

Station 1

Materials: Ziplock bag, teaspoon, graduated cylinder, ammonium nitrate

Procedures:

1. Place 1 level teaspoon of **ammonium nitrate** into the bag.
2. Add 30 mL of tap water to the bag.
3. Close the bag and feel the contents of the bag. Mix the contents by squeezing the bag.
4. Look, listen and feel. Record your observations.

Clean up:

1. Throw the plastic bag and its contents in the trash.
2. Wipe off the lab table.

Ammonium Nitrate & Water Reaction

You may associate ammonium nitrate with explosives; it's commonly used in safety explosives and pyrotechnics as well as fertilizer. But not all ammonium nitrate experiments end with a bang. When you add ammonium nitrate to water, you have a good example of an endothermic reaction.

Ammonium Nitrate Properties

The chemical compound ammonium nitrate, is a colorless, crystalline solid that is highly soluble in water. Its chemical formula is NH_4NO_3 , meaning it is a molecule made up of atoms of nitrogen, hydrogen and oxygen.

Adding Ammonium Nitrate to Water

Ammonium nitrate consists of ionic bonds packed tightly together. When it comes into contact with water, the polar water molecules interfere with those ions and eventually make them disperse. It takes energy to do this, which is absorbed from the surroundings and makes the solution cold. This process is an endothermic reaction, or one that absorbs energy from its surroundings. It's for this reason that solid ammonium nitrate is used in commercial cold packs, which are really just a mixture of ammonium nitrate and water. If you hurt yourself, you can mix the contents of the bag together and place it on the injured part of your body. The endothermic reaction of the mixture of ammonium nitrate and water removes heat from the part of the body, "freezing" the painful area.



Station 2

Materials: Ziplock bag, 1/2 teaspoon, graduated cylinder, calcium chloride

Procedures:

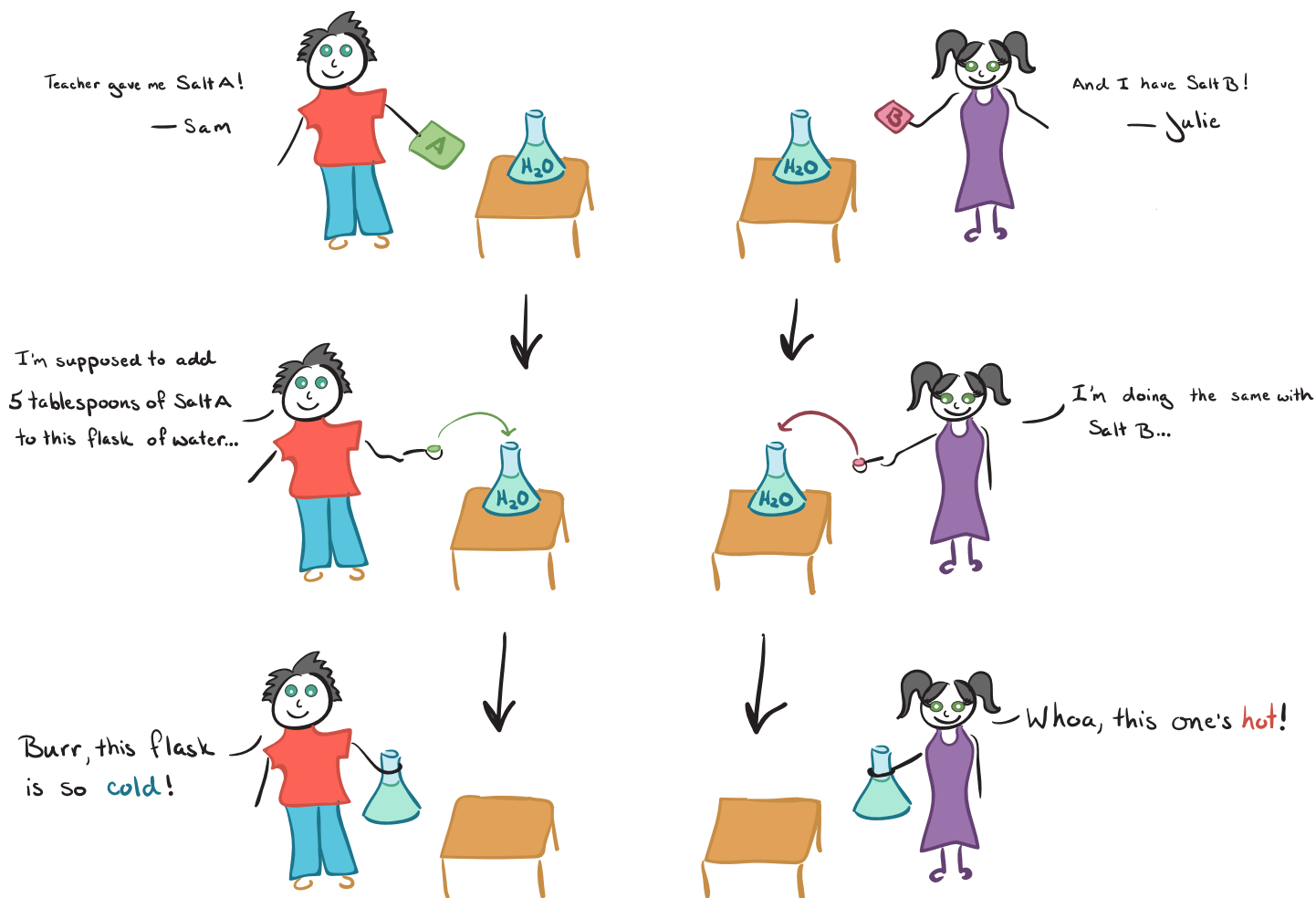
1. Place 1/2 a teaspoon of **calcium chloride** into the bag.
2. Add 30 mL of water to the bag.
3. Close the bag and feel the contents of the bag. Mix the contents by squeezing the bag.
4. Look, listen and feel. Record your observations.

