How Does Oxidation Occur?

Unit	Utah SEEd Standard / NGSS Performance Expectation	Estimated Lesson Time:
Strand 8.1: Chemistry	Standard 8.1.3: **Plan and conduct an investigation** and then **analyze and interpret** the **data** to identify patterns in changes in a substance's properties to determine whether a chemical reaction has occurred.	90-100 minutes

Access to all material for this lesson: https://byu.box.com/s/08nzf4rhly873bbl8cta8jeujlb127gl

LESSON OVERVIEW

Learning Objective(s)

Using the provided fruit, conduct an investigation to show if a chemical reaction has occurred.

Anchor Phenomenon

Oxidation & Red Rocks - 2019 Rockfall in Zion National Park, Video and Before and After Pictures (See teacher slides)

Driving Question(s)

- What are some of the physical and chemical properties that you can see in this series of photographs?
- Did a chemical reaction occur? How do you know?
- What predictable patterns occur during a chemical reaction?
- What event caused this particular chemical reaction to take place? (Asked for both the rocks and the apples)
- What three molecules were the reactants? What molecule is the product? Do you see anything in common about the molecules in the reactants and the products?

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Lesson Level Performance Expectations

- Use of planning and conducting experiments to show that patterns can be used to explain that two substances combine to make a new substance through a chemical reaction.
- Patterns show data in that two substances combine to make a new substance through a chemical reaction using planning and conducting experiments.
- What patterns in the data from the experiment that you plan and conduct would you expect to see that show two substances combined to make a new substance through a chemical reaction?

LESSON SNAPSHOT

LESSON SUMMARY:

	Section Overview	**How are students answering the driving question or meeting the learning objectives?**
Experience the Phenomenon	Students will see two pictures of Zion National Park before and after a landslide, observe a video of the event, and then participate in a discussion about finding patterns in chemical changes. Students will then read about what happens to cause rocks to oxidize and gain the red color. Introduce students to what a chemical change is and how they can recognize if a chemical change has happened. Students will then view a picture of a rusted chain and answer questions about the patterns they see and whether they think chemical equations exist.	**Guiding Question:** What pattern do you see in each rock fall? Students will be able to identify the physical properties of differing colors in the rockfalls. **Guiding Question:** Did a chemical reaction occur? How do you know? Students will compare a picture of a chain before and after and decide whether it shows a chemical change.
Investigate the Phenomenon	Students will read a passage about what happens to an apple when it is cut and how it oxidizes.	**Guiding Questions:** What event caused this particular chemical reaction to take place? Students will read a passage about the process of oxidation in apples, which will guide them on what caused this chemical reaction.

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Model the Phenomenon	Students will then choose a fruit to test. They will place the fruit in three different liquids to see if it will oxidize. Students will then design an investigation about how to test the fruit with the liquids. The students will gather data about what they see in the investigation and generate a conclusion about the results. Students will then compare their results to those of another group. They will then evaluate what they saw in both experiments.	Students will be given the choice of: ● Different fruits: pears, apples (maybe different kinds of apples), avocados ● Different liquids: water (required as control), lemon juice, lemon-lime soda, saltwater, crushed vitamin C tablets mixed with water, crushed multivitamins mixed with water, white vinegar **DCI: Matter and Its Interactions** Students will identify how substances combine and react to create a new substance and use the properties of a chemical change to identify if one has occurred. **SEP: Planning and Carrying Out Investigations** Students will be given a choice of different fruits to test to see if they will oxidize when exposed to three different liquids. The student will design an investigation, gather data, make a conclusion, and evaluate their results compared to another group. **CCC: Patterns** Students will look for patterns of darkness and lightness to determine if the fruit has oxidized.

