Fire / Explosive Demos

Colored Flames:

- Copper nitrate
- Ethanol
- Lead nitrate
- Lithium nitrate
- Methanol
- Potassium nitrate
- Pyrex crystallizing dishes (7)
- Sodium nitrate

Place some of the appropriate salt into a crystallizing dish, and add enough methanol to dissolve some of the salt. Mix well. Ignite the mixture. The color of the flame will depend on the metal contained in the salt. Copper nitrate will produce blue green flames, potassium nitrate will give purple flames, lithium nitrate will produce a red flame, sodium nitrate has an orange flame, and lead nitrate burns blue. Ethanol will burn yellow.
Note: Chloride salts may be used as an alternative, but the nitrate salts do burn brighter.

Glowing Pickle:

- Electrical cord
- Pickle

Separate an electrical extension cord 10 cm from the bottom so that you have a plug at one end and two separated, exposed wires at the other end. Obtain a pickle (Kosher dills work best). With the extension cord unplugged, place an exposed wire in each end of the pickle (be sure the wires don't touch). Plug in the extension cord. The pickle will glow orange, which is due to the high sodium chloride content.

CAUTION: Do not plug the extension cord into the outlet until the pickle is hooked to the exposed cord. This mistake could electrocute the presenter.

Tesla Coil:

- Tesla coil

Turn on the Tesla coil and bring it close to a metal object. A bolt of electricity will be seen. Ask for a volunteer to be "shocked." It will not harm the individual as the Tesla coil produces a low current, but a voltage of about 40,000 V. It is current that can be harmful. An individual may also hold onto the end of the Tesla coil (before it is turned on, and without breaking contact until it is turned off) and shock other willing individuals.

Human Light Bulb

- Fluorescent light bulb
- Tesla coil

Obtain a long fluorescent bulb. Have one person grab the end of a Tesla coil before it is plugged in. This same person should hold the bulb close to one end. Another person can hold the opposite end of the bulb. After all persons are in place, plug in the Tesla coil. The electricity will flow through the person holding the Tesla coil, through the bulb, and finally through the person on the other end of the bulb. Do not allow anyone to break contact with the bulb or the Tesla coil until the Tesla coil is unplugged or they will get shocked.

Methanol Cannon:

- 1 L Nalgene bottle
- 2 Nails
- Cork
- Methanol
- Tesla coil

Prepare the cannon by inserting two large nails through the sides of a heavy plastic bottle. The points of the nails should be separated by about 1/4 inch to provide a gap. Add about 1 mL of methanol to the bottle, cork the bottle, then shake the bottle to vaporize and distribute the methanol (It may help to blow some air into the bottle before corking it). Point the cannon away from students, and use a Tesla coil to apply a spark to the head of one of the nails. The result is a loud explosion, and the cork will be ejected.

Gun Cotton (Nitrocellulose):

- Cotton balls
- Lighter
- Nitric acid
- Sulfuric acid
- Tongs

Hazards:

1. *Nitric acid and sulfuric acid are strong acids and powerful oxidizing agents, and can cause severe burns.*
2. *Since the mixing of concentrated nitric acid and sulfuric acid evolves considerable heat, the procedure must be carried out in an ice bath.*
3. *Gun cotton is extremely flammable and can explode if ignited in an enclosed space.*

Preparation of Cotton:
Place a 1 L beaker in an ice bath, and add 210 mL of concentrated sulfuric acid, and slowly add 90 mL of concentrated nitric acid while stirring to the beaker. Unroll the cotton balls so that the cotton is a thin strip. With tongs, immerse each piece in the acid solution. Let the cotton stand for 1 hour. After 1 hour, dilute the acid mixture carefully and rinse down the drain. Rinse the cotton several times in a strainer to remove excess acid. Squeeze dry and spread on paper towels to dry overnight.

