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| **Fellow Name:** Logan Buck | **Contact Info:** (859) 866-8161 | **Date:** 12/14/15 |
| **Teacher Name:** Ashley Gregory | **School Name:** Gray M.S. | **Grade and Class:** 7th / Science |

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| **Activity Title:** | **Applying Endothermic and Exothermic Reactions** |
| **Estimated Activity Duration:** | **45 minutes** |

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| **Setting:** | **Classroom** |

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| **Activity Objectives:** |

The student will be able to:

1. Define what endothermic and exothermic reactions are
2. Identify endothermic and exothermic reactions
3. Identify chemical vs. physical change
4. Recognize the effect of concentration on the transfer of energy

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| **Activity Guiding Questions:** |

1. What is an endothermic reaction? What is an exothermic reaction?
2. What are the characteristics of an endothermic reaction? What are the characteristics of an exothermic reaction?
3. What are some examples of chemical change? What are some examples of physical change?
4. What is the effect of concentration on the transfer of energy?
5. Are there other ways to improve the transfer of energy?

| **Next Generation Science Standards (NGSS)**  |
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| **Science and Engineering Practices (Check all that apply)**  | **Crosscutting Concepts (Check all that apply)** |
|   Asking questions (for science) and defining problems (for engineering) | ☐ Patterns |
|   Developing and using models |   Cause and effect |
|   Planning and carrying out investigations |   Scale, proportion, and quantity |
| ☐ Analyzing and interpreting data | ☐ Systems and system models |
| ☐ Using mathematics and computational thinking |   Energy and matter: Flows, cycles, and conservation |
|   Constructing explanations (for science) and designing solutions (for engineering) | ☐ Structure and function.  |
|   Engaging in argument from evidence |   Stability and change.  |
|   Obtaining, evaluating, and communicating information  |  |

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| **Unit Academic Standards (NGSS, ONLS and/or CCSS):** |

**07-PS1-2.** Analyze and interpret data on the properties of substances before and after the substances interact to determine if a chemical reaction has occurred.

**07-PS1-6.** Undertake a design project to construct test and modify a device that either releases or absorbs thermal energy by chemical processes.

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| **Materials**: (Link Handouts, Power Points, Resources, Websites, Supplies) |

Activity Assessment

Power Point on Exo- and Endothermic reactions

Activity Procedure

Data Table

Plastic sauce cups with lids

100 mL Squeeze bottles

Calcium Chloride

Citric Acid

Baking Soda + Distilled Water Solution

Plastic Bags

Thermometer

Medicine-Measuring Cup

Teaspoons

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| **Teacher Advance Preparation:** |

Print out Pre- and Post-Assessments

Print out Lab Sheets

Load PowerPoint for short explanation of endothermic and exothermic reactions

Determine how to split class into 8 groups (table groups)

Fill 8 cups with 10 tsps of Citric Acid (extra set aside)

Fill 8 cups with 10 tsps of Calcium Chloride (extra set aside)

Fill 8 100 mL squeeze bottles with Sodium Bicarbonate Solution (extra set aside)

Provide each group with 2 mini-measuring cups

Provide each group with 5 Ziploc bags

Provide each group with 2 teaspoons

Ensure thermometers are all working properly (2 for each group if available)

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| **Activity Procedures:** |

Bell Ringer (on the projector): ‘Take the Pre-Assessment, found in the boxes on your desks.’

 5 minutes

 Collect Assessments

Go through the presentation and briefly explain the procedure and safety rules (procedure, data tables and safety glasses in boxes).

 5 to 10 minutes

Split students into ‘turn-around’ table groups

Begin activity (lab material found in boxes on desks)

 30 minutes

Clean up and restock

 3 to 5 minutes

**Formative Assessments:** Link the items in the Activities that will be used as formative assessments.

Data Table

**Summative Assessments:** Prepare a Pre-Test and Post-Test with the input of the RET Teacher. This should be a simple 10-12-question assessment tool. These questions will cover the content related to the Standards. The Pre and Post Test will be identical. There may be several summative assessments at the end of this Activity. Besides the Pre and Post Tests, the students might create a product for which this is a rubric developed. The rubric is also a summative assessment tool. Link the assessment tools.

