

Classroom Safety Demonstration

Invisible dangers

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Basic Procedure and Guidance

Safety: This demonstration involves open flame. Be sure to have fire safety equipment ready before beginning the demonstration.

Materials:

Five 600 ml Beakers
Two 150 ml Beakers
One 250 ml Beaker

Ethanol (Ethyl Alcohol) ~75% aqueous solution by volume (not denatured)
2-Propanol (Isopropyl Alcohol) >90% by volume
Hydrogen Peroxide, 3% (household peroxide)
Sodium Hypochlorite Solution, 6% (household bleach)
Water

One 5 gallon Bucket (for fire control)
Two metal pie pans (for fire control)
Fire Blanket (get out the class fire blanket. At minimum cotton towel previously soaked in water and wrung out to damp dry)
Fire Extinguisher (suitable for chemical fire)

Several long cotton swabs
Test tube holder or vise grip pliers (to hold cotton swab at a distance)
Twenty dark color cloth rags, 10 cm x 10 cm
Tongs
Beaker tongs (suitable to lift 600 ml beaker)
Votive candle
Matches or Gas Lighter
Two Lab coats (one to wear, one to hang on coat rack)
Coat Rack
Safety Goggles
Cookie sheet (optional)

Setup:

1. Wear lab coat and safety glasses
2. Position fire extinguisher in conspicuous place next to stage
3. Position fire blanket in conspicuous place next to stage
4. Fill 5 gal. bucket with 2.5 gal of water and set to side of the stage for fire control. Assure an unobstructed path between stage and water.
5. Optional - Place cookie sheet in front of stage on the floor
6. Hang lab coat on coat rack to side of stage
7. On fireproof table top set out five 600 ml beakers
8. From left to right, fill each 600 ml beaker with 100ml of one of the following chemicals:
 - a. Water
 - b. Ethanol
 - c. Hydrogen peroxide
 - d. Isopropyl Alcohol
 - e. BleachLabel each beaker
9. Return chemical supplies to a safe distance from the stage.
10. Place the pie tin in a handy location near the 600 ml beakers. The pie tin will be used to extinguish fire in the beaker.

Safety note: Separate the Isopropyl Alcohol beaker from the Ethanol beaker by at least 0.5 meter. Later in the demonstration the ethyl alcohol will be ignited and burning so the two alcohols need to be separated so one does not ignite the other.

11. Fill 150 ml beaker with 50 ml of Ethanol, (deep enough to cover end of cotton swab). Place to the side of the stage. This beaker serves as the fuel source for the cotton swab torch.
12. Fill 250 ml beaker with 150 ml of water. Place to the side of the stage to use to extinguish the burning swabs.
13. Light votive candle. Locate the votive candle 0.5 m from any of the beakers with alcohol.
14. Fill 150 ml beaker with 75 ml of water
15. Place two pieces of dark cloth on the stage visible to the audience
16. Secure a cotton swab in the test tube clamp

Dialog and Demonstration:

1. “Here on the stage are five beakers containing different substances.” Ask the class about the state of matter of these substances and their appearance. Discuss the difference between clear and colorless.
2. “Today we are going to talk about invisible dangers and you will see why it is absolutely essential that you follow lab instructions and why you may never, never fool around the in the lab. There will be zero tolerance for misbehaving in lab.”
3. Pick up the 150 ml beaker of water
4. “I have in my hand a beaker of a clear, colorless liquid.” Throw some water on the hanging lab coat. “Oops, now I have spilled something on my partners clothes! What’s going to happen now? It’s too late to say: ‘I’m sorry.’”
5. Pick up a piece of the dark cloth squares with tongs and immerse in the beaker of bleach. Say: “What if the liquid I spilled on my partner was some of this stuff: any problem?” After just about 30 seconds, the cloth begins to be bleached. Hang the cloth over the side of the table so the students may see and observe the cloth over time. No need to answer the question, just move on with the demo. During the course of the presentation the bleach will discolor the cloth, perhaps put a hole in the fabric. If you wish, you can comment on the result later. Move on.
6. Light the votive candle. “Fire can be your friend, but you must treat it with respect.”
7. “On this table are several chemicals. Each has uses; all have dangers you must respect.”
8. Pick up the cotton swab already in the clamp. Dip it in the 150 ml beaker of ethanol and light the end of the cotton swab by passing it over the candle. “In front of me are four clear, colorless chemicals. Will any of these burn?”
9. Put the flaming cotton swab down into the 600 ml beaker of bleach, close to the liquid surface. “No; this does not burn.” Extinguish the flaming swab in the 250 ml beaker of water.
10. Pick up another cotton swab in a clamp, dip it in the 150 ml beaker of ethanol and light the end of the cotton swab by passing it over the candle.
11. Put the flaming cotton swab down into the 600 ml beaker of isopropyl alcohol and watch the liquid burn with a yellow-blue flame. “Does this burn? Yes.” Extinguish the flaming swab in the 250 ml beaker of water. Once the class realizes they can see the flame in the beaker of isopropyl alcohol, place the pie pan over the beaker to extinguish th flame.

12. Put another flaming cotton swab down into the hydrogen peroxide beaker. “Does this stuff burn? No, this does not burn.” Extinguish the flaming swab in the 250 ml beaker of water.
13. Put another flaming cotton swab down into the 600 ml beaker of ethanol and note that the liquid burns with a blue flame that is barely visible. “Does this burn? I can’t tell.” Ask the class if they can see it burning. Holding a piece of the dark cloth with tongs, pass the cloth over the flaming ethanol beaker and show the class the burning cloth. “See, the liquid was burning even though you could not see the flame. This is one of the invisible dangers to watch for.”
14. Thrust the burning cloth into the 5 gallon bucket of water and drop the fire blanket on the flames to extinguish the fire.
15. “Class! Why is there zero tolerance for bad behavior in lab? The reason is because there are no second chances, no ‘do overs’. The chemicals will do as they will and there is nothing you can do to change that.” Hold up the bleached cloth. “Once you have spilled on your partner the damage is done!”
16. “Did anyone notice the liquid in this beaker is burning? It’s still burning now.” Rinse the cotton swab in the water and then dip it in the small beaker of ethanol. Pass the cotton swab over the ethyl alcohol again. It will ignite. Breathing on the flames may add enough contaminants to make the flame visible. Extinguish the flame by covering the beaker with the pie tin as before.
17. “One point of this demonstration is to show you there may be invisible dangers in the lab, especially if you deviate from the instructions. You may NEVER deviate from the instructions you are given. You may never horse around in lab. There will be zero tolerance for misbehavior!”