Full List of Demos

First Day of School

1. Pencils through bag of water
    Materials:
        Ziplock bag
        several sharp pencils
    Instructions:
        1. Fill the bag with water and seal.
        2. Push pencils through the bag one at a time. Make sure they go all the way through.
    What is happening:
        The polymer chains of the bag seal around the pencil.
    Could be used: Polymer unit

2. Mesh jar
    Materials:
        Jar with mesh lid
    Instructions:
        1. Fill the jar as high as possible and put the lid on.
        2. Place an index card over the lid.
        3. Turn the jar perfectly upside down and slide the card out.
    What is happening:
        The water molecules are joined through cohesion.
    Could be used: IMF's

3. Water to wine to milk.
    Materials:
        Wine glass
        Water glass
        Milk glass
        Phenolphthalein
        Dropper
        Saturated sodium bicarbonate solution
        Saturated barium chloride solution
        20% Sodium carbonate solution
    Instructions:
        1. Put 22 mL of saturated sodium bicarbonate solution and 6 mL of 20% sodium carbonate solution together in the water glass (or beaker).
        2. Put a couple drops of phenolphthalein in the bottom of the wine glass.
        3. Put a small amount of barium chloride into the milk glass (or beaker)
        4. Pour the water glass into the wine glass and the clear liquid will become pink.
        5. Pour the wine into the milk glass and it will turn thick and milky.
    What is happening:
        The "water" mixture is a base that turns the indicator pink. The reaction with barium chloride produces barium carbonate - a white precipitate.
    Could be used: Acids/Bases, Precipitates

4. Burning money
    Materials:
        Beaker
        Isopropyl alcohol (70%)
        Salt
        Tongs
        Lighter
        $1 bill (or any denomination)
    Instructions:
        1. Mix 50/50 IPA and water in the beaker.
        2. Add a little salt to the mixture (for color)
        3. Soak the money in the beaker.
        4. Using the tongs, take the money out and light it on fire.
    What's happening:
        The alcohol vapor on the outside of the dollar burns. The water protects the paper by absorbing the energy.
    Could be used: Combustion reactions, thermodynamics

5. Sulfuric acid snake
    Materials:
        2 Beakers
        H_2SO_4
        Sugar
        Pan lined with foil (for easier clean up)
    Instructions - Do in fume hood!!:
        1. Fill the beaker half way with sugar.
        2. Pour sulfuric acid into it.
    What is happening:
        The water is removed from the sugar leaving just carbon
    Could be used: Evidence of chemical change

6. Crystal ball:
    Materials:
        Glass dish
        Dry ice
        Dish soap
        Paper towels
    Instructions:
        1. Put a piece of dry ice into the dish and fill it to the brim with water.
        2. Soak a paper towel in water and dish soap.
        3. Slide it carefully across the top of the dish forming a large bubble,
    What's happening:
        The dry ice is subliming into CO_2 gas and that gas fills the bubble.
    Could be used: States of matter, just for fun

7. Floating candle

Materials:

Candle
Pan
Beaker
Lighter
Food coloring

Instructions:

1. Put a small amount of colored water into the pan (higher than spout of beaker).
2. Light the candle.
3. Cover the candle with the beaker. When the candle goes out, the water will rise into the beaker.

What's happening:

When the candle goes out, to gas pressure inside decreases and the water is pushed in by atmospheric pressure.

Could be used: Gases

8. Lighting the table on fire (I don't have gas jets for methane bubbles!

Materials:

Isopropyl alcohol
Lighter

Instructions:

1. Pour alcohol on the desk.
2. Light it on fire.

What is happening:

Only the vapor burns, not the liquid, so the table is safe.

Could be used: Combustion reactions, getting students attention

<u>Halloween Demos</u>

1. Exploding jack-o-lantern

Materials:

Carved Pumpkin - jack-o-lantern with hole drilled in the back
Tuna Can with water
Calcium Carbide, 1g
Lighter

Instructions:

1. Put about 10 mL of water in the tuna can and place it inside the jack-o-lantern
2. Drop no more than 1g of calcium carbide into the can of water, put the top back on the pumpkin, and plug the hole on the back with your thumb
3. After 15-20 seconds, hold the lid down while you light the the built up acetylene gas with the lighter through the hole. The face pieces will blast out of the front.

Extremely important safety note: Make sure the face pieces move in and out of their holes freely right before doing the demo (or leave them out until you are ready). If they sit in the pumpkin for too long, they dry out and get stuck and the explosion has no where to go but out the top where your hand is!

Could be used: Combustion reactions

2. Gummy Bear (produces a lot of smoke, fume hood might be best
    Materials:
        Gummy bear
        Potassium chlorate
        Bunsen burner
        Test tube (a bigger one so the gummy bear can't block the opening)
        Tongs
        Ring stand with clamp
    Instructions:
        1. Melt the potassium chlorate in a test tube over a flame.
        2. Using the tongs so your hands a safe distance away, drop the gummy bear into the tube.
    Could be used: decomposition reaction, light (flames are purple due to potassium ions)

3. Disappearing styrofoam ghosts
    Materials:
        Styrofoam peanut "ghost" (old ones, not eco-friendly, with eyes drawn on)
        Beaker of acetone
        tongs
    Instructions:
        1. Push the styrofoam into the beaker slowly as it "disappears"
    Could be used: Solutions (miscibility)

