

University of Utah Chemistry Demonstration:

Universal Indicator Reaction

Reagents:

1800 mL distilled H₂O

7 mL universal indicator

(if you have prepare: Make a 1 L solution of 25 mL methanol, 25 mL isopropanol, and 50 mL H₂O. To the solution add 0.50 g methyl red, 0.80 g bromothymol blue, 0.11 g thymol blue, and 1.72 g phenolphthalein)

Small amount of 6 M NaOH (~5 mL)

Concentrated HCl

Dry ice (CO₂)

From the stock room retrieve ~1.25 lbs in the white Styrofoam box. You will not need this much; it is just to be safe. Check stock room hours. Ask if you need help retrieving CO₂.

Instructions:

Since this reaction could fizz over, place the 2 L graduated cylinder in something easy for clean up (ie. the plastic rectangular container)

- Add 7 mL of universal indicator to 1800 mL H₂O in a 2 L graduated cylinder. Stir until the indicator is uniformly distributed through the H₂O.
- Add a small amount of 6 M NaOH. Only a small amount of NaOH is needed to turn the solution into a deep purple.
- Using a heavy glove, add a small piece of dry ice (about the size of a golf ball) to the cylinder. If needed, more dry ice can be added in the same size increments. To break the CO₂ into smaller pieces use something to act as a pick (screwdriver) and a hammer.

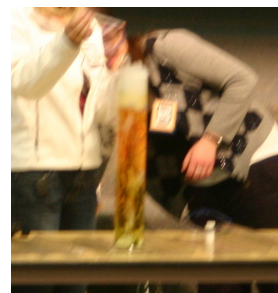
You will observe the colors change from purple → blue → green → orange (sometimes the rxn will stop at green, and not advance to orange). If you would like to repeat the experiment:

- Add 1 mL concentrated HCl
- Add a small amount of 6 M NaOH
- If needed add more dry ice

The addition of HCl and NaOH can be done only a couple of times.

Disposal: Let the reaction stop bubbling, and then it can be poured the down drain.

The color transitions represent a change in pH. The solution runs from basic to acidic (purple to orange) when CO₂ is added. The CO₂ reacts with water to form carbonic acid, thus decreasing the pH. The addition of HCl will cause the solution to turn red (most acidic). This addition is needed because the carbonic acid does not become acidic enough to reach the red color. Adding more NaOH brings the solution back to basic.



SAFETY

CO₂.....extremely cold.
Do not let skin come in contact.
Wear heavy (winter) gloves when handling.

NaOH.....corrosive
Conc. HCl.....corrosive