Chapter 6 Acids and Bases

Materials

Please see the teaching notes for each activity for a list of the materials required. Please see page TR-31 for a summary of the materials required in this chapter and other chapters.

Advance Preparation

- Purchase red cabbage, lemon juice, Ivory™ bar soap, and wooden safety matches.
- Verify supplies of universal indicator, a range of other indicators, red and blue litmus papers, pH paper, and pH meters.
- Prepare 1–2 L of red cabbage juice indicator by boiling shredded red cabbage.
- Prepare 0.1 mol/L hydrochloric acid, 0.1 mol/L sodium carbonate, and 0.1 mol/L sodium hydroxide.
- Collect samples of household products to test pH levels (e.g., foods, beverages, cosmetics, soaps, and cleaning materials).
- Copy and laminate sets of playing cards from **BLM 6-4 Acid Playing Cards.**
- Book computer lab or library for research.

In this chapter, students learn to describe chemical reactions that involve acids and bases. They learn how to name and write formulas for acids and bases, use indicators and the pH scale to classify samples as acidic, basic, or neutral, and observe neutralization reactions.

Using the Chapter Opener (Student textbook pages 216 and 217)

- Define *indicator* and show examples. Identify what quality each indicates: pregnancy tests use a pigment that shows only if the pregnancy hormone is present; pool test kits react to the level of free (excess) chlorine or bromine. Survey the class for experiences they have had with indicators outside the chemistry class.
- Explore the *National Geographic* feature (student textbook page 221) as a class, noting in particular, the way in which hydrangea flowers act as an indicator of soil acidity.
- Demonstrate a natural indicator (grape juice or tea) and a chemical indicator (phenolphthalein and pH paper) in an acid and a base.
- Have students review the Key Terms in Chapter 6 using **BLM 6-1 Chapter 6 Key Terms.**

Alternative Context

Show an insect bite relief medication such as After Bite™. Ask, "Have you ever considered why your skin gets irritated when you are stung?" Survey students for experience with this and other remedies. Did they relieve the sting? Have a student read out the ingredient list, then as a class, brainstorm how the remedy works.

When bees, ants, and mosquitoes sting, they inject a small amount of acidic solution under the skin. Histamine is released when cells become damaged or irritated. This dilates blood vessels, causes swelling, redness, and itchiness. The pH of sting remedies neutralizes the acid in the sting area, reducing the reaction. Many medications use ammonia, a weak base.

To extend understanding, ask the class what they could use to neutralize a wasp sting, which is basic.

Many common reactions involve neutralization reactions between an acid and a base, which form a salt and water. Ask students to consider what they learned in previous chapters. Can they identify other examples of neutralization? Examples include neutralization of stomach acid or the use of lime-based materials to reduce acidity in lakes.

Activity 6-1 Cabbage Detector (Student textbook page 217)

Pedagogical Purpose

The activity illustrates how an indicator shows whether substances are acidic, basic, or neutral.

Planning	
Materials	10 mL red cabbage juice 2 test tubes Test-tube rack Lemon juice "Natural" or Ivory™ soap shavings The day before, shred soap and collect the juice from boiled, shredded red cabbage. On the day of lab, divide lemon juice into two samples.
Time	10 min preparation 20 min in class
Safety	Safety goggles and an apron must be worn.

Background

An indicator is a chemical dye that varies colour depending upon the concentration of hydrogen ions in the solution. Indicators change colour over a range of pH values rather than at a specific pH.

Red cabbage contains a pigment called flavin that can indicate pH. It will turn a variety of colours depending on the pH of the sample substance. This pigment is found in many other plants including grapes and apples. There are many other natural indicators including black tea, geranium flowers, dandelions, blueberries, stems of rhubarb, and goldenrod.

Activity Notes and Troubleshooting

- Create a definition of *clear,* as a class, that emphasizes the substance may still have colour.
- A drop of liquid soap can be substituted for bar soap. Do not substitute shampoo as its slight acidity will not provide desired results. This is a possible extension.
- Read the procedure as a class, then allow students to carry out the activity in groups of two or three.
- Direct students to the acid–base indicator colour chart (student textbook page 567).
- If time permits, allow students to test other chemical indicators such as pH paper, phenolphthalein, and universal indicator, and natural indicators such as grape juice or tea.
- **Alternative activity—**Demonstrate how indicators can change between pH many times using phenolphthalein in water (colourless). Add five drops of 0.1 mol/L sodium hydroxide to turn it pink, then five drops of 0.1 mol/L hydrogen chloride to turn it colourless. Repeat to show that the sequence can be continued.

Additional Support

- ELL As students write out their observations, create a master list of colours labelled with their names for reference.
- Allow students to draw observations using coloured pencils.
- Provide the procedure in pictures or in a flow chart.

Answers

1. Three
2. These are chemical changes.
3. Reacting with the lemon juice and soap.

Study Toolkit

Strategy	Page Reference	Additional Support
Interpreting Tables	To read the table on page 234, identify the title and column headings, predicting what information is in the table.	Refer students to the Study Toolkit Overview on page 560 of the student textbook, specifically the heading Reading Graphic Text.
Using Graphic Organizers	After reading page 220, students can use a graphic organizer to manage information about acids. A concept map may be the most useful form.	Have students create a fishbone organizer for the terms *acid, base, pH, indicator,* and *neutralization*. Refer students to Study Toolkit 4, in particular the section Organizing Your Learning: Using Graphic Organizers on page 565 of the student textbook. Alternatively, have students begin a word map for *acid*, as shown on page 178 of the student textbook.
Word Parts	Examine the word parts in each chemical name on page 223 to identify the ion each acid is composed of.	Refer students to Appendix A on page 567 of the student textbook in which they will recognize many ions.