

ILAB – Independent Laboratory Access for the Blind

Adaptations to Experiments from the Prentice-Hall Chemistry Laboratory Manual

Teacher's Edition, A. Wilbraham, D. Staley, M. Matta, and E. Waterman, Eds.,
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Physical and Chemical Change

Students learn to differentiate the physical and chemical properties of substances, classify processes as physical or chemical changes, and learn that mass is conserved in chemical reactions. The observations include separation of iron and sulfur with a magnet, separation of sand and salt by dissolution/evaporation, combustion and acid dissolution of magnesium metal, the reaction of solid iron with sulfur, and the reaction of sodium bicarbonate with acid. Adaptations include the use of the CALS to identify the colors of the solid samples, Petri dishes to hold the samples instead of pieces of paper, white paper below the Petri dishes to minimize the background interference, and use of the submersible audible light sensor (SALS) to differentiate solutions from suspensions by using the tone memory storage functions. Items are labeled in Braille, and large test tubes replace the small test tubes used by sighted students. The larger test tubes are used as a result of the scaling up of the volumes of solution required. The concentrations of the solutions are maintained.

Observing a Chemical Reaction

In this experiment a solution of copper(II) chloride is reacted with aluminum foil. Students learn to distinguish observations from interpretations, and to classify observations as qualitative or quantitative.

The laboratory is adapted by replacing the thermometer with a Vernier temperature probe; and gloves are worn by the student. The color analysis laboratory sensor (CALS) in conjunction with the beaker sensor plug-in can be used to monitor color changes in a 100 ml beaker. Color changes are spoken by the CALS at the various stages of the reaction as it runs to completion. The CALS must be calibrated before each reaction is carried out.

Periodic Properties

In this experiment, students investigate the periodic variation of density in Group 4A compounds. The densities of silicon, tin, and lead are measured by the displacement method. In the adapted experiment, the balance is the Ohaus balance and the CALS sensor is used to identify the colors.

A disposable pipette can be calibrated to a specific graduated cylinder volume, e.g., 50 ml, by means of a piece of masking tape on the pipette. The tip of the pipette is aligned with the 50 ml line and the tape then marks the place on the pipette that is aligned with the mouth of the graduated cylinder. Water is then pipetted into another beaker. Water is added to the graduated cylinder containing the solid up to the 50 ml line. The amount of water added is

determined gravimetrically using the balance. Once the mass of the water is obtained in grams, its volume (in mL) is subtracted from 50 ml to determine the volume of the solid sample.

Molecular Models

In this experiment, students investigate the three-dimensional shapes of molecules by building ball-and-stick molecular models of hydrogen sulfide, carbon tetrachloride, ethane, and other molecules.

In the adapted experiment, the balls that represent C, H, O, N, Cl, Br, and I are labeled in Braille.

Precipitation Reactions

In this experiment, various salt solutions are mixed to determine which combinations of ions form water-insoluble precipitates. The reaction is done using drops of solution on a spot plate.

In the adapted experiment, the volumes are scaled up to accommodate large test tubes, and the SALS is used to detect precipitate formation. Notched syringes are used to deliver specific volumes of solutions instead of dropper patents.

Qualitative Analysis

In this experiment, students develop a systematic panel of chemical tests to identify an unknown compound. The procedure is similar to that of the Precipitation Reactions experiment, in that a spot plate is used to combine reagents in a grid. Some combinations produce precipitates, while others cause color changes or evolution of bubbles.

The adaptations are similar to those of the Precipitation experiment: incorporation of the SALS for the purposes of detecting the formation of a precipitate, increasing volume of the solutions to accommodate the SALS sensor, and using notched syringes to more quickly measured specific volumes of stock solutions. The CALS is used in conjunction with using the test tube sensor to determine the colors of precipitates.

Balanced Chemical Equations

In this experiment, students examine the relationship between amounts of reactants and products in the reaction of lead nitrate with sodium iodide, which forms a yellow precipitate. Students test supernatant solutions for the excess reagent by adding a drop of either reagent.

In the adapted experiment, the dropper pipette is replaced by a notched syringe. Braille is used to label tubes, and the lead iodide precipitate is filtered off, dried, and weighed. The supernatant analysis is scaled up to allow manipulation of larger volumes, and precipitation is detected with the SALS.

The Clock Reaction

In this reaction, students determine how the concentration of reactants affects reaction rates using a starch-iodine clock reaction.

Adaptations: The SALS is used to monitor color changes, and a digital talking timer is used to measure time. Notched syringes are used to more quickly dispense stock solutions, in place of dropper pipettes and graduated cylinders, the soluble starch is added to the solution before the students perform the experiment,

Estimation of pH

In this experiment, students estimate the pH of solutions by using acid-base indicators.

Adaptations: The SALS is used to determine if a color change has occurred. Bromthymol blue is used as the primary indicator. Larger volume samples are used, and the CALS is used to determine the color change of the litmus paper. To provide a large enough colored area, several pieces of litmus paper are used and the paper is submerged entirely in the test solution. The Vernier pH meter is used to compare pH values.