Lesson Topic: Energy Transfer in Chemical Reactions

Objective:
Students will be able to:

1. Demonstrate understanding that chemical reactions can store energy or release energy.
2. Understand that heat lost or gained in a chemical reaction is an example of energy transfer.
3. Explain the difference between endothermic and exothermic reaction.
4. Identify examples of endothermic and exothermic reactions.

Time Required: 75 minutes

Materials Needed:

- Instant hot pack
- Instant cold pack
- Styrofoam cups (2 cups)
- Water
- Thermometer

Teacher Preparation:

- Assign a Legends of Learning Instructional Quick Play list for the day(s) you will be teaching the lesson.
    - Instructional – Middle School – Energy Transfer in Chemical Reactions
- Assign a Legends of Learning Content Review Quick Play list for the day(s) you will be teaching the lesson.
    - Content Review – Middle School - Energy Transfer in Chemical Reactions
- Makes copies of the Energy Transfer in Chemical Reactions worksheet (1 per student)

Engage (15 minutes):

1. Fill two cups with an equal amount of water. Allow the water to reach room temperature while introducing the demonstration.
2. Hold up the instant cold pack and heat pack for the class.
3. Ask the students if they have ever used either product for an injury.
4. Explain to the students that chemical reactions are responsible for producing the cooling and heating effect of the packs. Explain that a chemical reaction occurs when a salt compound contained in a separate bag inside the pack meets water inside.
5. Measure and record the temperature of the water for both cups. Record the initial temperature on a whiteboard or interactive whiteboard where it is visible to the class.
6. Activate the heat pack.
7. Place the heat pack into the cup.
8. Measure and record the temperature of the water. Record the final temperature where it is visible to the class.
9. Remove the bag from the cup. Pass the bag around the class to allow students to observe the heat transfer.
10. Explain to students that chemical energy changed to thermal (heat) energy during the

chemical reaction.

11. Explain to the students that the chemical reaction has released heat, which is why the temperature of the water increased, and the bag felt warm.
12. Write the term exothermic on the board.
13. Guide students in defining the term exothermic.
    a. What is the meaning of the prefix exo-? (outside, think “exit”)
    b. What do you think is happening in this reaction? (heat is produced)
    c. Write the definition of an exothermic reaction on the board. (a chemical reaction where heat energy is released)
14. Repeat the demonstration using the instant cold pack.
15. Explain to students that the instant cold pack uses different compounds.
    a. What do you think will happen to the temperature in the cup? (it will decrease)
    b. Why is the bag cold instead of hot? (heat is absorbed)
16. Guide students in defining the term endothermic.
    a. What do you think the prefix endo- means? (inside)
    b. What is absorbed in this reaction? (heat)
    c. What happens to temperature when heat is absorbed in a chemical reaction? (it decreases)
    d. Write the definition of an endothermic reaction on the board. (a chemical reaction where heat energy is absorbed)
17. Remind students that they have witnessed energy transfer in two chemical reactions, and they will learn other examples of exothermic and endothermic examples during the lesson.

Explore (25 minutes):

1. Have your students sign into Legends of Learning. Instruct students to complete the Instructional playlist.
2. As students complete the assigned games, students will complete the Energy Transfer in Chemical Reactions worksheet.
3. Circulate as students work through the playlist and complete the worksheet. Listen for evidence of understanding and use this opportunity to correct any misconceptions.

Explain (20 minutes):

1. Review the answers to Energy Transfer in Chemical Reactions worksheet by writing the paragraph on the board, leaving the answers blank, and drawing a labeled two-column chart on the board like the chart on the worksheet.
2. Have a student volunteer to read the paragraph with the completed answers.
    a. Fill in the correct answers on the sample paragraph on the board. Provide time to ensure that all students have the correct answers on their worksheet.
3. Ask for student volunteers to place the examples of exothermic and endothermic reactions in the correct columns.
    a. Correct any misconceptions concerning the examples.
4. Relate student knowledge to the demonstration at the beginning of the class.
    a. What is an example of energy transfer in a chemical reaction? (heat transfer)
    b. What evidence was shown that an energy transfer occurred? (measured and observed temperature change)
    c. Where does energy transformation happen in a chemical reaction? (where

chemical bonds break and reform)
   d. What is the difference between an exothermic reaction and endothermic reaction? (exothermic reactions release heat energy, endothermic reactions absorb heat)
   e. Why does the instant heat pack eventually cool? Where did the heat go? (heat energy is lost to the surrounding air)

Elaborate (5 minutes):

1. Explain to students that there are many examples of endothermic and exothermic reactions in everyday life.
2. Remind students that chemical reactions transfer energy, heat and light are examples.
3. Show this video of glow sticks being activated.
   a. The sticks do not glow until they are broken. What do you think is happening to make the sticks glow? (chemical reaction)
   b. Heat is absorbed during the chemical reaction. What kind of chemical reaction is occurring? (endothermic)
   c. What kind of energy is being transferred in this reaction? (light)

Evaluate (10 minutes):

1. Have your students sign into Legends of Learning. Instruct students to complete the Content Review playlist.
2. Analyze student results to access topics that may require reteaching.

Additional Lesson Strategies:

- To use Legends for additional instruction, create a custom playlist with an instructional game and pre and post assessment.
- To use Legends for a quick formative assessment, create a 5-question assessment in a playlist.
- To use Legends for a student-directed experience, create a targeted freeplay playlist.
- Encourage students to play on their own at home in Legends of Learning: Awakening for a student-driven experience including avatars, battling, and quests all centered around topics they are covering in class.

Energy Transfer in Chemical Reactions

Name:____*Key*_____

While playing the Instructional games in Legends of Learning, complete the paragraph about energy transfer in chemical reactions, then sort the examples below into the correct box based on whether the reaction is exothermic or endothermic.

Part 1: Complete the paragraph using the word bank.

Chemical reactions always involve __*energy*_____. Sometimes energy is transferred as __*heat*_____ in a chemical reaction. An example of this type of energy transfer occurs when an instant heat pack is activated. When a chemical reaction absorbs heat, it is an __*endothermic*_____ reaction. When a chemical reaction release heat, it is an ___*exothermic*_____reaction.

Word Bank

Exothermic	Endothermic	Energy	Heat

Part 2: Sort the chemical reactions below by writing them in the correct box based on if the example is endothermic or exothermic.

Endothermic

Glow sticks

Photosynthesis

Cooking an egg

Baking bread

Vinegar reacts with baking soda

Exothermic

Burning match

Fireworks

Cellular respiration

Photosynthesis Baking Bread Burning Match Cooking an egg

Cellular respiration Fireworks Glow Sticks Vinegar reacts with baking soda

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Word Bank

Endothermic	Energy	Exothermic	Heat

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Endothermic	Exothermic

Photosynthesis Baking Bread Burning Match Cooking an egg

Cellular respiration Fireworks Glow Sticks Vinegar reacts with baking soda