

Acid Rain in a Beaker

Instructions

Materials:

Large beaker to hold water and a smaller beaker (50-mL or 100-mL)

Universal pH Indicator

Copper wire

Concentrated nitric acid, $\text{HNO}_{3(\text{aq})}$

Water

Aluminum foil

Safety Precautions*: This reaction should be carried out in a fume hood and you should proceed with extreme caution. Nitric acid is a very corrosive chemical. The nitrogen dioxide gas generated is noxious and toxic. Wear chemical-resistant gloves and goggles. If you have any concerns, you should show the video demonstration and use the information on this page to explain the procedure.

Set Up:

1. Add only enough water to the larger beaker so that it's clearly visible to the class.
2. Add universal indicator to the water and mix the solution until you see the green color.
3. Place the smaller beaker carefully in the center of the large beaker. Be sure that it's not tilted.
4. Carefully pipet 1.0 mL of concentrated nitric acid into the small beaker.
5. Have a piece of aluminum foil ready to cover the top of the large beaker. You can poke a few small holes in the foil ahead of time.

Demo Procedure:

1. Point out to your audience that the small beaker contains concentrated nitric acid and the larger beaker just has water and universal indicator.
2. Clearly hold up the pieces of copper and gently place the copper inside the smaller beaker.
3. Cover the top of the larger beaker with the aluminum foil to keep the brown and noxious nitrogen dioxide gas from escaping. Wait 1-2 minutes and let the gas collect and concentrate inside the beaker.
4. Add small amount of water to the top of the aluminum foil. The water should drip through the holes into the larger beaker. A reaction occurs between the water and the nitrogen dioxide gas producing nitric acid which drops down into the water at the bottom of the larger beaker.
5. The neutral aqueous solution is acidified by the nitric acid "rain", this is indicated by the green aqueous solution changing into a red solution.

Waste Disposal*: The final acidic solution should be diluted with water and neutralized safely with sodium bicarbonate (baking soda). The copper (II) nitrate solution in the small beaker needs to be collected and disposed properly. Do not pour solutions that contain copper ions down the drain.

**For specific information about safety and proper waste disposal please contact your science specialist at the local or state board of education. This is recommended by the Council of State Science Supervisors in the following Science & Safety document (<http://www.csss-science.org/downloads/scisafe.pdf>).*