Clean up:

1. Throw the plastic bag and its contents in the trash.
2. Wipe off the lab table.

Let's see what Sam and Julie are up to in the chemistry lab.

Chemistry Lab: Experiments are fun! ☺



Excited but a bit confused, Sam and Julie run to their chemistry teacher. Sam asks, "Teacher, why did my flask turn cold after adding the salt to water, while Julie's flask turned hot?"

The teacher replies: "That's because you were given two different salts. One of your salts generated an **endothermic reaction** with water, while the other salt generated an **exothermic reaction** with water. Let me first reveal the identity of your salts: Salt A is ammonium nitrate and Salt B is calcium chloride."

Now, Sam and Julie are curious about the difference between an endothermic and an exothermic reaction.

Consider the reaction mixture—salt plus water—as the **system** and the flask as the **surrounding**. In Sam's case, when ammonium nitrate was dissolved in water, the *system absorbed heat from the surrounding*, the flask, and thus the flask felt cold. This is an example of an endothermic reaction. In Julie's case, when calcium chloride was dissolved in water, *the system released heat into the surroundings*, the flask, and thus the flask felt hot. This is an example of an exothermic reaction.

Station 3

Materials: ziplock bag, film canister, teaspoon, ½ teaspoon, graduated cylinder, baking soda, calcium chloride.

Procedures:

1. Place 1 level teaspoon of **baking soda** into the bag.
2. Place ½ teaspoon of **calcium chloride** into the bag.
3. Mix the two powders together **in the bag.**
4. Add 30 mL of water to the film canister.
5. **VERY CAREFULLY** - lower the film canister containing the 30 mL of water upright into the bag. Do **not** let any spill out.
6. Have a student help you hold the film canister by squeezing the film canister gently from the outside of the bag while you squeeze the excess air out and seal the bag.
7. Hold the film canister and bag up and slowly spill the liquid out of the film canister (while the bag is still sealed).
8. Look, listen and feel. Record your observations.

Clean up:

1. Open the plastic bag and take the film canister out.
2. Dump the contents of the bag into the sink and rinse it down.
3. Throw the plastic bag in the trash.
4. Rinse out the film canister.
5. Wipe off the lab table.

What is happening in this lab?

Virtually everyone is familiar with sodium bicarbonate (NaHCO_3), because it's the baking soda you use to deodorize your refrigerator. Fewer people are familiar with calcium chloride (CaCl_2), but they should be. Like sodium chloride, it's a salt, and it's hygroscopic, which means it absorbs moisture from the air. Putting a dish of calcium chloride in your closet is a good way to protect your clothes from mold. Calcium chloride helps dust control and works as a food additive, because it can make foods like pickles taste salty without actually adding sodium chloride.

A Two-Part Reaction

The reaction between sodium bicarbonate and calcium chloride must occur in solution, so water is always a part of the reaction. Both reactants dissolve readily in water, so that isn't a problem. You can dissolve one in water then add the other, or you can keep both in opposite corners of a plastic bag and place a vial of water between them so that, when you shake the bag, they combine with the water and each other.

