Experiments

pH Paper

TERMINOLOGY

Litmus Paper Paper coated with a chemical coloring obtained from lichens that turns red in acidic water and blue in basic water. It is used as an acid-base indicator.

pH Paper Paper that changes color to show the pH of a substance.

The answers to all of the questions in the experiments section can be found at the end of the section, on page 33.

Measuring With pH Paper

For most of the following experiments, you will need a pH indicator. A pH indicator contains a chemical that changes color when it is exposed to acids or bases. For example, LITMUS and pH PAPER turn red in strong acids and blue in strong bases. Because only a few pH indicators measure pH over a wide range of pH values, you will need to find out the pH range of the indicator you use. Typically, the color chart provided with each pH indicator kit will show the pH range of that indicator. Color pH indicators provide only an approximate measure of the pH, or the strength of the acid or base. They are not as accurate as pH meters, but they are adequate for the following experiments.

When measuring pH with pH paper or litmus paper, dip the end of a strip of the paper into each mixture you want to test. Follow the directions on the package regarding how long you need to keep the pH paper in the mixture and how long to wait before reading the measurement. Then compare the color at the wet end of the paper with the color chart provided with that pH indicator. Write down the pH value and color. Always use a clean, unused strip of pH paper for each mixture that you test. Be sure to conduct the pH test for each substance three times, using a new pH paper for each test. Record the results of each test. If possible, have a different student conduct and record each test. This helps to ensure scientific accuracy, consistency, and replicability.

Measuring With pH Meters

A pH meter provides a more precise pH measurement than pH paper. Before using a pH meter, rinse the electrode with distilled water and blot dry with a clean paper towel. Calibrate the meter according to the directions. When testing the pH of a substance, put the electrode tip in the mixture and stir once. Be sure not to touch the bottom or sides of the container. Hold the electrode in the mixture for 1 minute or until the reading is steady. Record the measurement and repeat the test two more times for accuracy and consistency.

For more information on measuring the pH of soil and water, check out the pH protocols defined by GLOBE (Global Learning and Observations to Benefit the Environment) at www.globe.gov/protocols.

Tips

- Except for wide-range pH test paper and pH meters, all the materials called for in these experiments can be obtained at grocery stores or from local lawn and garden stores or nurseries.
- Wide-range pH test paper is pH paper that covers the whole pH scale. Not all pH test papers do this. Other papers cover only part of the pH scale and there are different papers to test for acids, bases, and neutrals. Both kinds are inexpensive, and a school science laboratory will probably have one or the other, if not both. If the school does not already have pH test paper a science teacher may know where to order it, or you may order it on your own through a biological supply company. If you have to order pH test paper, we recommend wide range pH test paper since it can be used for all the experiments, and may be less confusing to younger students.
- Baking soda and ammonia are both bases. You may substitute baking soda for household ammonia in the experiments. If you do, be sure to stir well because baking soda does not dissolve easily in water unless heated. The pH of undissolved baking soda will not be the same as dissolved baking soda.
- Lemon juice and white vinegar are both acids. You may substitute fresh-squeezed lemon juice for white vinegar. Lemon juice is slightly more acidic than the vinegar sold in grocery stores. White vinegar is preferred over cider vinegar or lemon juice because it is colorless and relatively free of impurities.
- Use clean, dry containers and utensils.

Safety In The Laboratory

A science or chemistry laboratory can and should be a safe place to perform experiments. Accidents can be prevented if you think about what you are doing at all times, use good judgment, observe safety rules, and follow directions.

Always wear protective safety glasses or goggles when working on experiments.

Writing down your observations can be very helpful.

- Eye protection (goggles or safety glasses) must be worn when working on experiments. Make a habit of putting them on before the experiment begins and keeping them on until all clean up is finished.
- Do not eat or drink while in the laboratory.
- Do not taste any chemical.
- Long-sleeved shirts and closed-toe, leather-topped shoes must be worn at all times.
- Long hair must be tied back, so it will not fall into chemicals or flames.
- Do not work alone; work with an adult.
- Never perform any unauthorized experiment.
- All glassware must be washed and cleaned. Wipe all counter surfaces and hands with soap and water.
- All experiments that produce or use chemicals must be done in a well-ventilated area.
- Never point the open end of a test tube at yourself or another person.
- If you want to smell a substance, do not hold it directly to your nose. Instead, hold the container a few centimeters away and use your hand to fan vapors toward you.
- When diluting acids, always add the acid to the water; never water to acid. Add the acid slowly.
- Dispose of all chemicals properly, according to the directions of your teacher.
- If you spill any acid or base material on you, wash the exposed area with large amounts of cold water. If skin becomes irritated, see a physician.

Recording Observations

Writing your observations on these experiments will help you to keep better track of the progress of the experiment and help you to remember information for answering questions or writing lab reports. Record keeping can be very simple and still be a help. These hints can help you organize and record your thoughts.

- Use a bound notebook so that pages are not lost.
- Write complete sentences for all written entries.
- Use drawings as needed.
- Date each entry (even drawings).
- Use the title of the experiment as your first entry.
- When your observation entries have been completed, write your answers to the questions that follow each experiment.
- Write your own thoughts about the experiment as the conclusion.