

The pH Is Right Game

Introduction to Acids and Bases



Introduction

Let the whole class play along in this version of the Price Is Right! Guess the properties and pH of common household substances. Competitive and fun!

Concepts

- pH Indicators
- Acids and Bases

Materials

- | | |
|--|----------------------------|
| Universal indicator solution, pH 4–10, 0.5%, 35 mL | Household chemicals, 6–10* |
| Water, distilled | Stirring rods, 2–3 |
| Beakers, 600-mL, 6–10 or clear plastic cups | |

*Some suggestions for household chemicals are given in the tips section

Safety Precautions

Universal indicator solution is an alcohol-based solution and is a flammable liquid. Some household chemicals are toxic by ingestion or inhalation and are skin and eye irritants. Avoid contact of all solutions with eyes and skin and clean up spills immediately. All food-grade items that have been brought into the lab are considered laboratory chemicals and are for lab use only. Do not taste or ingest any material in the lab and do not remove any remaining food items after they have been used in the lab. Wear chemical splash goggles, chemical-resistant gloves, and a chemical-resistant apron. Wash hands thoroughly with soap and water before leaving the laboratory. Please review current Material Safety Data Sheets for additional safety, handling, and disposal information.

Procedure

1. Place eight to ten household products in their original product containers at the front of the room. Place a beaker of distilled water next to all the products that are in a solid form.
2. Begin the game by selecting three volunteers. Perhaps use a “game show announcer” voice to call down three people from the class to be participants in the game.
3. Pick up the first product and give a description of the item. *Note:* Adding flair to the presentation will add to the fun of the game for the class.
4. After the product has been described, the contestants are asked to decide whether it is an acid or base, and their responses are recorded for everyone to see. *Note:* It is a good idea to change the order of participant response after each item to eliminate the possibility of one participant always being copied by the other two.
5. After all of the items have been cycled through and the contestants have given their responses, reveal the answers by testing each item with a few drops of the universal indicator solution. Place solid items in a beaker or clear plastic cup and add distilled water. Stir to dissolve. Liquid items may be tested “as-is” or diluted to make the indicator color change more visible. An alternative would be to test each item as soon as contestants have given their responses.
6. Tally the correct responses and announce the winner.

Disposal

Please consult your current *Flinn Scientific Catalog/Reference Manual* for general guidelines and specific procedures governing the disposal of laboratory waste. Universal indicator solution may be disposed of down the drain with an excess of water according to Flinn Suggested Disposal Method #26b. Many household items may be disposed of according to Flinn suggested disposal method #26b.

Tips

- The game can be reasonably completed in approximately 10–15 minutes, depending upon the number of items you choose to use and the degree of showmanship which you put into the presentation.
- For best results, use either bottled water or freshly distilled water when diluting or dissolving products. Distilled water absorbs large amount of CO₂ from the air during storage and may test slightly acidic instead of neutral.
- This lesson provides an opportunity to show that many common products, even those we consume for food, may contain acid and base materials.
- This demonstration could be an excellent introduction to a unit on acid-base chemistry.
- To add excitement to the presentation, select a prize to be given to the winner of the game. An ad from a magazine showing a sports car makes for an effective gag, by handing the winner only the picture itself.
- This demonstration could also be done in a simple and efficient manner by holding up the products, one at a time, and having all the students in the class guess whether each is an acid or base. The intent is to introduce the terms acid and base by using examples of consumer products which are, or which contain acids and bases.
- Listed below are some common household chemicals that provided interesting results. Included are suggestions for playing the game at several different levels of sophistication. Individuals may be able to come up with choices that seem more suitable to their own presentation and are encouraged to make additions and deletions.

Basic Level

(A) Vinegar
 (B) Baking Soda
 (B) Windex
 (B) Tums or Rolaids
 (A) Lemon juice or a lemon
 (A) Soda pop or tonic water
 (B) Bathroom cleaner
 (A) Aspirin
 (B) Detergent
 (B) Drano

Some Substitutions for Intermediate Level

(A) Liquid Plummer
 (B) Oven Cleaner
 (A) Visine
 (A) 10-0-6 Lotion
 (B) Milk of Magnesia
 (B) Shaving Cream
 (A/B) Alka Seltzer**

Some Substitutions Advanced Level

(A) Naval Jelly*
 (A) Zud*
 (B) Loreal Setting Lotion
 (B) Wel-cote Masonry Plug*

*Naval Jelly is a rust remover in which the main ingredient is phosphoric acid. ZUD is a stain remover in which the active ingredient is oxalic acid. Wel-cote Masonry Plug contains Portland cement and lime.

