

The Rainbow Demonstration

The genie in the bottle

Education in Chemistry

September 2018 With modifications by David A. Katz

rsc.li/2PyWj3w



Kit

- 50 cm³ of methanol (highly flammable liquid and vapour, harmful) NOTE: Ethanol can be substituted for the methanol. (**NOTE: Ethanol is highly recommended for this demo.**)
- 2.5 – 3.0 g of the following salts:
 - lithium chloride (*Hazard 47B*)
 - sodium chloride (*Hazard 47B*)
 - potassium chloride (*Hazard 47B*)
 - anhydrous calcium chloride (irritant) (*Hazard 19A*)
 - hydrated strontium chloride (*Hazard 19A*)
 - hydrated barium chloride (harmful, toxic) (*Hazard 10A*)
 - hydrated copper(II) chloride (harmful, irritant, very toxic to aquatic life) (*Hazard 27A*)
 - **Optional:** Boric acid (may damage fertility, may damage the unborn child) (*Hazard 14A*)
- 7 80 mm borosilicate crystallising dishes or 250 cm³ borosilicate beakers (Beakers are recommended.)
- Heat-resistant mats (or ceramic fibre hot pads)
- wooden splints

Safety

Methanol is highly flammable. Avoid all flames and sources of ignition. When setting up the demonstration, use a bottle of methanol no larger than 100 mL. Approximately 50 mL of methanol is needed. Do not add the methanol to the beakers of salts until just before the demonstration is to be started. Do not leave the beakers containing methanol uncovered for more than 1 – 2 minutes. Seal the bottle of methanol after pouring the alcohol into each beaker, even if it is empty, and move it at least 2 m away from the demonstration.

Once the demonstration is started, do not, under any circumstances, attempt to add additional methanol to any of the beakers. The beakers will remain hot for at least 10 to 15 minutes. Do not attempt to add methanol to any beaker that is warm or hot. If you want to show the demonstration again, start with a new setup at room temperature.

The beakers will get hot during the demonstration. Place each beaker on a ceramic fibre hot pad or other fireproof/heat proof material.

Preparation

Work in a well-ventilated room and wear eye protection. Place the beakers / crystallizing dishes on the heat-resistant mats and spread 2.5 – 3.0 g of each salt around the bottom of the container. Dampen the solid with approximately 0.5 cm³ of water and add approximately 6 cm³ methanol or ethanol over each. Stopper the ethanol bottle and remove it to at least 2 m away from the demonstration.

In front of the class

Position the audience 3 m away from the demonstration with eye protection. Ask for a volunteer to switch off the lights if the switch is not nearby. Ignite the solvent in each container with a splint on a metre rule. Each beaker will burn with a characteristic colour. Allow the flames to burn out – do not attempt to add more solvent until at least 15 minutes have passed since the last flame extinguished.

Safety and disposal

Boric acid is a teratogen – you may not wish to use it.

Do not be tempted to pour more alcohol onto the flame or hot glassware in order to extend the demonstration. Use only borosilicate glass (avoid watch glasses, which are usually made from soda glass and may crack).

The beakers used in this demonstration will get very hot. The beakers should be placed on ceramic fibre insulating boards or equivalent to protect the benchtop. Handle the hot beakers with the proper beaker tongs.

Dilute the contents of the copper(II) chloride beaker to 1 L and pour down the sink. The other salts will be unchanged at the end of the demonstration and can be retrieved and recycled for future demonstrations.