When you combine the reactants, two things occur. The first thing is that they combine to form calcium carbonate -- a compound found in limestone, chalk, marble and the shells of snails and sea creatures -- along with sodium chloride and hydrogen ions. The hydrogen ions turn the solution acidic, and they combine with leftover sodium bicarbonate to produce carbon dioxide gas, water and sodium ions. They also combine with chlorine to make hydrogen chloride.

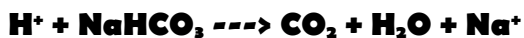
The release of carbon dioxide gas blows up the bag, and because the gas is produced in an exothermic reaction, the temperature of the solution goes up.

The Chemical Equations

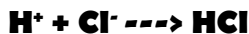
In the first reaction, the reactants combine to form calcium carbonate, sodium chloride and hydrogen ions. The equation for this reaction is:



The hydrogen ions then combine with unused sodium bicarbonate to form carbon dioxide, water and sodium ions.



Sodium chloride dissociates into Cl^- and Na^+ ions in water. Some of the free chlorine ions combine with hydrogen ions to form hydrogen chloride.



A simplified equation for the overall process is:



Station 4

Materials: ¼ teaspoon, iron powder, vinegar dropper bottle, medicine cup

Directions:

1. Place 1/4 teaspoon of iron powder in the medicine cup.
2. Place 3-5 drops of vinegar on the iron powder.
3. Waft to wift.
4. Record your observations on the student data sheet.

Clean up:

1. Use a paper towel to wipe the iron into the trash.
2. Clean and dry the medicine cup.
3. Spray and wipe the lab table.

Why Are We Doing This Lab?

To learn about chemical changes and some of the characteristics of a chemical change. Odor can be used as an identifying characteristic for some elements, specifically, sulfur compounds that have a tendency to smell like rotten eggs. In this experiment, you will be generating hydrogen sulfide gas by mixing iron filings with an acid in a cup. This reaction produces a memorable odor, something re-sampling rotten eggs. Definitely a face wrinkler that should be shared with a close friend or cherished sibling—and when you do, they are going to want to know what you have done.

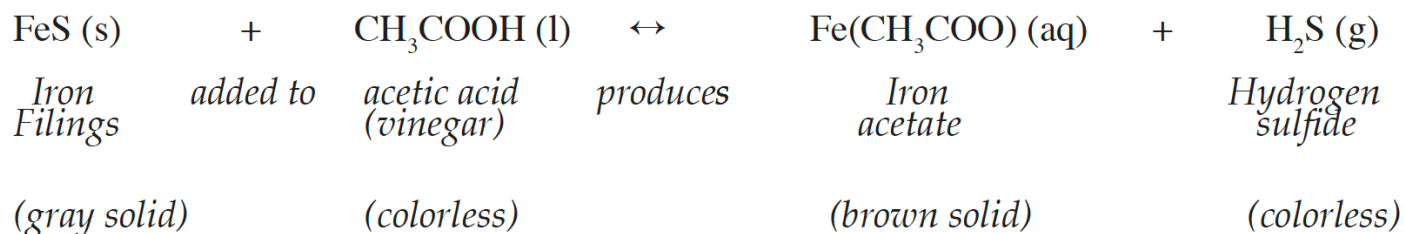
Rotten egg gas, also known as hydrogen sulfide, commonly escapes Mother Nature's bowels via volcanoes, gas wells, coal pits, sulfur springs, and the gastrointestinal exit ports of individuals who have eaten large quantities of fried onion rings. You may be more familiar with the smell as it emanates from an egg that you lost during the annual Easter hunt in spring and found just before Christmas—not a pleasant smell.



How come huh?

Vinegar is a weak solution of acetic acid. It reacts with iron filings to produce hydrogen sulfide gas. This experiment has a couple of twists that make it easier to understand once you know them. First of all elemental, iron is represented with the symbol Fe. So you are thinking, Why did we write FeS, the formula for iron sulfide, instead? Simple. The iron filings are not pure; they actually have a lot of sulfur mixed in simply because that is a by-product of the refining process. If we used pure iron, the experiment would not produce the wonderful smell that it does. The rest of the equation pans out just like you would think it should.