4. Elephant toothpaste
    Materials:
        30% hydrogen peroxide
        Dish soap
        KI
        Tall cylinder
        Pipet
    Instructions:
        1. Put the H2O2 into a tall graduated cylinder
        2. Add a squirt or 2 of dish soap
        3. Drip a couple drops of concentrated potassium iodide solution
    Notes: Some people use food coloring, I don't because it is really messy and I do a lot of demos that day. I also put the whole thing in a baking pan to collect the foam
    Could be used: decomposition reaction, catalysis

5. Purple Poof - The time of this one is tricky, practice some on your own! Must be done in a fume hood
    Materials
        Ammonia
        Iodine crystals
        Filter paper
        Ring stand with ring
        Spatula
        Sodium hydroxide, about 1M

Instructions

1. Weigh out no more than 1 g of iodine crystals into an evaporation dish (or any small container)
2. Add a small amount of concentrated ammonia stir it together and let it sit for 5 minutes
3. Tape a piece of filter paper to a ring on a ring stand
4. Smear the sludge from the evaporating dish onto the filter paper and keep a beaker under it
5. Once the substance (NI3) is dry it is VERY unstable so you can gently tape it with a meter stick and it will snap with a purple cloud glass. If you do it too early it won't pop, if you wait too long, it might pop on its own
6. Put everything that came in contact with the iodine/ ammonia mixture into 1M sodium hydroxide to stabilize the material so you don't have surprise pops later!

Could be used: Synthesis reactions

6. Old Nassau Reaction

https://edu.rsc.org/resources/a-colourful-clock-reaction-old-nassau/1704.article

7. Bloody knife

Materials

Dull knife
Ferric chloride (5g in a few mL of water)
Potassium thiocyanate (5 g in a few mL of water)

Instructions

1. Put some of the potassium thiocyanate solution on your arm without the kids noticing
2. Dip a plastic knife in the ferric chloride solution
3. Swipe the knife across you arm

Could be used: Precipitation reactions

Compounds, Elements, Mixtures

Look at sulfur on it's own and iron filings are their own. Mix together and show that you can separate them with a magnet. Heat the mixture and form a compound that can't be separated

Signs of a Chemical Change

1. Unexpected change of color: base in phenolphthalein compared to expected change with food coloring
2. Light produced: Burning magnesium ribbon
3. Heat produced or absorbed: ammonium chloride added to water and calcium chloride added to water
4. Producing bubble: Mg ribbon in HCl compared to expected bubbles blown
5. Formation of a precipitate: $PbNO_3$ and KI

Periodic Trends

Drop very small pieces of Li, Na, and K individually into large beakers of water to show how reactivity increases down the period. I also use youtube videos of the halogens with aluminum to show the same (very high and very low electronegativities are the most reactive)

IMFs

Boiling point of water vs acetone
Paperclip on water for surface tension
Oil and water for miscibility

Types of Reactions

1. Synthesis: Burning Mg ribbon to form MgO (solid gains weight)
2. Decomposition: Place a small pile of ammonium dichromate on a piece of foil and light it - get it burning and it will go from orange crystals to fluffy green powder. I do it in the fume hood, but don't turn it on or the green stuff will be EVERYWHERE!
3. Single Replacement: Zn in 3M HCl in a flask with a balloon over the mouth. I light it on a bunsen burner afterward (I tape it to the end of the a meter stick), so I don't fill the balloon more than about 4 inches in diameter
4. Double Replacement: $PbNO_3$ and KI (I use random concentrations)
5. Combustion: The balloon on the bunsen burner or igniting alcohol on the table

Phases of Matter
In vacuum pump - put water in a beaker - water will boil at low pressure and room temperature

Gas Laws

1. Vacuum pump: balloon, sealed chip bag, beaker of shaving cream, marshmallow peeps
2. Crushed can: Heat a small amount of water in an empty soda can. Quickly flip the can into a container of ice water
3. Rising egg: Show that a hardboiled egg won't fit through the mouth of a flask (the mouth of the flask should be just slightly smaller than the egg). Put a birthday candle into the egg and light it. Hold the flask upside down over the egg. As soon as the flame goes out the egg rises into the container. To get the egg out, turn the flask upside down and blow air into it - the egg will pop out
4. Cartesian diver: Put a medicine dropper into a 2-L soda bottle full of water. Squeeze the bottle

Thermodynamics

1. Heat capacity: Place a piece of wood and a piece of metal on the counter. Let students brainstorm why the metal feels colder even though they are both in the same room. Place ice cubes on a piece of metal and a piece of wood. They predict it will melt faster on the wood because it's warmer, but it melts very rapidly the metal.

2. Endothermic reaction: Mix 32 g of barium hydroxide hexahydrate and 17g ammonium hydroxide. The 2 solids will get cold while turning into a liquid.

3. Transfer of heat: Show how an empty paper cup burns but a cup with water doesn't because the water has a higher heat capacity and absorbs the energy.

4. Exothermic reaction: nearly any demonstration on this list is exothermic, including elephant toothpaste which I sometimes use here if I haven't already.

Solutions

Supersaturation: Mix 250 g of sodium acetate into 500mL of water to make a supersaturated solution. Drop one crystal of sodium acetate in and the whole thing will recrystallize

Nuclear

Decay:
Materials: a balloon and a penny for each student.

1. Have each student blow up their balloon and hold it up pinched shut.
2. Tell the kids to flip a coin and if it's heads, they let go of their balloon so it flies away, otherwise they hang on to it (it will be about half) and count the number of balloons left.
3. Repeat the process until all the balloons have been let go
4. I make a graph as we go of number of balloons vs. number of coin flips which will show first-order decay

Polymers

1. The polymer chains in a garbage bag can be seen if you stretch it
2. Plastic bag demo from day one