

Bay Area Scientists in Schools Lesson Plan

Lesson Name: Reaction Reasoning

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For Grade 3rd

Related CA Science Standards and Vocabulary

Specific standards and new vocabulary related to lesson

CA Science Standard(s): Combining substances can create new substances with different properties; all matter is made of atoms/molecules; matter has three states (solid, liquid, gas)

Vocabulary Definitions:

Reaction - A chemical or physical property change when two things are mixed, heat is added, or light is shone on a substance, etc.

Endothermic- takes in heat;

Exothermic - gives off heat

Materials and Preparation in Classroom

Required materials and classroom set-up for complete lesson.

Volunteer Brings:

- Chemicals,
- Containers,
- Paper towels,
- All demonstration materials,
- Numbered signs for each station.
- Blue and yellow cellophane or other color mixture prop.

Classroom Needs:

- Tables,
- Sink (preferable)

Set-Up Requirements:

Four tables to use as stations, room for the children to rotate between the stations



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Introduce and Engage

Making personal connections, engaging curiosity, building connections to kids' experiences

Personal Introduction: What do you do for work, hobbies, play? Why are you interested in this topic?

We are part of a professional chemistry fraternity at UC Berkeley. Because we are a professional fraternity, we welcome both women and men into our membership. Most of us are undergraduate chemistry or chemical engineering majors, though we do have some biology, physics, and bioengineering majors as well as a few graduate students. (*Personal introductions.*)

Building Connections to Kids' Experiences: Can you think of an experience most kids would have related to your topic? Is there something to show that will grab their attention? Or can you pose a mystery with a question about something they see every day?

Today we're going to experiment with chemical reactions. [write on board] Reactions occur all around us every day, even within our own bodies. Breathing in oxygen and breathing out carbon dioxide is a reaction that we do every minute of our lives.

Chemical reactions happen when the atoms [write on board] that make up everything actually rearrange to make a new substance with different properties. For example, who knows what oxygen is? [pick a hand, listen, prompt if needed] – Right, we breathe it! So is it normally found as a solid, liquid or gas?

[pick another student] How else could we describe it? [– colorless, odorless] Hydrogen is also a colorless, odorless gas.

But when we put them together they make something new: [write H₂O on board] Who knows what this stands for? Right, water is made up of two hydrogen atoms and one oxygen atom.

What are the properties of water? [liquid, colorless, odorless] We know that a chemical reaction happened here because the two original substances have become something new (liquid instead of gas) with different properties.

Sometimes substances combine into a mixture that blends properties but isn't really a reaction. We're going to show you some things to look for – clues - that will help you tell whether a real chemical reaction has occurred. There are four stations set up around the room. Each one will show you a different clue that a chemical reaction has occurred. Your job is to observe and remember all the changes that you see or feel at each station.

Learning Experiences

What kids will see, do, hear, touch, taste or make.

Any combination of demonstrations, hands-on activities, and pictures that help kids explore new ideas. Describe specific experiences in the order you plan, including instructions you need to give students.

[Divide class into groups of four or less and assign them a station (1- 4) to start at.] We will start at the assigned stations and then move around clockwise [physically demonstrate how to move]. We will tell you when to move by [choose bell, buzzer, clapping, lights] Are there any questions? OK go to your assigned station.

Color change: Mixing two solutions that look different will result in a chemical reaction that changes the color of the solution.

Slime: Mixing two solutions that are liquids produces a solid-like slime with different physical state

Exo/endothermic reactions: Many chemical reactions give off or take in heat, resulting in a reaction mixture that feels cold or warm

Soap bubbles: Chemical reactions can produce a variety of products. Here, a liquid and a solid react to give off gas, proof of which is shown by adding detergent to the mixture.

Sharing Experiences & Building Ideas

How kids will share experiences and build links to ideas and vocabulary.

Sharing and Interpretation: Ideas for questions to invite sharing and guide interpretation of experiences.

[Draw chart on board to record observations at each station. Ask each group what they noticed at one of the stations [purple to orange to yellow], then invite other comments for station] What did you notice at station 1? Did anybody else notice something different?

So what kinds of clues or indicators can show us that a chemical reaction has occurred? [Have each station leader talk about their station.]

- Color change –here new atom combinations reflect light differently, not just paler or color combinations, but new color, demonstrate with pieces of blue and yellow cellophane to make green
- New physical state – not just combination, Here one molecule linked two others together to form longer chain. [ask for three volunteers and demonstrate with their bodies] This keeps the atoms in the new substance from moving as easily, so it gets thicker, more like a solid.

- Absorbs heat – scientists call this endothermic [write on board, “Thermic” is an word for heat, and “endo” means absorbing or pulling in] The substances are drawing energy in the form of heat from your hands into their new product. Reactions can also give off energy because they don’t need it all and get hotter to the touch. Scientists call this exothermic.
- Makes new product (gas, solid) – these substances, a solid and a liquid combined to produce a gas. Reactions can make different kinds of products, two liquids might create a solid that sinks out to the bottom, at our station we made a gas that was a combination of the two substances. The bubbles were caused by soap that we added so that we’d be able to see all the gas that formed as it blew up bubbles on the way out – otherwise it could have been invisible.

Closing Statements: *connect experiences to larger world, big ideas, vocabulary.*

Chemical reactions are interactions between atoms and molecules that change to produce different atoms and molecules. They can be identified if something gives off gas, changes color, changes physical state, or becomes cold or hot.

Follow-Up Activities

Ideas for follow-up activities, your favorite kid books, things to notice

Ask Teacher and kids to write a letter about what they learned. Include drawings!

Maybe the kids could try to find some chemical reactions that they see in their everyday lives.

There are some great resources in the American Chemical Society’s [Inquiry in Action](http://www.inquiryinaction.org/classroomactivities/) curriculum:

<http://www.inquiryinaction.org/classroomactivities/>

Chapter 5: Chemical Change – In this chapter, students gain experience with the evidence of chemical change—production of a gas, change in temperature, color change, and formation of a precipitate.

1. [Powder Particulars](#)
2. [Using Chemical Change to Identify an Unknown](#)
3. [Exploring Baking Powder](#)
4. [Change in Temperature—Endothermic Reaction](#)
5. [Production of a Gas—Controlling a Chemical Reaction](#)
6. [Change in Temperature—Exothermic Reaction](#)
7. [Color Changes with Acids and Bases](#)
8. [Neutralizing Acids and Bases](#)
9. [Comparing the Amount of Acid in Different Solutions](#)
10. [Formation of a Precipitate](#)



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