

Measuring pH with a pH Probe

pH can be measured in several ways. Probes can be used to measure pH very exactly. pH probes work by measuring the voltage potential of a test solution compared a standard. pH paper can also be used but is less exact. pH paper is saturated with a pH indicator. When the paper is dampened with the test solution it will change color. The color is compared to a standard color chart which indicates the solution's pH. Other indicators, both organic and inorganic liquids can be dropped into samples of a solution. Again the indicator changes to a specific color to reflect the solution's pH.

Materials

Water	Water
Small beakers (50 mL)	Sodium bicarbonate (baking soda)
Pipette	Ammonium nitrate (fertilizer)
Small (50 mL) beakers - 9	Milk
Medium (250 mL) size beakers - 2	Vinegar
Hydrochloric acid (stomach acid)	pH probe and pH meter
Lemon juice	Graduated cylinder (50 mL)
Ammonium hydroxide (household ammonia)	

You will be using a pH probe to determine the pH of a number of solutions (see materials list). Write a hypothesis for this activity. Which compounds do you expect to be acidic, basic or neutral?

Procedure

1. Pick up 8 small beakers. Label the beakers with the appropriate test reagent.
2. Add ~25 mL water to the first beaker. Add 25 mL each of the following, hydrochloric acid, lemon juice, milk and vinegar to its own beaker. Keep track of where you put each test reagent.
3. Add a small scoop of ammonium hydroxide to a labeled beaker. Add a small scoop of sodium bicarbonate and ammonium nitrate to the appropriately labeled beakers. Add 25 mL of water to the each of the beakers containing a solid (powder). Remember pH can only be determined in solutions. Gently swirl the beakers to dissolve the solid reagents.
4. Connect the pH probe to the pH meter. ** Turn on the meter. The pH probe may or may not be resting within another container to keep the pH probe wet.
5. Add 25 mL of pH 7 standard to a medium-sized (250 mL) beaker.
6. Remove the pH probe from its container. Hold the probe over a medium-sized (250 mL) beaker and rinse the probe with distilled water.
7. Insert the probe into the beaker containing the pH 7 standard. Use the pH probe to 'gently stir' the pH 7 standard solution. If the pH probe is attached to a stand, then immerse the probe in the standard and gently swirl the beaker.
8. Turn on the pH meter and adjust the reading to pH 7.
9. Remove the probe and rinse the probe with distilled water.

10. Insert the probe into the beaker containing water, swirl. Read the pH and record it in the table below. Remove the probe, hold the probe over the rinse beaker and rinse with distilled water.
11. Insert the pH probe into each beaker container a reagent. Read the pH and record it in the table below. Remove the probe, hold the probe over the rinse beaker and rinse with distilled water before testing the next solution.
12. Complete the table below.

**There are a variety of pH meters and probes that vary in how they are used. Your instructor will provide specific instructions on the pH meter found in your lab.

Tested Compound	pH	Acid or Base	Ion in highest concentration? H^+ or OH^-
Water			
Hydrochloric acid			
Lemon juice			
Ammonium hydroxide			
Sodium Bicarbonate			
Ammonium nitrate			
Milk			
Vinegar			

Was your hypothesis supported? Explain.

Which substance was the most acidic? _____

Which solution was the most basic? _____

Most of the body's environments (cell cytoplasm and blood plasma for example) have a pH near neutrality, however some cells in your stomach produce hydrochloric acid which drops the pH of the stomach to pH 1-2. How do you explain this? Design an experiment that would test your explanation.

What advantages and disadvantages are there to determining pH using a pH probe and pH meter?