

# Chemical Reactions Game Plan

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## eCamp Chemistry Lab

**Objective** You're going to do several chemistry experiments that expose your kids to the different type of chemical reactions. I want you to focus on honing your observational skills when you do the experiments. Did the temperature, color or volume change? Even the smallest differences can indicate something big is going on. The first thing to do is watch the video on the *Chemical Demonstrations* website page, and then dive into the experiments.

**Main Ideas** Chemistry is chocked full of demonstrations and experiments for two big reasons. First, they're fun. But more importantly, the reason we do experiments in chemistry is to hone your observational skills. Chemistry experiments really speak for themselves, much better than I can ever put into words or show you on a video. And I'm going to hit you with a lot of these chemistry demonstrations to help you develop your observing techniques.

While the kids are playing with the experiments see if you can get them to notice these important ideas. When they can explain these concepts back to you (in their own words or with demonstrations), you'll know that they've mastered the lesson.

**About the Experiments** A lot of folks get nervous around chemistry. You can't always 'see' what's going on (are there toxic gases generated from that reaction?), and many people have a certain level of fear around chemicals in general.

I don't want you dipping your hands in molten lead or lying on a bed of nails while someone with a sledgehammer breaks a cinder block on your stomach. Demonstrations of this kind that result in injury are the ones forever burned in the memory of the audience, who are now fearful and have made the generalization that chemicals are dangerous and their effects are bad. In fact, every chemical is potentially harmful if not handled properly. That is why I've prepared a special set of chemistry experiments that include step-by-step demonstrations on how to properly handle the chemicals, use them in the experiment, and dispose of them when you're finished.

Chemistry is predictable, just as dropping a ball from a height always hits the floor. Every time you add 1 teaspoon of baking soda to 1 cup of vinegar, you get the same reaction. It doesn't simply stop working one time and explode the next. I'm going to walk you through every step of the way, and leave you to observe the reactions and write down what you notice. At first, it's going to seem like a lot of disjointed ideas floating around, but after awhile, you'll start to see patterns in the way chemicals interact with each other. Keep working at Chemistry and eventually it will click into place. And if there's an experiment you don't want to do, just skip it (or just watch the video). Some of this may be a review for you, especially if you've completed Units 3 (Matter) and 8 (Chemistry 1).

**The How and Why Explanation** There are several different types of chemical reactions: combustion, decomposition, synthesis, and displacement. All chemical reactions somehow fit into one of these, and here's how you can tell them apart...

**Combustion:** A combustion reaction gives off energy, usually in the form of heat and light. The reaction itself includes oxygen combining with another compound to form water, carbon dioxide, and other products. A campfire is an example of wood and oxygen combining to create ash, smoke, and other gases.

**Synthesis:** This reaction happens when simple compounds come together to form a more complicated compound. The iron (Fe) in a nail combines with oxygen (O<sub>2</sub>) to form rust, also called iron oxide (Fe<sub>2</sub>O<sub>3</sub>).

**Oxidation-Reduction (Redox Reaction):** When the oxidation numbers of atoms change during the reaction, it's called a redox reaction. Oxidation happens when a compound loses electrons (increases oxidation state) and reduction occurs when a compound gains electrons (decrease in oxidation state). Electroplating is an example of a redox reaction.

**Decomposition:** On the other side, a decomposition reaction breaks a complicated molecule into simpler ones. When you leave a bottle of hydrogen peroxide on the counter, it decomposes into water (H<sub>2</sub>O) and oxygen (O<sub>2</sub>).

**Displacement:** There are several different types of displacement reactions, including single, double, and acid-base more on this later). Antacids like calcium hydroxide (CaOH) combine with stomach acid (HCl) to form calcium chloride salt (CaCl<sub>2</sub>) and water (H<sub>2</sub>O).

**Questions to Ask** When you've worked through most of the experiments ask your kids these questions and see how they do:

1. What's true about phenolphthalein? (a) it goes from clear to pink when mixed with bases (b) it's impossible to spell (c) it is colorless in acidic solutions (d) soluble in water
2. How does increasing the hydrogen peroxide affect the rate of the iodine clock reaction?
3. Which chemical turns coldest when added to water? (a) calcium chloride (b) aluminum sulfate (c) ammonium nitrate (d) citric acid
4. A polymer is: (a) a long piece of spaghetti (b) an element on the periodic table (c) a long molecular chain (d) a plastic bag
5. What does a cross-linking agent do?
6. Which of the following are cross-linking agents? (a) calcium (b) borax (c) white glue (d) starch (e) bubble gum
7. Which substance is both a solid and a liquid? (a) bubble gum (b) slime (c) cornstarch and water (d) last night's dinner

**Answers:**

1. What's true about phenolphthalein? **(a) it goes from clear to pink when mixed with bases (b) it's impossible to spell (c) it is colorless in acidic solutions** (d) soluble in water
2. How does increasing the hydrogen peroxide affect the rate of the iodine clock reaction? **By accelerating the first reaction, you can shorten the time it takes the solution to change color. There are a few ways to do this: You can decrease the pH (increasing H<sup>+</sup> concentration), or increase the iodide or hydrogen peroxide. (To lengthen the time delay, add more sodium thiosulfate.)**
3. Which chemical turns coldest when added to water? (a) calcium chloride (b) aluminum sulfate **(c) ammonium nitrate** (d) citric acid
4. A polymer is: (a) a long piece of spaghetti (b) an element on the periodic table **(c) a long molecular chain** (d) a plastic bag
5. What does a cross-linking agent do? **Coagulates the polymers. (Turns the long polymer chains into something that looks more like a fishnet.)**
6. Which of the following are cross-linking agents? (a) calcium **(b) borax** (c) white glue (d) starch (e) bubble gum
7. Which substance is both a solid and a liquid? (a) bubble gum (b) slime **(c) cornstarch and water** (d) last night's dinner