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Disciplinary Core Ideas	Science & Engineering Practices	Crosscutting Concepts
NGSS Appendix E PS1.B Reacting substances rearrange to form different molecules, but the number of atoms is conserved.	NGSS Appendix F Practice 3: Planning and Carrying out Investigations: Plan an investigation individually and collaboratively, and in the design: identify independent and dependent variables and controls, what tools are needed to do the gathering, how measurements will be recorded, and how many data are needed to support a claim.	NGSS Appendix G 1. Patterns. Observed patterns of forms and events guide organization and classification, and they prompt questions about relationships and the factors that influence them.
Related knowledge and skills from prior grades		
Disciplinary Core Idea: NGSS Appendix E PS1.B Grades 3-5: Chemical reactions that occur when substances are mixed can be identified by the emergence of substances with different properties; the total mass remains the same.	Science and Engineering Practices NGSS Appendix F Practice 3 Grades 3-5: Plan and conduct an investigation collaboratively to produce data to serve as the basis for evidence, using fair tests in which variables are controlled and the numb	Crosscutting Concept: NGSS Appendix G 1. Patterns: In grades 3-5, students identify similarities and differences in order to sort and classify natural objects and designed products. They identify patterns related to time, including simple rates of change and cycles, and to use these patterns to make predictions.

Materials

Student Materials	Teacher Materials	Lab Materials/Other Resources
Chromebook/Tablet Pencil or Pen Student Worksheet Red Rocks Article Fruit Oxidation Color Chart Patterns of Chemical and Physical Change Card Sort	Teacher Slides Post-It Notes Stick and Ball Models or Paper Circles Card Sort Key	**Possible Fruits** • Apples (Red Delicious) • Asian Pears • Avocados **Testing Liquids** • Water (Control) • Lemon Juice (Variable) • Orange Juice (Variable) • White Vinegar (Variable) • Saltwater (Variable) • Lemon-lime Soda (Variable) • Vitamin C Tablet (Crushed) w/ Water (Variable) • Nutrient Tablet (Crushed) w/ Water (Variable) **Other Materials** • Plastic bags • Aluminum foil • Paper bags • 3 Beakers (Per Group) • Paper Towels • Tongs • Knife

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Lesson Preparation

Material Preparation:
Cut fruit into pieces, copy the lab sheet, make color copies of the fruit oxidation chart, and laminate for each lab station. Set out testing materials at lab stations, including beakers, paper towels, tongs, fruit pieces, and liquids.

Required Previous Knowledge:
Students should be able to know the difference between physical and chemical properties from Utah Standard 8.1.2

Vocabulary Definitions:
Oxidation, Chemical Change, Physical Change, Reactant, Products, Independent Variable, Dependent Variable, Control, Hypothesis
Variable poster (to help students with terms)

Experience the Phenomenon/Problem

What Students Are Doing	Teacher Tips
Students will view a picture and video of a recent rockslide at Zion National Park and notice the before-and-after landfall. They will also observe a video of the event.	
What Teachers Are Doing	**Teacher Tips**
Show the before and after pictures of the rockfall in Zion National Park. Watch the video of the rockfall and then look at the other rockfall pictures. **Phenomenon Questions**: What pattern do you see in each of these rockfalls? What is the difference between the before and after shots each time?	Teacher Slides Slides 1-4

Investigate the Phenomenon

What Students Are Doing	Teacher Tips
Students will group read within their lab groups to read the two paragraphs from the USGS website. They will review the definition of a chemical change to determine if the different colors of the rocks on the rockfall are because of a chemical change through a class discussion. Students and teachers will review examples of physical and chemical changes and signs of a chemical change through a teacher-led discussion. Students will look for a discernible pattern in the chemical equation describing the iron oxidation process.	Red Rocks article
What Teachers Are Doing	**Teacher Tips**

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Read the Red Rocks article from the United States Geological Survey Website (on slide 13.) Highlight the pattern of the rocks being red because oxygen and iron combine. Discuss how when physical properties change, it can sometimes be evidence indicating chemical changes. **Teacher discussion and questions:** - Define "chemical change" and signs of chemical change. - Briefly mention that the reactants and the products are balanced. - Did a chemical reaction occur? How do you know? - What three molecules were the reactants? What molecule is the product? Do you see anything in common about the molecules, reactants, and products? - Did you notice the pattern in the chemical equation? When exposed to oxygen and water, iron forms a NEW substance with all the same molecules.	Slides 5-13

