

Title - **Physical & Chemical Reactions**

By - Charlotte McCoy

Primary Subject - Science

Secondary Subjects - Science

Grade Level - 5th - 8th grade

This lesson plan is the teachers side of a virtual classroom science lesson performed by the Discovery Center of Springfield. To co-ordinate a virtual class or to inquire about our rates, contact us by phone (417) 862-9910 ext. 713, or visit our website at www.discoverycenter.org/video_conferencing.asp.

I. Goals and Objectives:

Students will learn...

1. The difference between a physical reaction and a chemical reaction
 2. The 4 ways in which a reaction can be sped up; (concentration, surface area, temperature, & catalysts).
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II. Vocabulary:

1. Physical Reaction: The matter stays the same, but change in size, shape, or appearance.
 2. Chemical Reaction: The matter changes to a different kind of matter, or change in color.
 3. Concentration: amount of substance dissolved in a certain amount of solvent.
 4. Surface Area: refers to the amount of material that is exposed
 5. Catalysts: substance that increases the rate of a chemical reaction without being changed by the reaction.
 6. Endothermic
 7. Exothermic
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III. Brain storm, "What is chemistry?"

IV. PHYSICAL VS. CHEMICAL "REACTIONS IN A BAG" EXPERIMENTS

EXPERIMENT #1:
MAKE YOUR OWN INSTANT COLD PACK (PHYSICAL)

The process in making the cold pack is not a chemical reaction but merely the physical act of dissolving. When ammonium nitrate is dissolved in water, the process is endothermic, thus producing the cold pack.

You will need: Ammonium nitrate, tap water, ziplock bag (sandwich size), graduated cylinder
* *Wear chemical resistant goggles, gloves and apron!*

1. Weigh out 25 grams of ammonium nitrate directly into a one-quart size Ziplock plastic bag.
2. Using a graduated cylinder, measure out 50 mL of water.
3. Quickly, pour the water into the bag of ammonium nitrate, and seal the bag (try and remove excess air before sealing the bag.)
4. Gently squeeze the bag to mix the solid and water.
5. Let the students feel the bag. It becomes cold within seconds and will remain cold for about 20 minutes.

EXPERIMENT #2:

CALCIUM CHLORIDE: A REACTION IN A BAG. (CHEMICAL)

Introduces students to a chemical reaction involving a color change, the formation of a gas and heat changes from hot to cold. The students can actually hold this chemical reaction in their hands to see and feel the reaction take place. The acid-base indicator will change colors (from basic to acidic). For example: phenol red solution goes from red to orange to yellow. Universal indicator solution starts out green and changes to pink. Cabbage juice, changes from blue-green to purple to pink. The plastic bag will also inflate due to the formation of carbon dioxide gas.

You will need: calcium chloride, Sodium Bicarbonate (baking soda), Acid-Base indicator (any kind), Ziplock sandwich bags, spoons, graduated cylinder

1. Place one spoonful of calcium chloride into a plastic sealable bag.
2. place 1 spoonful of sodium bicarbonate (BAKING SODA) into the bag. Seal the bag, shake it and see if a chemical reaction takes place.
3. measure 10 ml (or 2 teaspoons) of indicator solution. Carefully add it to the bag. Flatten the bag to remove the air and seal it.
4. Tilt the bag back-and-forth to wet all of the solid. Squeezing the bag may also help in wetting the solid. Be careful not to squeeze the bag too hard as it might break or open up.
5. observe the reaction. If the bag gets tight due to pressure, open the seal to release the pressure, then reseal it.
6. Answer the following:
 - a.) How was this experiment different then the one before?
 - b.) Did a noticeable reaction occur before the indicator solution was added?
 - c.) What color change did the indicator go through?
 - d.) Why does the bag inflate?
 - e.) Does the reaction get hot or cold initially?
 - f.) Does the reaction get hot or cold after 1 minute?

- g.) What observations did you make that tell you a chemical reaction is taking place?
 - h.) Was this experiment a physical or chemical reaction?
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V. Define and clarify the difference between a physical and chemical reaction.

VI. RATE OF CHEMICAL REACTIONS EXPERIMENTS

There are many ways to change the rate of a chemical reaction. It can either be sped up or slowed down. There are 4 things that affect the rate of a chemical reaction:

1. Concentration
 2. Surface Area
 3. Catalysts
 4. Temperature
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EXPERIMENT #1:

Concentration of vinegar (Balloon Blowing)

You will need: $\frac{1}{4}$ cup vinegar, 2 tbsp baking soda, 2 balloons, 2 graduated cylinders.

1. Pour the vinegar into one of the graduated cylinders.
2. Pour watered down vinegar into the other graduated cylinder
3. Stretch open the balloon mouth and carefully pour the baking soda into both of the balloon.
4. Place the balloon mouth over both of the cylinders. Make sure that the balloon mouth is tightly around the neck of the graduated cylinder.
5. Hold the balloon to the side so that the baking soda does not fall into the graduated cylinder.
6. Shake the balloon so that the baking soda falls into both of the graduated cylinders.

What happened? Which balloon blew up faster? More?

EXPERIMENT #2: Surface Area (Antacid Tablet Race)

You will need: Antacid Tablets, water, napkins, cups, spoons

1. Group students into groups of 2.
2. 1 partner crushes tablet with the spoon and puts the powder onto the spoon.
3. At the same time, partner #1 puts powder into cup A and the other partner puts tablet into the cup B.
4. Which tablet dissolves first?

Increasing surface area, speeds up the reaction.

EXPERIMENT #3: Paper Clip Catalyst

You will need: paper cut in the size of a dollar, 2 large paper clips per student.

1. Give each student a strip of paper the size of a dollar.
2. Have them fold it into thirds, the shape of a Z or N.
3. Insert big ear of paper clip, clipping the second and third folds together.
4. Insert big ear of second paper clip, clipping the first and third folds together.
5. Grab the papers ends and pull
6. paper clips should come free of the paper but be hooked together.

A catalyst speeds up the reaction but does not become part of the reaction.

EXPERIMENT #4: Heat (Dry Ice Film Poppers)

You will need: dry ice chips, a film canister for each student.

1. Students must wear eye goggles.
 2. Team students up to do a popper first without adding water.
 3. Then add hot water to the canister and have them observe which is the quicker explosion.
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EXPERIMENT: #5: Flaming Coffee Creamer

Have students decide which of the 4 things that speed up chemical reactions the following experiment demonstrates.

1. Try and set a pile of coffee creamer on fire. What happens? Nothing.
2. Sprinkle the creamer above the match, and you will get huge flames!

You increase the surface area by allowing oxygen to get all around the creamer particles.

E-Mail [Charlotte McCoy!](#)