

| Lesson 3-1: Energy Changes | |
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| Curriculum Expectations | <ul style="list-style-type: none"> • D2.1 • D3.1 • D3.2 |
| Learning Goals | <p>By the end of this lesson you will:</p> <ul style="list-style-type: none"> ○ Understand the difference between potential and kinetic energy ○ Be able to differentiate between the system and surroundings in a chemical process ○ Be able to define enthalpy and how it relates to heat absorbed or released during a chemical process ○ Understand the difference between endothermic and exothermic processes |
| Success Criteria | I know I have achieved the learning goals when I can explain the difference between chemical and potential energy, define enthalpy and identify chemical processes based on whether they absorb energy from or release energy into their surroundings. |
| Teacher Prep | <ul style="list-style-type: none"> • Prepare slides from Introduction to Exo & Endothermic Reactions Group activity • Print out questionnaires for Where Does the Energy... group activity. • |

Minds On

Goal: The goal of this activity is to introduce terminology and concepts related to energy and energy transformations in chemical reactions.

1. Introduction to Exo & Endothermic Reactions Group Activity

Instructions:

1. Put students into groups of 2-4.
2. Have each group designate a "recorder" who will write down all the answers for the group.
3. Display the first slide in the presentation to the class with the prompt.
4. Give the students 5 minutes to record as many words as they can think of with the prefix "ex" or "en"
5. Next have the groups read out their words, the group with the most words gets a point.
6. As a class, discuss the words that begin with the prefix "Ex-". Ask students to find the similarities in the meaning of these words.
7. Come up with a class definition of what the prefix "ex" means.
8. Repeat steps 5-7 with the prefix "En-"
9. Display slide #2
10. Have each group discuss the slides. You may prompt them by asking "what do the arrows represent?"
11. Each group must come to a consensus on the answer to the questions on the slide and decide on a justification for their answers.
12. Each group will present their answers and justifications, leading to a class discussion.
13. Display slide 3 and discuss the differences between 'endo' and exo thermic reactions in the context of the previous discussion of the En- and Ex- prefixes.
14. Display slide 4 and have groups discuss their answers to the questions for 5-10 minutes.
15. Each group presents their answers.

Action

****Refer to the Differentiation Resources link for additional practice worksheets, and to enrich your classroom teaching using different tools throughout the lesson. ****

1. 3-1A: Energy & Enthalpy

- This activity can be done individually by students or as a class with the presentation displayed.
- Encourage students to ask questions as they progress through the activity or to record questions as they take notes.
- Students should take notes as they navigate through the activity, recording relevant information.
- Take up answers to embedded questions as a class.

2. 3-1B: Change in Enthalpy: Reactions & Changes of State

- This activity can be done individually by students or as a class with the presentation displayed.
- Students should take notes as you progress through the activity, recording relevant information and formulas.
- If this activity is completed as a class activity, invite students up to answer the embedded questions, attempting to let all students participate in the learning.
- ensure students are comfortable distinguishing between endo and exo thermic.
- Encourage students to ask questions as they progress through the activity or to record questions as they take notes.
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3. 3-1: Where does the energy released in combustion come from.

- This activity is meant to begin as a class (or small group) discussion about the nature of energy and then progresses to an individual and group activity where students can explore their own knowledge and understanding of energy. Through this discussion you will uncover ideas relating to the transfer of energy, stored energy and may extend the discussion to introduce the Law of conservation of energy.
1. Begin the activity by brainstorming with the whole class or by breaking students up into groups and asking the leading question ***'Where does energy come from?'***
 2. To help lead the discussion you can re-frame the question to ask students to also provide examples of energy sources.
 3. As the teacher write the responses out for the class to observe or have the groups record their responses using a brainstorming format.

4. After the brainstorming session describe the combustion of methane or show a video of this process.
5. Next handout the questionnaire below and have students answer the questions individually.
6. After they have completed the questionnaire individually have students group together and discuss each of the options on the questionnaire until they come to a consensus as to whether they agree or disagree with each statement.
7. Review the responses as a class.
8. Ask groups to write the chemical equation for the reaction between methane and oxygen.
9. Use molecular models (or ball and stick drawings or online models) to demonstrate that energy needs to be supplied to break bonds – pull the model molecules apart.
10. Reform the models into carbon dioxide and water; show that the reverse process, energy release, occurs when new chemical bonds are formed. This reforming of bonds is what causes the energy to be released in the combustion of methane.

Consolidation

1. 3-1D: Energy & Enthalpy Quiz

- To be completed individually, in class or at home. Take up the answers together the following day. Address any misconceptions or questions by reviewing material from the lesson.

2. Exit Card

- Print out the following on an exit card and hand to students as they leave to be brought in the following class and discussed.

Exit Card Question:

“Research and identify a common everyday reaction that is either endo- or exothermic. Describe the reaction equation, the applications of this reaction and the evidence that it is exo- or endo-thermic.

****Refer to Differentiation Resources for additional practice worksheets, and to enrich your classroom teaching using different tools. ****