MODEL THE PHENOMENON THROUGH THE EXPERIMENT	
What Students Are Doing	**Teacher Tips**
- Students will read two paragraphs about Apple oxidation and then plan an investigation for fruit oxidation using the provided lab sheet. Students can choose between apples, pears, and avocados for their fruit. They can choose between various materials to stop their fruit's oxidation. - Students will determine the independent, dependent, and control variables, data collection method, and amount of data needed as they complete the lab sheet. - Students will slice their fruit and choose tools to prevent it from oxidizing. They will place their pieces of fruit on a paper towel and wait until the next day for results. **DAY TWO** - Students will compare their oxidized fruit with the Fruit Oxidation Color Chart to gather data. They will complete a bar graph to convey their results from the experiment. - What do you predict will happen to the oxidation of your fruit in the future, based on the patterns we have seen with the rockfall? - Through teacher discussion, students will look for a pattern in their results and determine whether the combination of substances caused the chemical change. They will slice their fruit to see that the inside of the piece of fruit is still "unoxidized." - Does the pattern in your data support the conclusion that oxidation is related to oxygen and iron coming into contact with each other? Why or why not?	Slides 14-24

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- Students will finish with a post-lab by creating a model of products and reactants in some chemical reactions. Students will use stick and ball models or paper circles to create several models of products and then develop models of several reactants to see that the mass was conserved in the reaction. Students will work with partners to create a model of the apple reacting with the air or the iron in the rock reacting with air. - Students will then answer the questions on their lab sheets.	
What Teachers Are Doing	**Teacher Tips**
Students will read an ELL passage about Apple oxidation. They will highlight how the inside of the apple oxidized. **Plan their lab with guiding questions:** - What is the definition of an independent variable? What is your independent variable? - What is the definition of a dependent variable? What is your dependent variable? - What is the definition of a control? What is your control? - What tools do you think you will use to gather data? - How will you record your observations? - How will your investigation generate relevant evidence to answer your guiding question? **DAY TWO:** Graph the apple colors based on the Fruit Oxidation Color Chart. Discuss Chemical Reactions. **AFTER THE LAB questions:** - What predictable patterns do you see that occur during a chemical reaction? - If we did not check all the boxes for chemical reactions, how would we know that the apple follows the pattern? How do we know it is a NEW substance? - How do we know that combining two substances' patterns (exposure to oxygen) caused the chemical change? - Remember the rockfall? What do you think the inside of the apple will look like if we cut a slice off of it? - What event caused this particular chemical reaction to take place? (Ask for both the rocks and the apples) **Kinetic Activity:** Students will finish with a post-lab by creating a model of products and reactants in some chemical reactions. They will use stick-and-ball models or paper circles to develop several models of products and then create models of several reactants to see that the mass is conserved in the reaction. The students will pick a partner and then select one of the chemical equations on **Slide 19** to create their model. **Post Lab Questions:** 1. What do the apples, the sandstone, and the chain all have in common?	

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2. Which evidence of chemical change did we see in each of these instances? A. Change in Color B. Change in Odor C. Produces Gas 3. Why is the skin of the apple important? A. It keeps the air inside the apple B. It protects the inside of the apple from the air C. It holds all of the apple's iron 4. When you compare your group's data with the results from another group that used a different fruit or liquid, how does it compare to your group's patterns? List at least three similarities or differences between the data sets. 5. What observations could you ask next to help explain the pattern in the data?	

POSSIBLE EXTENSIONS/ALTERNATIVE ADAPTATIONS

Chemical and Physical Changes Card Sort
Card Sort Key
Variable poster – to help students with vocabulary terms

This lesson was created by Kris Erickson, Maggie Grindstaff, Luis Hernandez, and Karen Pineda.

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