Table of Contents

Introduction

This series of science simulations is designed for students in years 3–5. The activities will awaken the interest of students in a variety of science areas. The simulations in this book are briefly described below.

The Life of Ants takes the students into the world of ants to find out their life cycle and how they divide up the labour within their community. Activities include observing ants in the wild to see how they behave and then examining them closely with magnifiers to study their anatomy. The life within an ant colony is enacted through the use of a shadow puppet show, illustrating all the various jobs and challenges which ants encounter. A commercial ant farm is set up in the classroom for students to make long-range observations of these fascinating insects. Finally, the unit assessment asks an open-ended question in which the students pretend that they have become worker or queen ants and must describe what this is like.

Being an Inventor enables students to develop a basic understanding of electric current generated by batteries. They begin by discovering how to light a small globe and learning how the globe works. This is followed by exploration on the part of the students as they invent flashlights. Next, they work with simple electric circuits to find the difference between parallel and series circuits. This leads them into finding conductors of electricity and then constructing circuit boxes. The performance-based assessment uses a series of activities taken from the unit for students to do independently, thus demonstrating their depth of understanding.

Flying a 737 enables students to take on the roles of ground and flight crew members of a commercial flight aboard a 737 jet. As the play unfolds, they learn how ground and flight crews communicate with each other, the jobs each performs for the comfort and safety of their passengers, as well as some exciting challenges which occur enroute. Activities before the play teach how planes fly and include building a working model of an aeroplane. Students also learn the unique alphabet and terminology used by pilots. The assessment is an open-ended question in which the student writes about a career in commercial aviation.

This wide array of scientific applications is designed to stimulate scientific curiosity. Hopefully, students' thinking will be challenged to higher and higher levels.

Being a Chemist

Teacher Background: Most students think that the study of chemistry is about explosions, smelly stuff and magical potions. Chemistry is actually the study of matter and the way it changes, sometimes with surprising or spectacular results. This series of lessons is designed to simulate how chemists are able to identify different types of matter. In this case, students will work with indicator dyes to be able to identify matter as an acid or a base. This will appear to be magic since the indicator dyes undergo surprising colour changes when mixed with the acids or bases.

Some indicator dyes will only react to acids, others to bases (also called alkalies) and some react to both. Extracts from some vegetables such as red cabbage or coloured flower petals can be used as indicator dyes. Other acid/base indicators include bromothymol blue (BTB) and phenolphthalein (fe´ nol thal´ en) and pH paper which are available commercially. The pH scale ranges from 1–14. The pH paper is actually thin filter paper which has been impregnated with an indicator dye. Like thermometers, pH paper has been calibrated to provide a value. A pH paper ranging from 1 to 12 is used for these activities.

The teacher initiates this series of lessons by performing a *magic show,* using indicator dyes. The activities culminate with a simulation of students acting as scientists helping to discover the cause of pollution in an imaginary lake. After finding the cause of the problem, students do an experiment to neutralise an acidic substance.

Safety Note*:* These lessons should be done in a well ventilated room or outdoors. Caution the students in the use of ammonia and vinegar. Both have strong fumes and can burn if they get into the eyes. It is wise for students to wear safety goggles and wash their hands after this activity.

The risk of using vinegar and ammonia is greatly reduced by using small quantities of the liquids in these activities. It is suggested that 3.5 ml microscale pipettes be used rather than droppers. Pipettes should be designated for one chemical only (e.g., ammonia) to avoid contaminating the test samples.

Reaction strips, which are plastic strips of tiny cups, are recommended for holding the indicator dyes. Order reaction strips with 12 wells and 0.3 ml capacity. Since they can be washed and reused, you should be able to do all the lessons with 10 of these strips.

Chemical Magic

Topic: Using indicator dyes

Objective: Students will use simple, safe indicator dyes to learn how to identify acids and bases.

Materials:

- safety goggles for students (often available in paint and hardware shops
- 1 litre red cabbage extract (see recipe on page 51)
- 1 gram bromothymol blue (BTB) powder
- uncoated laxative tablets (from chemist) for phenolphthalein
- 2 pH paper vials of 100 strips each with colour code (1–12 range)
- 27 thin stem microscale pipettes (ends may be cut to shorter length)
- microscale 8-well reaction strips (optional: 30 ml clear plastic cups)
- 5 test tubes (about 20 ml capacity)
- 6 Styrofoam cups (or a test tube rack)
- 1 litre white vinegar
- 1 litre plain ammonia (without soap added)
- Testing Indicator Dyes record sheet (page 52)
- 8 trays (used to deliver materials to students and as a work surface in the event of spills)
- 1 litre distilled water
- 8 pairs of scissors

Preparation:

- Follow the directions on page 51 to create the indicator dyes needed for this lesson.
- Make 8 copies of the pH colour code and seal them in clear plastic wrap or laminate them.
- Make small adhesive labels for the 16 pipettes as follows: vinegar (8 pipettes), ammonia (8), water (8). Fill the pipettes about 1/2 full with vinegar, distilled water or ammonia.
- Use another set of three pipettes and mark them V, A and W with small letters in permanent ink.
- Fill these pipettes with vinegar (V), ammonia (A) and distilled water (W).
- Make holders from the six Styrofoam cups by turning them upside down and punching a hole in the bottom of each so it will hold one test tube snugly. (Optional: Use a test tube rack.)
- Fill the test tubes 1/2 full of (3) cabbage extract, (1) phenolphthalein, (1) BTB.
- Fill five of the reaction strip cups half full as follows: (3) cabbage extract, (1) phenolphthalein, (1) BTB.
- Place the trays, pipettes of vinegar, filled reaction strips and record sheets on a table.

Motivator:

- Present a chemical magic show to introduce this lesson. Practice this magic act before doing it for the students to perfect the surprise aspect of the demonstration.
- Place the test tubes containing the cabbage extract, BTB and phenolphthalein where students can see them. Point out the colour of each of the three indicators but do not tell what they are.
- Show that the liquid in pipettes marked V, W and A are clear. (Do not show the letters.)