Close

Reteaching Key Ideas

Adding Energy Discuss with the class the conservation of mass and energy that occurs when a candle burns. Ask students: "Where does the energy come from and where does it go?" (Energy comes from the chemical changes that occur as the candle burns, and it is released into the surroundings as light and heat.) "How is mass conserved as the candle disappears?" (Mass is conserved but all of the products of the reaction cannot be seen because some of the products are gases.) LS Logical/Verbal

Formative Assessment

How are mass and energy affected by a physical and chemical change?

A. The amount of mass and energy remains constant in an open system. (Incorrect. Mass and energy will remain constant in a closed system, but some mass and energy may be lost in an open system.)

B. Mass and energy can be converted to other forms. (Correct. Mass and energy are neither created nor destroyed, but they can be converted to other forms.)

C. Some mass and energy are destroyed. (Incorrect. Mass and energy are never destroyed; instead, they are converted to other forms.)

D. Mass and energy are created. (Incorrect. Mass and energy cannot be created. They are converted from other forms.)

SCILINKS
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Topic: Conservation of Energy
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Figure 5 Energy is conserved when gasoline is burned to power a lawn mower.



Mass cannot be created or destroyed.

In chemical changes, as well as in physical changes, the total mass of the substances undergoing the change stays the same before and after the change. In other words, mass cannot be created or destroyed, which is the *law of conservation of mass*.

For instance, when you burn a match, it seems to lose mass. The ash has less mass than the match. But the oxygen that reacts with the match, the tiny smoke particles, and the gases formed in the reaction also have mass. The total mass of the reactants (the match and oxygen) is the same as the total mass of the products (the ash, smoke, and gases).

Energy cannot be created or destroyed.

Energy may be changed to another form during a physical or chemical change, but the total amount of energy present before and after the change is the same. In other words, energy cannot be created or destroyed, which is the *law of conservation of energy*.

Starting a lawn mower, as **Figure 5** shows, may seem to violate the law of conservation of energy, but that is not the case. It is true that for the small amount of energy needed to start the mower, a lot of energy results. But the mower needs gasoline to run. Gasoline has stored energy that is released when it is burned. When the stored energy is considered, the energy present before you start the lawn mower is equal to the energy that is produced.

Some of the energy from the gasoline is transferred to the surroundings as heat, which is why the lawn mower gets hot. The total amount of energy released by the gasoline is equal to the energy used to power the lawn mower plus the energy transferred to the surroundings as heat.

Section 2 Review

KEY IDEAS

1. **Describe** the following changes of state, and explain how particles behave in each state.
   - **a.** freezing
   - **b.** boiling
   - **c.** sublimation
   - **d.** melting
2. **State** whether energy is released or whether energy is required for the following changes of state to take place.
   - **a.** melting
   - **b.** evaporation
   - **c.** sublimation
   - **d.** condensation
3. **Describe** the role of energy when ice melts and when water vapor condenses to form liquid water.
4. **State** the law of conservation of mass and the law of conservation of energy, and explain how they apply to changes of state.

CRITICAL THINKING

5. **Drawing Conclusions** If you used dry ice in your holiday punch, would it become watery after an hour? Why or why not?

Answers to Section Review

1. **a.** During freezing (liquid to solid), particles slow down.
   b. During boiling (liquid to gas), particles speed up.
   c. During sublimation (solid to gas), particles speed up.
   d. During melting (solid to liquid), particles speed up.
2. **a.** Energy is required.
   b. Energy is required.
   c. Energy is required.
   d. Energy is released.
3. Sample answer: As energy is transferred to ice, the attraction between water molecules is broken and the ice melts. As water vapor releases energy, attraction between molecules increases, and liquid water condenses.
4. Mass cannot be created or destroyed. Energy cannot be created or destroyed. During a change of state, the total mass and total energy of the system remain constant.
5. Sample answer: No. Dry ice is solid carbon dioxide, which undergoes sublimation and turns directly from a solid into a gas.