Bowwow Barker Training 012: Helpful Heat

Developed by Allie Ososkie, Director of Detective Training

Biblical Integration

“So we fix our eyes not on what is seen, but on what is unseen, since what is seen is temporary, but what is unseen is eternal.” 2 Corinthians 4:18

Objective

Using the superhero strengths of inquiry and creativity, discover the invisible effects of heat within a chemical reaction of basic acids and carbon compounds.

Vocabulary

- **Chemistry**: the branch of science that studies the properties of matter and how it interacts with energy, such as heat
- **Acids**: a chemical substance that reacts with other materials. In foods, acids usually taste sour or bitter.
- **Oxidation**: a chemical reaction that occurs when a substance comes into contact with oxygen or another oxidizing substance.
- **Heat energy**: also called thermal energy, the energy an object has because of the movement in its molecules. Heat can be transferred from one object to another.

Materials

- Half of a fresh lemon
- Small bowl (glass works best)
- Spoon
- 2-3 Q-tips or small paint brushes
- White computer paper
- Iron or high-heat blow dryer
- Pencil
- Data sheet

Lesson: Helpful Heat

When faced with an obstacle or puzzle, a superhero must look for hidden clues. They use the tool of *inquiry*, or asking questions. Superheroes must also use creativity to solve problems.

Scientists also use the tools of inquiry and creativity. They often combine everyday materials to create new solutions to existing problems.

(It's important to note that both scientists and superheroes are experts in their fields, so use caution when *you* combine materials in your experiments! Make sure to always ask an adult before carrying out an experiment.)

In today's activity, you will learn about oxidation. **Oxidation** is a chemical reaction that occurs when a substance comes into contact with oxygen or another oxidizing substance.

For example: Have you ever left an apple slice on the counter for about 10 minutes? What happens to it?

It turns brown! That's because the **acid** within the apple has come into contact with the air (oxygen). A chemical reaction takes place which starts to turn the apple brown.

The reaction that takes place within oxidation is unseen, but its results can be seen. As Christians, we are asked to place our faith in God, whom we cannot see.

However, when we choose to place our trust in Him, we can see the evidence of His existence through the way we love others, show patience in the face of trials, or exercise self control in the face of temptation.

2 Corinthians 4:18 states, "So we fix our eyes not on what is seen, but on what is unseen, since what is seen is temporary, but what is unseen is eternal."

When we fix our eyes on God and surrender our hearts to Him, a sort of reaction takes place within us: we become more like Him. As we seek to draw others to God, the reaction of sanctification continues on in our hearts and spreads to those around us.

Today, you will use simple household materials along with the skills of inquiry and creativity to witness the effect of heat within the chemical reaction of oxidation.

Challenge Parameters:

Note to parents: Adult participation is required for this activity. Please do not let young children use the iron or blow dryer.

Bonus Activity: This activity can be repeated with other liquids such as milk, grape juice, or apple juice.

Procedure

#1. Answer questions 1 on the data sheet.

#2. Using half of the lemon and the small glass container, squirt the juice from the lemon into the container.

#3. Dip a Q-tip into the lemon juice and write a message (or draw a picture) on the white computer paper.

#4. Let the paper dry for a few minutes. Answer 3-4 on the data sheet. If using an iron, plug it in and turn it to the medium setting.

#4. Answer question 5 on the data sheet.

#5. Have an adult use the iron or the hair dryer (use its highest heat setting). Hold the hair dryer close to the paper. Or, run the iron quickly over the surface of the paper. Answer question 7.

#6. Read the Bible verse out loud together. Answer question 8 on the data sheet

Data Sheet

1) **Prediction:** Predict how you will be using the materials in this activity. Be creative!

2) Is the lemon juice drying clear or colored on the paper?

3) Is the iron or hair dryer adding heat or cold to the situation?

4) **Hypothesis:** How do you think heat will affect the paper?

5) What happened when the paper was heated?

6) Was your hypothesis from question 4 correct? Why or why not? Remember that even if you were wrong, you are still learning. Often we learn best when we are wrong!

7) Thinking about the Bible verse, what does it mean to “fix our eyes on what is not seen”?

Conclusion

When the paper was heated, a chemical reaction called oxidation occurred as **thermal energy** was transferred from the heating element to the paper.
Writing on the paper with lemon juice caused the carbon compounds in the lemon juice to absorb into the fibers of the paper. Heating the paper caused the chemical bonds to break down, releasing the carbon. The carbon then came into contact with the air and oxidation occurred.

One outcome of oxidation is a substance turning brown, so the once-invisible lemon juice is now visible, revealing a secret message. Though the process was invisible, it produced visible results.

Just as our secret message was made visible, how can we as Christians show visible results of our invisible relationship with God?

How can we be superheroes to the people around us and share God’s love with everyone we meet?

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