Pre-Test & Post-Test

 - Each has 8 questions due to the time constraint I was under

 - Results shown below

Pre-Test Frequently missed questions:

 - Over 90% flipped the temperature change of endothermic and exothermic reactions

Post Test Frequently missed questions:

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| --- | --- | --- | --- | --- | --- |
| Question | Correct | Uncommon Choice\* | Common Choice\*\* | Total | % Common Choice |
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| #2 | 43 | 12 | 77 | 132 | 58% |
| #5 | 20 | 12 | 100 | 132 | 76% |
| #7 | 39 | 12 | 81 | 132 | 61% |

\*Incorrect random responses

\*\*Incorrect common responses (most people that didn’t get the correct answer chose this response)

Graphical Analysis

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| Class | 1 | 2 | 5 | 6 | 7 | Overall |
| Pre-Test | 52% | 42% | 54% | 49% | 41% | 47% |
| Post-Test | 64% | 65% | 67% | 70% | 59% | 65% |
| Percent Change | 19% | 35% | 19% | 30% | 30% | 27% |

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| **Differentiation:** Describe how you modified parts of the Lesson to support the needs of different learners. Refer to Activity Template for details. |

‘Ashley helped me to adapt the instructions throughout the day as we learned different steps that the students were misinterpreting. We added a picture, re-worded a few of the steps, and I demonstrated some parts to the whole class. This made a huge difference in the outcome of the activity. By removing the difficulties in the instructions students were able to focus more on the concepts behind the lesson.’

‘The first period quickly revealed the confusing sections of the instructions. All of the classes were engaged with the intro presentation, however, the activity needed some refining and modifying throughout the day. The students split into groups, read through the instructions and followed them well in most aspects. The first bit of confusion came in combining the chemicals. Many students wanted to mix their solid with the sodium bicarbonate solution immediately instead of placing them inside the Ziploc separately, closing the bag, and then combining them. I was able to put a picture in the instructions that provided some clarity and I also demonstrated this technique to the students before they reached this stage. This resolved the confusion completely. The students also wanted to place the thermometer inside the bag instead of placing the bag on top of the thermometer. This was remedied with a simple ‘NOTE’ near the temperature-measuring step. Everything else ran smoothly. The students made good observations on the chemical reactions, the heat released/absorbed, the color, the bubbles, etc.’

This response from my Reflection Essay gives examples of the ways in which I had to modify the Lesson as a whole for the class. As far as modifications done to help individual students, Ashley, Debbie, and I all helped different groups throughout the day. Some students needed demonstrations of multiple steps from the procedure. While others struggled to read the directions, but understood perfectly when told what to do verbally. A lot of the individual modifications occurred while walking around the class throughout the activity and giving guidance to students.

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| **Reflection:** Reflect upon the successes and shortcomings of the Activity. This is done after the Activity is implemented. |

The students enjoyed the activity overall and were extremely enthusiastic during the class. Below is an explanation of my Pre/Post-Test results shown above – the successes and shortcomings within them.

‘The students averaged about a 47% on the Pre-Test as compared to a 65% on the Post-Test. This is a 27% increase in grade. It is clear that some learning took place, however, I believe that the wording/structure of a few of my questions added some unnecessary difficulty. The questions missed in the Pre-Test were fairly varied except for an overall switching of the two questions about the actual temperature change felt from endothermic and exothermic reactions. The Post-Test was pretty consistent. Out of 132 students only 4 mixed up the temperature change questions that they struggled with in the Pre-Test. The rest of the students missed all or a combination of 3 specific questions - #2, #5, #7. Each of these 3 questions had an option (D) of ‘Both (letter) & (letter).’ The answers for #2 & #7 were both (D), but approximately 60% of the students chose the first right answer they came upon without considering there might be two right answers. For #5 it was apparent that I did not teach the concept well enough. Only 15% of the class got it right, while another 75% put down (B). The question read, ‘Boiling water is considered\_\_\_.’ The correct answer was ‘(C) an endothermic process,’ however; most students chose ‘(B) an exothermic process.’ I assume this is because they saw it as a ‘hot’ process that was releasing heat, though in reality water must absorb heat to boil and is therefore an endothermic process. I did say this in my introductory presentation, but I did not teach the concept well. Endothermic and Exothermic processes are about whether the system absorbs or releases heat, not solely based on apparent temperature.’

I also addressed some instructional shortcomings in the ‘Differentiation’ section above. One other shortcoming of my activity was the time constraint. I had to lead my activity before the chemistry unit was over and the day before I got knee surgery. I would have loved to have a second day to go through the whole EDP.

In conclusion I received a lot of encouraging feedback from the students, the principle, my teacher, and my COFSP mentor on the presentation and implementation of the activity.