Safety in Chemical Demonstrations

Chemical Demonstrations

https://www.youtube.com/watch?v=AatVxtYPubE

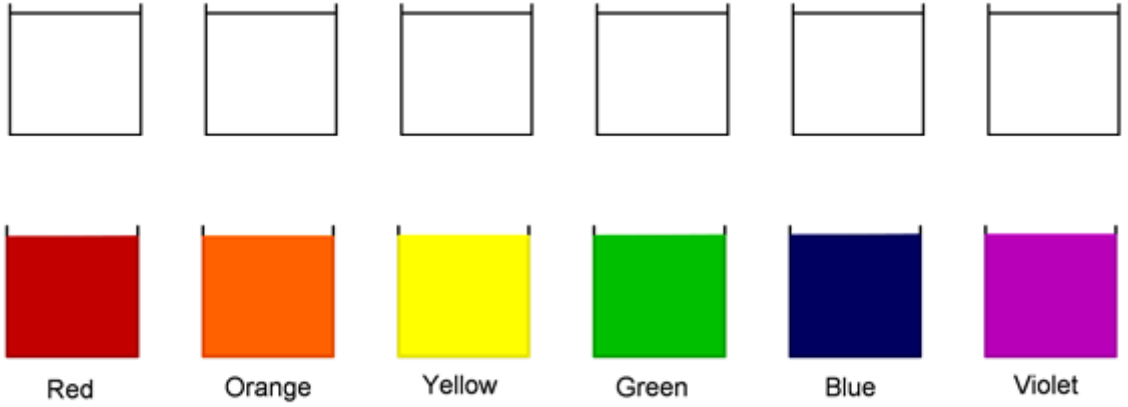
Chemical Demonstrations

- Can be effective in showing teacher enthusiasm

Chemical Demonstrations

- Can be effective in displaying scientific phenomena in the classroom

Rainbow Connection



Shows the dramatic color change of solutions containing indicators at different pH levels.
Demonstrates the reversibility of indicator color changes