The Chemistry Behind It



Station 5

Materials: 2- 300mL beakers labeled A & B, 1 tablespoon, 1 teaspoon, magnesium sulfate (Epsom salt), sodium carbonate (washing soda), 2 spoons, water

Procedures:

Beaker A	Beaker B
<ol style="list-style-type: none">1. Fill beaker to 100 mL with water2. Add 1 TBS magnesium sulfate (Epsom salt)3. Stir until the solution is clear	<ol style="list-style-type: none">1. Fill the beaker to 50 mL with water2. Add 1 tsp sodium carbonate (washing soda)3. Stir until the solution is clear

4. Slowly pour the beaker with the smaller amount of solution into the beaker with the larger amount of solution.
5. Record your observations.

Clean Up:

1. Dump the solution into the sink
2. Wash the beakers

What is a Precipitation Reaction?

A precipitation reaction takes place when two different materials react in a solution to form an insoluble product. The insoluble product of the reaction forms a powder, solid mass or crystal that either sink to the bottom of the liquid solution or stay in suspension. The solution may contain the remaining chemicals that did not react, or it may contain another reaction product that is soluble and remains in solution. Many chemical experiments involving precipitation reactions are easy to carry out and produce interesting results, often with colorful precipitates.

Ionic Compounds in Solution

Precipitation reactions can only take place when two conditions are fulfilled. The dissolved compounds have to dissociate into ions, and the ions have to be able to combine to form a new compound. As a result, only ionic compounds in solution can produce a precipitate.



Station 6

Materials: 2-300mL beakers labeled A & B, solution of ascorbic acid, Provodone iodine, hydrogen peroxide, laundry starch, 100mL graduated cylinder, medicine cups

Procedures for Beaker A	Procedures for Beaker B
<ol style="list-style-type: none">1. Using the graduated cylinder, add 60 mL warm water2. Using a medicine cup, add 5mL of ascorbic acid solution (shake the solution before adding).3. Using a medicine cup, add 5mL of iodine4. Record any observations on your student data sheet	<ol style="list-style-type: none">1. Using the graduated cylinder, add 60 mL warm water2. Using a medicine cup, add 15mL of hydrogen peroxide3. Using a medicine cup, add 2.5mL of liquid starch

4. Pour liquid A into liquid B.
5. Then pour back and forth between the 2 beakers a few times.
6. Place the beaker down and observe... be patient... don't take your eyes off it.
7. Record any observations on your student data sheet.

Clean Up:

1. Dump the contents in the beaker in the sink.
2. Wash the beakers.
3. Spray and wipe off the lab table.

How does it work?

This is an example of the chemical reaction known as the **IODINE CLOCK REACTION**. It is called a clock reaction because you can change the amount of time it takes for the liquids to turn blue. The chemistry of the demonstration gets a bit complicated, but basically it is a battle of chemistry between the starch which is trying to turn the iodine blue, and the Vitamin C which is keeping it from turning blue. Eventually the Vitamin C loses and, bam! – you get instant blueness.

Station 7

Materials: glow stick, chromebook

Procedures:

1. Crack the glow stick.
2. Record your observations in the data table on the student sheet.

Videos: Watch the following videos and answer the questions on your student sheet.

The Science of Glow Sticks

<https://www.youtube.com/watch?v=uJgNTeBWhDk>

What Makes Animals Glow?

<https://www.youtube.com/watch?v=Bv6VkasWmrU>

Station 8

Materials: chromebook, sheet of chemical/physical changes

Procedures:

1. Watch the YouTube video (find the link on class website)
2. Answer the questions about the video

Using the sheet titled "Physical or Chemical Change," identify each picture as a Chemical or Physical change by putting a C in the box for Chemical and a P in the box for Physical.

