

TEACHER INFORMATION

Household Acids and Bases

1. The student pages with complete instructions for data collection using LabQuest App, Logger *Pro* (computers), DataQuest (TI-Nspire Technology), EasyData or DataMate (calculators), and DataPro (Palm handhelds), can be found on the CD that accompanies this book. See *Appendix A* for more information.
2. Red cabbage juice solution can be prepared by boiling red cabbage in water. Alternatively, you can grind up red cabbage in a blender, and then strain it with a sieve to obtain the juice.
3. The use of 13 × 100 mm test tubes is suggested.
4. Suggested solution concentrations:
 - 0.1 M ammonia (6.7 mL concentrated NH₃ per 1 L) **HAZARD ALERT:** Both liquid and vapor are extremely irritating—especially to eyes. Dispense in a hood and be sure an eyewash station is accessible. Toxic by ingestion and inhalation. Serious respiratory hazard. Hazard Code: A—Extremely hazardous.
 - 0.1 M NaOH (0.40 g of NaOH per 100 mL to use as a drain cleaner solution) **HAZARD ALERT:** Corrosive solid; skin burns are possible; much heat evolves when added to water; very dangerous to eyes; wear face and eye protection when using this substance. Wear gloves. Hazard Code: B—Hazardous.
 - 1% detergent (1 g of solid detergent per 100 mL)
 - 1% baking soda (1 g of NaHCO₃ per 100 mL)

Note: For safety reasons, 0.1 M NaOH solution is substituted for a drain cleaner (Drano) solution.

The hazard information reference is: Flinn Scientific, Inc., *Chemical & Biological Catalog Reference Manual*, (800) 452-1261, www.flinnsci.com. See *Appendix D* of this book, *Chemistry with Vernier*, for more information.
5. The soda pop should be colorless.
6. To reduce the amount of litmus used, cut strips into 1 cm pieces.
7. We suggest that you have the pH Sensor connected to the computer for your students. Be sure to demonstrate the pH Sensor cleaning sequence as you pre-lab the experiment.
9. Solutions can be made available to the students in 50 or 100 mL beakers. The 3 mL portions in Step 3 can be poured directly from the beakers, and pH tests can be made directly in the beakers.
10. The computer procedure has students record pH values from the live readouts (without clicking on  play). Another possibility is to have students use the Selected Events mode for each of the 7 trials. In Logger*Pro*, the file is already set up for this option. Simply have your students click , then click  when the pH reading is stable. This saves the pH reading along with its trial number.

Experiment 21

- The electrode solution used in this experiment is pH 7 buffer solution. It can be purchased from chemical supply companies. Vernier Software & Technology sells a package of capsules for preparing buffer solutions of pH 4, 7, and 10 (Order Code PHB). The electrode solution can also be prepared using a recipe found in the *Handbook of Chemistry and Physics*. One such recipe specifies ingredients mixed in the ratio of 50 mL of 0.1 M KH_2PO_4 to 29.1 mL of 0.1 M NaOH. The 0.1 M KH_2PO_4 requires 13.7 g per 1 L of solution. The 0.1 M NaOH requires 4.0 g per 1 L of solution.
- The sensor soaking solution can be contained in baby food jars, or some similar sealable containers. After your students finish using the pH Sensors, you should return the probes to the small plastic, buffer-filled bottles supplied by Vernier Software. The sensor soaking solution can be sealed and stored in its container for future use.
- The stored pH calibration works well for this experiment.

SAMPLE RESULTS

Test Tube	Solution	Blue Litmus	Red Litmus	Red Cabbage Juice	pH
1	vinegar	pink	pink	red-pink	2.5
2	ammonia	blue	blue	blue-green	8.3
3	lemon juice	pink	pink	pink	2.7
4	soft drink	pink	pink	blue-pink	3.5
5	drain cleaner	blue	blue	yellow-green	12.0
6	detergent	blue	blue	blue-green	9.4
7	baking soda	blue	blue	blue	8.2

ANSWERS TO QUESTIONS

For Sample Answers to the questions in this lab, please contact Vernier Software and Technology at swanswers@vernier.com