

## **ToxMystery Lesson Plan 3: ACID OR BASE? TOXIE'S ON THE CASE!**

Grade Level: 2-6

**Description:** This lesson plan will extend the inquiry started in the ToxMystery activities by introducing students to the world of acidity and alkalinity in household products.

### **National Science Educational Standards**

#### **Unifying Concepts and Standards:**

- Understanding of evidence, models and explanation

#### **Science as Inquiry:**

- Abilities necessary to do scientific inquiry
- Understanding about scientific inquiry

#### **Science in Personal and Social Perspective:**

- Personal health
- Types of resources
- Natural hazards
- Changes in environments
- Science and technology in society

#### **History and Nature of Science**

- Science as human endeavor
- Nature of science

#### **Learning Outcomes**

Students will be able to:

- Understand the difference between acids and bases
- Compare and analyze appropriate uses for chemicals and other household products
- List and describe several chemicals and their uses, as well as their pH balance (acidity and alkalinity)

## **Background**

ToxMystery is a computer game activity developed by the National Library of Medicine to increase awareness of the environmental health field. In the activity, "Toxie", the animated cat leads students on a tour of his home and points out potential hazards that might be found day to day.

Litmus is a byproduct of a number of natural resources and is derived from the chemical azolitmin. The litmus test was derived from a number of natural sources, including plants like red cabbage and the hydrangea flower. Gardeners found that soils with higher pH content resulted in hydrangeas with blue flowers, while soils that had lower pH levels bloomed pink flowers. It was determined that the chemicals in these plants could detect acid content, and thus the litmus test was born. Litmus strips are used by scientists to determine the acid content of a number of materials.

## **Time Needed**

One forty-five minute class period

## **Materials Needed:**

- Computer
- ToxMystery Game (online or CD-ROM)
- Various household materials/chemicals (the materials can include, but are not limited to: water, soda pop, oil, baking soda, bleach, vinegar, different juices such as lemon juice or orange juice)
- Shallow glass dishes (or clear petri dishes)
- overhead projector
- Markers/Dry-erase markers
- Crayons/Colored Pencils
- 1 head of red cabbage, chopped and boiled (directions on teacher worksheet)
- 1 cheese grater

### **To prepare Litmus Culture:**

1. Take the head of red cabbage and grate it with the cheese grater.
2. Place the grated strips you get from this into a bowl and cover with water.
3. Allow to steep for about an hour, or until the water turns a purple color.
4. When finished, drain the purple water into a jar and, if so inclined, throw away the cabbage (the cabbage can be cooked or added to salads, if you prefer not to waste it).

### **Procedure:**

#### **Lesson 3: Let's investigate!**

1. Review and Discuss Lesson 1, ToxMystery. Evaluate student assumptions about the potential hazards in household products. Discuss and record some of the hazards found in ToxMystery.
2. Introduce the litmus activity and discuss properties of chemicals.
3. Write the materials you are using on the board.
4. Prepare litmus by pouring it into your individual petri dishes
5. Pass out accompanying worksheet, titled "Acid or Base? Toxie's on the Case!" to students.
6. Begin by asking students to read along with you on the worksheet.
7. Ask them to name some acids and bases they've heard about.
8. On worksheet page two, show students what happens when acids and bases mix by mixing baking soda and vinegar together in equal portion.
9. To demonstrate the power of neutrals, add pure water to the mix.
10. Show students how the mixture begins to lose its potency.
11. When you reach page three, ask your students to write down the names of your materials in the spaces provided.
12. Proceed to add each of your materials to your prepared litmus samples. (Note: Make sure the student notice the difference in color)

13. Depending on time, you may opt for more or less materials to test. It is recommended to test at least one acid, one base, and one neutral.

- When you've done all the substances, ask students these questions:
- What pH do you think the {insert acid name here} was?
- What about the {insert name of base}? The {insert name of neutral}?
- When we added {insert acid name}, it turned very pink.
- When we added {insert another acid name}, it turned even more pink. How could you tell which of the two acids is the strongest?
- Sometimes, acids and bases can be harmful. If you happen to find an unhealthy chemical in your house, what should you do?

### **Evaluation**

Students will demonstrate their ability to:

Identify levels of acidity and alkalinity in household items  
List and describe acids and bases found in the home.