Show how a regular cotton ball burns. It looks similar to a marshmallow, and there is carbon ash remaining after combustion. Using the gun cotton, hold a piece with tongs. Light the cotton with a lighter. The cotton will burn quickly and leave no ash. The combustion of gun cotton is an example of a complete combustion into gases, H_2O, CO_2, and N_2.

Lycopodium Powder:

- Candle and holder
- Lycopodium powder

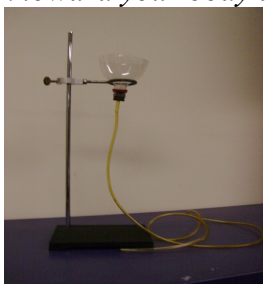
Hold some lycopodium powder in one hand, close to the fingertips. Put your hand close to the flame and begin to release the powder to release the fine dust. As the powder catches on fire, move your hand away from the flame, still releasing the powder. The powder itself is not flammable, but like in grain fires, if it has a large enough surface area, it will ignite. The flame will follow your hand as long as it has a large enough surface area. *Caution: Do not swing your hand toward your body or anything flammable.*

A less dangerous method of demonstrating lycopodium powder is to put some in a wash bottle. Squeeze the powder into the flame of a Bunsen burner.

Methane Bubbles:

- Lighter
- Dish soap
- Methane gas
- Soda bottle
- Tubing in a stopper and glass tube

Prepare a dilute solution with dish soap. (About 1 drop of soap per 1 L of water.) Cut off the top 6" of a 2 L soda bottle and stopper it with a one-holed stopper fitted with a glass tube connected to a rubber hose. Set the bottle top into a iron ring and fill it ½ full with the soap solution (make sure that the level of the solution is above the glass tube). Connect the hose to a methane tank, and turn on the tank gently. Bubbles will begin to form in the apparatus. Methane gas will fill the bubbles. (If the bubbles fall over, the soap solution is too concentrated. If the bubbles do not grow, the soap solution is too dilute.) Once there is a tower of bubbles, collect the bubbles in one hand, and with your arm fully extended, light the bubbles with a lighter. Since methane is lighter than air, the bubbles will burn upward, and only a small amount of heat will be felt. *Caution: be sure that the bubbles are only on the top of your hand, and that your arm is fully extended. Do not pull your hand back toward your body after lighting the bubbles*



Flame Thrower:

- Fisher Burner
- Gummy bears, gum, or wood splints (any organic material)
- Potassium chlorate
- Pyrex test tube
- Ring stand and clamp

This demo can help to illustrate why food, gum, etc. are not permitted in the lab. Clamp a test tube to a ring stand. Place $KClO_3$ in the bottom inch of the test tube. Heat with a Fisher burner until the $KClO_3$ melts completely (a Bunsen burner will take longer to melt). Extinguish thevurner, then insert any organic material (such as a wood splint, gummy bears, etc.) into the test tube to produce a flame thrower effect. *Caution: Stand back as you put the splint in the test tube, and quickly move your hand away from the mouth of the test tube. Some of the organic material may be expelled from the test tube. Be sure not to direct the test tube toward other people or anything flammable, since the flames will be quite intense.*

Hydrogen Balloon:

- Candle on a 2 m stick
- Hydrogen gas
- Large balloon
- String

Fill a balloon with hydrogen and tie it closed. Use string to fasten the balloon to a heavy object, such as the cap to the hydrogen gas tank. Warn students to cover their ears, and then ignite the balloon using a candle on a meter stick.

Hydrogen and Oxygen Balloon:

- Paper towel/paper on a 2 m stick
- Hydrogen gas
- Large balloon
- Oxygen gas
- String

Caution: This explosion is extremely loud. It should be done outside and at a distance from students. Students should cover their ears. The person igniting the balloon should wear ear protection.

Fill a balloon with hydrogen and oxygen (two parts hydrogen, one part oxygen). Ignite the balloon with a burning piece of paper or paper towel on a meter stick. (The paper will not go out as easily as a candle).