Chemical Demonstrations

- Can be effective in sparking student interest

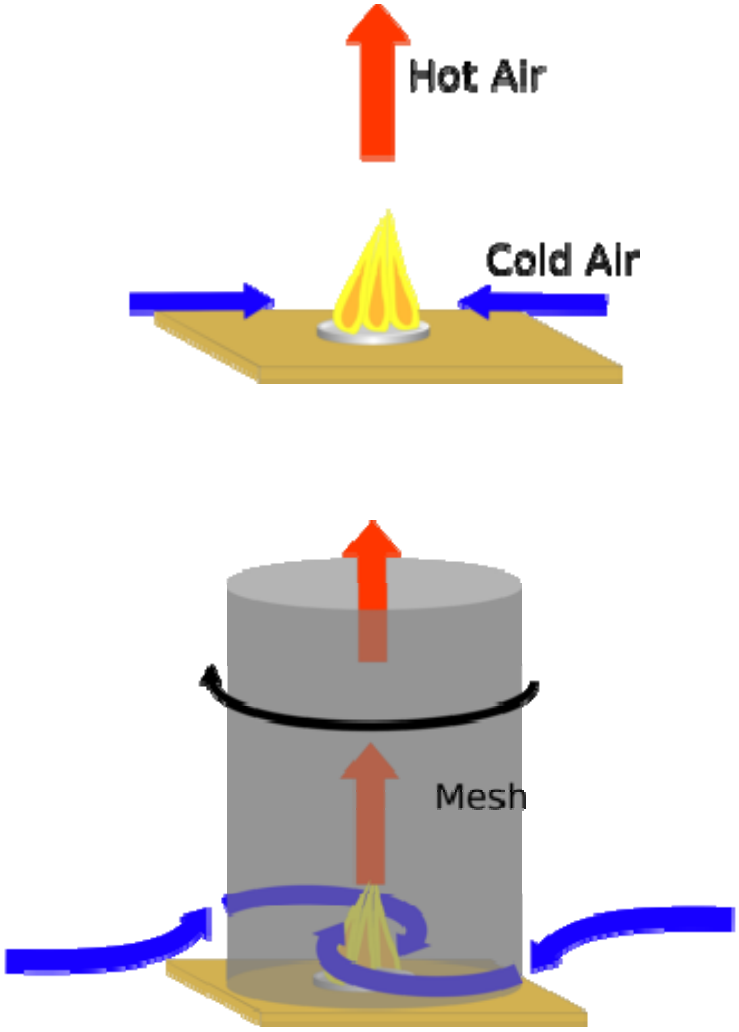
Chemical Demonstrations

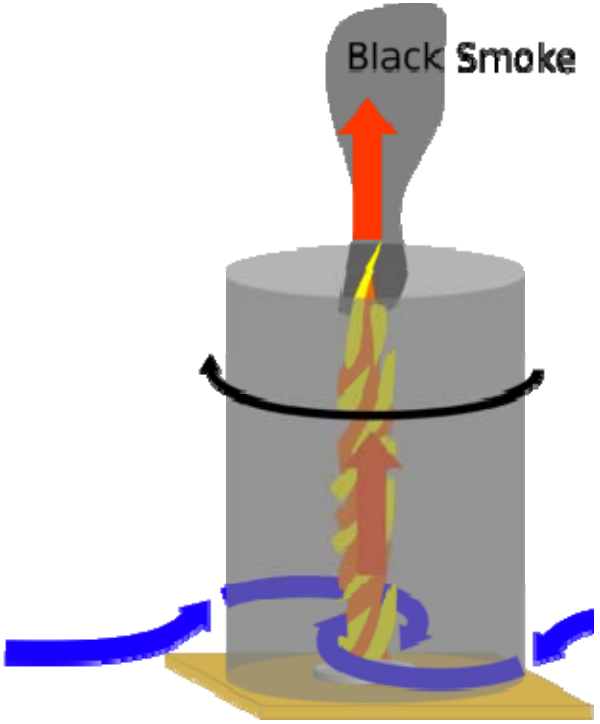
- Can be effective in initiating scientific inquiry

Chemical Demonstrations

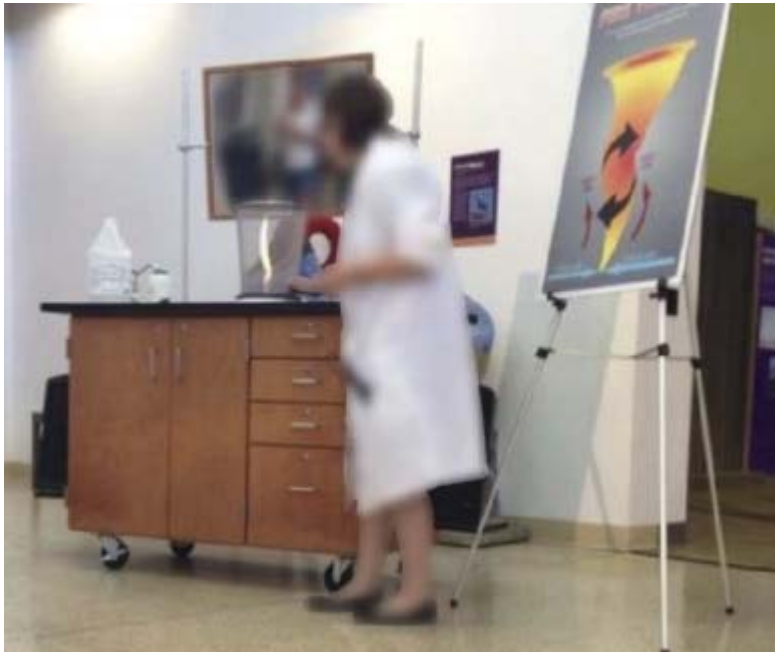
- Promotes
  - higher level thinking,
  - meaningful learning, and
  - better retention of information