Video: 7 Signs a Chemical Reaction is Taking Place

<https://www.youtube.com/watch?v=q76UNX3otvA>

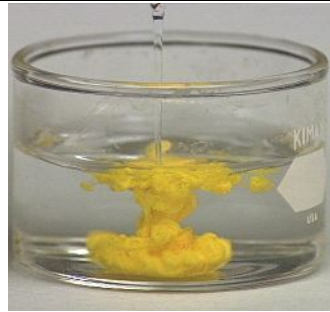
Physical or Chemical Change



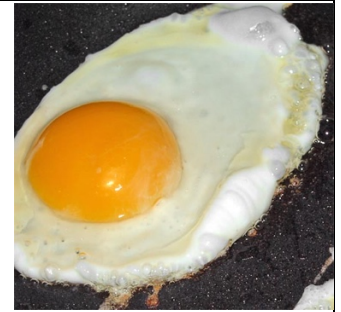
1. Breaking a Dish



2. Burning Wood



3. Two clear liquids react to form a yellow solid



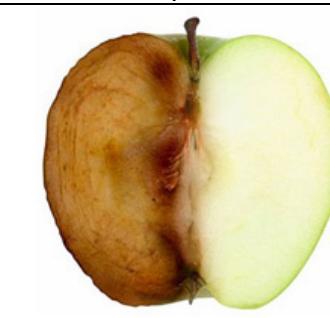
4. Frying an Egg



5. Melting Ice



6. Baking Soda Reacting with Vinegar



7. An Apple Rotting



8. Caramel Melting



9. Nail Rusting



10. Freezing a Popsicle



11. Folding Paper



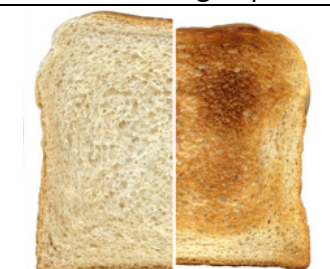
12. Bleaching Hair



13. Corroding Battery



14. Breaking an Egg



15. Toasting Bread



16. Spoiling Milk



17. Dissolving Kool-Aid in Water



18. Exploding Fireworks



19. Water Evaporating



20. Juicing an Orange

Station 9

Materials: 400 mL beaker, 3 medicine cups, magnetic stirrer, sodium hydroxide, sugar, potassium permanganate solution, water, digital balance

Directions:

1. Add 250 mL warm water to beaker.
2. Put the magnet bar in the beaker, put the beaker on the stirrer and start the stirrer. Turn the stirrer to here
3. Place a medicine cup on the balance. Zero out the balance.
4. Weigh out 3 grams of sodium hydroxide into the medicine cup.
5. Add the 3 grams of sodium hydroxide to the water.



*** **Warning! Sodium Hydroxide is Hazardous! Do NOT touch!**

6. Place another medicine cup on the balance. Zero out the balance.
7. Weigh out 4.5 grams of sugar into the medicine cup.
8. Add the 4.5 grams of sugar to the water.
9. Make sure it is ALL dissolved.
10. Using a dropper, fill another medicine cup with 15 mL of the potassium permanganate solution (**bright purple**).
11. Add the 15mL potassium permanganate solution to the beaker on the stirrer.
12. Watch, observe and record your observations.

Clean-up:

1. Turn off stirrer.
2. Using rod, take magnet out of stirrer.
3. Dump contents in beaker in the sink.
4. Rinse down with lots of warm water.
5. Wash the beakers.
6. Spray off lab tables.
7. **WASH YOUR HANDS!!!** Make sure you don't have any of the solution on your hands!!!

Caution:

Sodium Hydroxide is a hazardous chemical. Please do not touch the chemical.

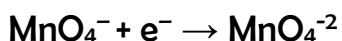
- **Skin Contact:** CORROSIVE. Contact can cause pain, redness, burns, and blistering. Permanent scarring can result. A severe exposure can cause death. Burns may not be immediately painful; onset of pain may be delayed minutes to hours.
- **Eye Contact:** CORROSIVE. Contact causes severe burns with redness, swelling, pain and blurred vision. Permanent damage including blindness can result.
- **Ingestion:** Can burn the lips, tongue, throat and stomach. Symptoms may include nausea, vomiting, stomach cramps and diarrhea. Can cause death.

Chameleon Chemical Reaction

Chameleon chemical reaction is a redox reaction which shows a beautiful color change. During the reaction, the color is changed from violet → green → yellow → red.

Even though this experiment is easy to perform, there's actually some really complicated and interesting chemistry going on! It involves something called a redox reaction. This basically means that new compounds are formed when one chemical takes electrons from another chemical. Here, the potassium permanganate is reduced, meaning it gains electrons, and the sugar is oxidized, meaning it loses some.

This happens in two steps. In the first step, the permanganate ion (the part of the potassium permanganate that changes) is reduced to the manganate ion:



The compound on the left is purple, and the one on the right is green. As this reaction is going, there is some purple and some green in the solution and these combine to make it look blue at the beginning.

Next, the green manganate is reduced again into manganese dioxide:



The manganese dioxide is a brown solid, but it's in such tiny particles that it appears to make the liquid turn yellow.

So, that's how you make colors with chemistry!

