

Discovering Chemical Changes

4th Grade

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References:

- CPS curriculum guide

Benchmarks:

SLC/GLI #: PS-2 4th grade

Objectives:

The objective of this lesson is to help students understand characteristics of a chemical change through many examples that show a variety of the physical observations associated with chemical changes, such as: release of heat or light, smell, color change, temperature change, or release of gas.

Materials:

- Something rusty
- Something rotting (wood or food, etc)
- Candle, paper, and lighter or matches (i.e. stuff to burn)
- Hot Hands – something that releases heat after chemical change
- Chemically reacting ice packs
- Apples (or other fruit that turns brown with oxidation) and knife or device for cutting
- Alka-seltzer tablets and water
- Old pennies that have green on them and new ones to compare with
- Milk and vinegar (the vinegar curdles the milk)

Initial Demonstration:

The initial demonstration should be a demonstration of a chemical change, preferable a more exciting example that catches the attention of the students and maybe that, for safety reasons, should not be conducted by the students. I plan to use burning a piece of paper as my demonstration. If you have the resources, another fun one is mixing an alkaline metal such as pure sodium with water (in the proper proportions and in a safe container).

The demonstration should be conducted in such a way that you ask the students what they think will happen, if anything when you do what you're planning. Ask them if they think it will be a chemical or physical change and why. Write their prediction and explanation on the board. Conduct the demonstration and have them make observations. Then compare their predictions to their observations. Go through exactly why the change was chemical and list the observations that help one to determine that it was a chemical change. You may want to make a list of these clues on the board so that the students can refer to the list later.

Target Observations:

- Students should start to understand the idea that chemical changes are not reversible, especially from my demonstration of burning paper – you cannot get paper back.
- Students should be able to recognize chemical changes by the observable clues that generally accompany chemical changes such as those listed in the CPS curriculum guide and in the objectives above.

Procedure:

This lesson should be an open inquiry-based lesson where you have many stations set up with before and after chemical changes so that students can make the chemical changes happen themselves or at least make observations of chemical changes that have happened at each station. I have listed above 9 possible chemical changes that can be used. Students should move from station to station and make observations in their journal of the chemical change: observations of how they know it's a chemical change and the clue that tipped them off to why it was a chemical change and not a physical change. After they're finished, you should go through each of the stations to explain what the chemical change was and why it happened.

Here are the chemical changes for the items I listed above:

Rusting: rust is formed through oxidation – exposing a metal, such as iron to oxygen (found in the air and water, for example). The chemical change is the oxygen and metal (I'll use iron) combine to form iron oxide, the red flaky compound we all know as rust.

Rotting: a common word for decomposition. which on a chemical level, really means the same as in everyday language, only applied to the molecules that make up something. When something decomposes, the molecules that make up that substance are broken up into smaller and smaller pieces and eventually down to atoms, becoming something different than what they were before. Rotting is also associated with the presence of mold, fungi that often grows on things that are decaying.

Burning – the chemical process of combustion, which is an exothermic chemical reaction between a substance, in this case the paper, which acts as the fuel, and a gas, in this case the air, which is the oxidizer (i.e. the gas must contain oxygen). As we all know from experience, combustion, or burning releases heat and usually light in the form of the flames (although flames are not necessary for combustion).

Hot Hands – an exothermic (heat is released) chemical reaction that occurs when powdered iron is mixed with activated carbon, water, salt, and wood fiber in the presence of air. This involves the quick formation of iron oxide (activated carbon catalyzes the reaction). This is the same chemical made in rusting, but that happens much more slowly. (explanation found at <http://www.vanderbilt.edu/vsvs/exothermic.pdf>)

Chemical Cold Packs – these usually contain a combination of ammonium nitrate (NH_4NO_3) and water. When combined, ammonium nitrate and water form an endothermic reaction that requires heat to happen, so it sucks up heat from the surroundings, hence feeling cold.

Foods (such as apples) turning brown – another example of oxidation, also with iron. Apples and other foods, such as potatoes turn brown when exposed to air because enzymes or proteins containing iron that are found in these foods react with the oxygen in the air and the chemical reaction causes the brown color that you see.

Alka-seltzer and water – Alka-seltzer contains citric acid and sodium bicarbonate (baking soda), so when you drop the tablet in water, these two chemicals are able to react, producing carbon dioxide gas. This is the same reaction that you observe from mixing baking soda and vinegar or lemon juice.

Copper pennies turning green – again, oxidation is the chemical reaction at work here. Only this time, instead of the rusty red color of iron oxide, copper oxide is the green.

Milk and vinegar – the acidity of the vinegar causes proteins in the liquid milk to tangle into solid masses, or coagulate, into lumps called curds.

Target Observations:

- Students should notice that chemical changes are accompanied by many observable changes that clue them into the fact that a chemical change had taken place

Target Revised Model:

- The students should be able to recognize a chemical changes by observing things such as color changes, heat being released or required, smells, etc.
- Students should understand that chemical changes are different from physical changes and that chemical changes are not reversible, and the original substances can never be recovered.

Summary:

This lesson was designed to teach chemical changes and to present the students with many examples of chemical changes so that they can better recognize when an chemical change has occurred by making observations and comparing those observations to a list of often observed “clues” to what happens when there is a chemical change. This was done by setting up many stations that contained many different chemical changes that the students could observe and then compare to a list of observational clues associated with chemical changes to see if they could determine that a chemical change had taken place.