Fire Tornado





Fire Tornado



Fire Tornado

Rainbow Flame Test

Rainbow Flame Test

http://www.csb.gov/file.aspx?DocumentId=637

Rainbow Flame Test

http://www.csb.gov/videos/after-the-rainbow/

http://www.nfpa.org/news-and-research/publications/nfpa-journal/2015/september-october-2015/features/unsafe-science

Hydrogen Explosion

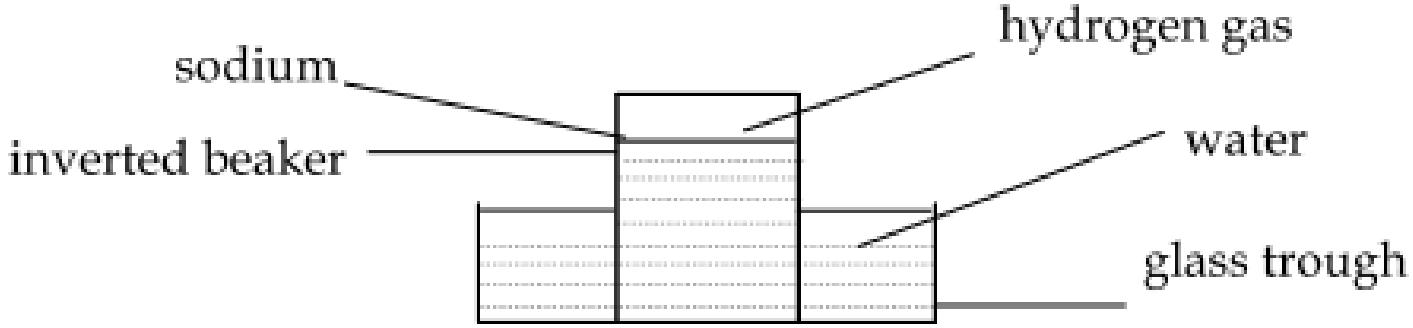
A teacher was demonstrating an experiment on testing hydrogen gas. The purpose of the experiment was to ignite the hydrogen gas trapped in the soap bubbles to produce a "pop" sound, a typical property of hydrogen gas. The experiment was included in the teaching plan for the first time.

The teacher tried to prepare some soap bubbles on the bench mat from hydrogen gas generated from a reaction flask containing some zinc granules and dilute hydrochloric acid. The teacher failed to make the soap bubbles after a few attempts. Aiming at producing the desired outcome, she then decided to light up a splint first and tried to ignite the soap bubbles once they were formed. Unfortunately, the burning splint was placed too close to the set-up. The flammable hydrogen gas inside the set-up was ignited and gave rise to an explosion.

During the demonstration, the students were either sitting or standing in front of the teacher's bench. The teacher, the laboratory technician and a number of students were injured by broken glass.

A Vigorous Reaction

In a demonstration experiment, a teacher allowed a piece of sodium to react with water in an inverted beaker as shown:



When some hydrogen gas was collected, the piece of sodium stuck onto the inner bottom of the beaker and the reaction stopped. The teacher attempted to start the reaction afresh by shaking the beaker so as to dislodge the sodium. In doing so, some air accidentally got into the beaker of hydrogen. Somehow, an explosion occurred and the beaker shattered into pieces. A student standing opposite to the teacher was hurt by glass fragments.

