

4.9 Relative pH of Solutions with Universal Indicator (or pH meter)

Subject: Chemical reactions, acids/bases

Description: The relative pH of some foods and household chemicals is illustrated by the use of Universal indicator or a pH meter.

Materials:

Several 150 mL beakers (~10)

Universal indicator‡

pH meter (optional) – Vernier pH sensor with an interface (Logger Lite or Logger pro software required) or the standalone pH meters.*

Mortar and pestle for grinding tablets

Household products taken from the table below:

Clear, water based liquids: -50 ml household bleach‡ -50 ml ammonia cleaner‡ -50 ml vinegar‡ -clear carbonated beverage (supplied by instructor)	Viscous, opaque liquids or powders: -~5 ml toilet bowl cleaner‡ -~5 ml oven cleaner‡ -~1 tsp Baking soda‡ -~1 tsp crushed vitamin C tablet -~1 tsp crushed aspirin tablet -100 mL water for each of the above powders and viscous liquids
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‡Household cleaners are located on their own shelf in the solutions storage cabinets.

‡Universal indicator is located in the flammables cabinet.

*pH meters are located in the drawers opposite the bin storage shelves.

Instructions for the Vernier sensors are located on the webpage or in the spec sheet included with the sensor.

*Additional glassware is located in the top drawer under the bin storage shelves and also in the top drawer to the right of the sink.

Pre-class Preparation:

Note: If using Universal indicator, all solutions should be clear.

1. Label all beakers in advance
2. Pour clear water based liquids into 150 mL beakers.
2. Crush the aspirin and Vit C tablets (if using) and put the powder into separate 150 ml beakers. Dilute with water.
3. Add viscous or opaque liquids to remaining beakers and dilute with water until clear.

Procedure:

1. Add ~10 drops of universal indicator to all of the sample test tubes, stopper, and mix.
2. Compare color of solutions to a color chart.

Optional: Use pH meter with interface and computer to project the pH.

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Discussion:

This demonstration illustrates a broad range of pH values found in household items and in foods. By showing the pH of a large range of items, patterns in pH can be seen. Food tends to be more acidic while cleaning products tend to be more basic.

If bleach is used with the Universal indicator, it will react with components of the Universal indicator and be colorless, demonstrating that Universal indicator is not suitable for all substances.

Safety: Use caution when handling some of the more caustic or corrosive of the household products.

Disposal: Dilute all solutions with large amounts of water and flush down the drain.

Reference:

1. B.Z. Shakhashiri. *Chemical Demonstrations: A Handbook for Teachers of Chemistry*; Wisconsin; 1989; Volume 3; p. 65-69