**When first added and bubbling occurs, Alka Seltzer tests acid. After standing, it tests slightly basic.

Discussion

Acids are compounds that release hydrogen ions (H⁺, the same as a proton) in solution. Acids are corrosive, sting if they contact broken skin, and taste sour. *Bases* are compounds that release hydroxide ions (OH⁻) in solution. Bases feel slippery as solutions, are corrosive, and have a bitter taste. (*Note:* Taste should never be used to identify a lab chemical, and chemicals should not be touched with the bare skin.)

To express the concentration of hydrogen ions in solution, a term called *pH* (potential of hydrogen) is used. The *pH scale* ranges from 0–14. If the concentration of H^+ ions is greater than the concentration of OH^- ions, then the substance is considered acidic and has a pH value lower than 7. Conversely, if the concentration of OH^- ions is greater than the concentration of H^+ ions, then the substance is basic and has a pH value greater than 7. If the H^+ and OH^- ion concentrations are equal (as in pure water, H_2O), the substance is neutral, with a pH value of 7. Figure 1 provides pH values for some common substances.

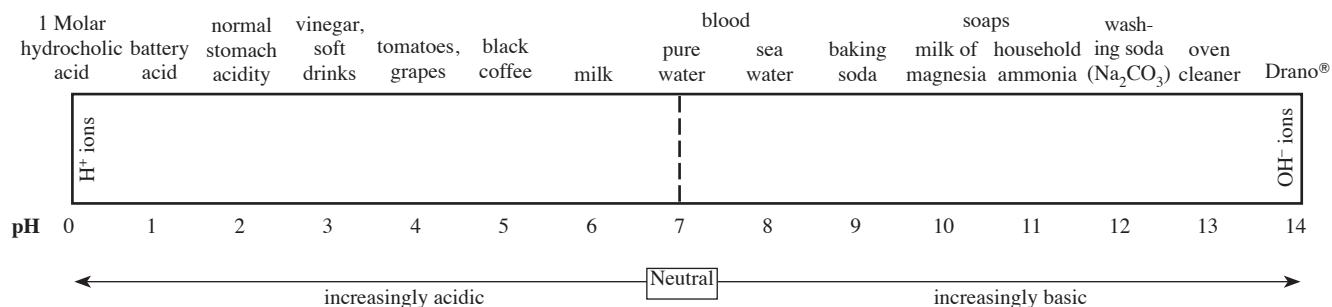


Figure 1. pH Values for Some Common Substances

Universal indicator solution is red in acidic solutions having $pH < 4$, green in neutral solutions, and purple in basic solutions having $pH > 10$.

Connecting to the National Standards

This laboratory activity relates to the following National Science Education Standards (1996):

Unifying Concepts and Processes: Grades K–12

Evidence, models, and explanation
Constancy, change, and measurement
Form and function

Content Standards: Grades 5–8

Content Standard A: Science as Inquiry
Content Standard B: Physical Science, properties and changes of properties in matter

Content Standards: Grades 9–12

Content Standard A: Science as Inquiry
Content Standard B: Physical Science, structure and properties of matter, chemical reactions

Flinn Scientific—Teaching Chemistry™ eLearning Video Series

A video of *The pH Is Right Game* activity, presented by Jamie Benigna, is available in *Introduction to Acids and Bases* and in *Classroom Fun*, part of the Flinn Scientific—Teaching Chemistry eLearning Video Series.

Materials for *The pH Is Right Game* are available from Flinn Scientific, Inc.

Catalog No.	Description
U0009	Universal Indicator Solution, 35 mL
GP1030	Beaker, 600 mL
GP5075	Stirring Rods, Glass, Pkg/10
V0001	Vinegar, Cider, 1 L
S0043	Sodium Bicarbonate (Baking Soda), 500 g
A0126	Cleaner, Alconox®, 4 lb
A0038	Ammonia, Household, 10%, 64 oz
A0201	Aspirin, Tablets, Bottle. 100
M0122	Magnesium Hydroxide (Milk of Magnesia), 500 mL
A0111	Alka-Seltzer®, Pkg/24

Consult your *Flinn Scientific Catalog/Reference Manual* for current prices.