Root Causes of Accidents

- Insufficient time to prepare and test demonstrations
- Lack of knowledges of suitable demonstrations
- Lack of safety awareness
- Lack of confidence / Too confidence

Safety Guidelines for Chemical Demonstration

- Know the properties of the chemicals and chemical reactions involved in all demonstrations presented
- Conduct risk assessment to identify potential hazards and take necessary safety precautions
- Practice all demonstrations before performing them in front of students
- Wear appropriate personal protective equipment for all chemical demonstrations

Safety Guidelines for Chemical Demonstration

- Have students wear safety googles or use a safety shield if there is the slightest possibility that a container, its fragments or its contents could be propelled with sufficient force to cause personal injury
- Don’t taste or encourage spectators to taste any nonfood substances or contaminated food.
- Make sure all glassware is borosilicate if heat is involved in the demonstration

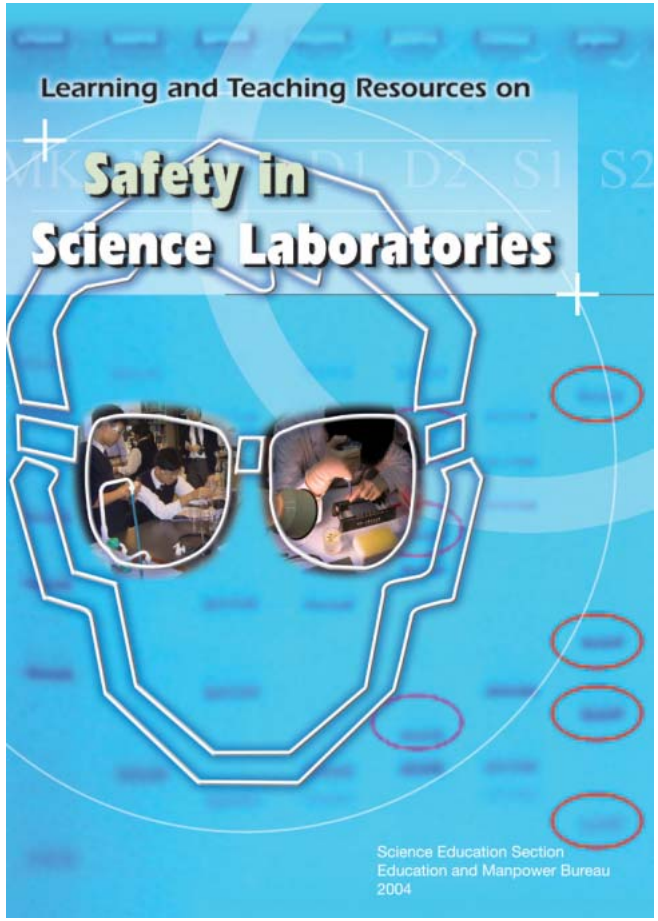
Remember

- Have a educational objectives and benefit
- Understand the chemistry of the demonstration
- Do a safety evaluation and minimize risks
- Try it out before
- Integrate it into the lesson so that you can get educational value from it
- Use it to teach and stimulate thinking not just to entertain

Never attempt a demonstration that will place you or your students at risk

https://www.youtube.com/watch?v=6DFrSd21q9o

Resources



Experiment: To Investigate the Hydrogen Bonding in some substances

1. Using a measuring cylinder, add 5 cm^3 of ethanol into a boiling tube. Measure the temperature of the liquid.
2. Add 5 cm^3 of cyclohexane to the ethanol in the boiling tube.
3. Shake to mix well. Record the lowest temperature attained.

Sample Risk Assessment:

Hazardous substances being used or made, procedure or equipment	**Nature of hazards**	**Control measures and precautions**	**Source of information**
Ethanol	Flammable	Keep container tightly closed and away from sources of ignition.	International Chemical Safety Cards
Cyclohexane	Flammable	Keep container in a well-ventilated place and away from sources of ignition. Dispose of properly into a waste bottle inside the fume cupboard.	International Chemical Safety Cards
Thermometer	Glass thermometer may break when handled improperly.	• Use alcohol or digital thermometer. Avoid the use of mercury thermometer for measurement of this temperature range. • Handle the thermometer carefully when mixing the liquids. • Return the thermometer back to its casing immediately after experiment and put it in a safe place. Do not place the thermometer in the measuring cylinder as it may be easily toppled.	Teacher's previous instructions.

Resources

The “Rainbow Connection” experiment
http://www.flinnsci.com/media/622105/91853.pdf