

4. **Organisms** use high-energy carbon molecules for growth. A large amount of the world’s carbon is contained in living things.

5. **Soil** When organisms die and decay, the carbon molecules in them enter the soil. Microorganisms break down the molecules, releasing carbon dioxide.

7. **Pollution** Combustion of fossil fuels and wood releases carbon dioxide.
We do

**Conservation of Mass/Energy We Do:**

1. How are processes of photosynthesis and cellular respiration related?

2. How do the processes of photosynthesis and cellular respiration obey the law of conservation of matter and energy?

3. How does the process of photosynthesis help move carbon through the carbon cycle?

4. How does the process of cellular respiration help move carbon through the carbon cycle?

5. Explain how the carbon cycle follows the law of conservation of matter and energy.

**Cellular Respiration:**

6. While working out, you notice that you are breathing heavily. Why would you need more oxygen after a workout?

7. How does the amount of energy released in cellular respiration compare to the amount of energy needed to make glucose in photosynthesis?

8. Where does the glucose necessary for cellular respiration to occur come from?

**EXIT Ticket (Closing):** How do living systems obey the Law of Conservation of Mass?
Bell Ringer Revisit

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