

3. ORGANISMS AND pH

How effective are chemical and biological buffers?

Objectives

- Evaluate the ability of various substances to resist large changes in pH.

Materials and Equipment

- Data collection system
- pH sensor
- Beakers (6), 50-mL
- Graduated cylinder, 25-mL
- Stirring rod
- Disposable pipets (2)
- Wash bottle filled with distilled water
- Lemon juice, 10 mL
- Detergent solution, 10 mL
- Distilled water, 50 mL
- Buffer solution, 50 mL
- Liver suspension, 50 mL
- Marking pen

Safety

Follow these important safety precautions in addition to your regular classroom procedures:

- Wear safety goggles at all times.
- Dispose of chemicals in the proper waste container as directed by your instructor.

Procedure

1. Select Sensor Data in SPARKvue.
2. Connect the pH sensor to your device.
3. Choose the Graph template.
4. Label 2 pipets "lemon juice" and "detergent". Label one beaker "water-lemon" and another beaker "water-detergent". Add 25 mL of distilled water to each beaker.
5. Remove the storage bottle from the pH sensor and push the cap to the top of the probe as shown in Figure 1. Rinse the probe with distilled water and place it in the "water-lemon" beaker.

Note: Hold the sensor upright to keep the beaker from tipping over as shown in Figure 1. Make sure the glass bulb at the end of the probe is completely submerged but is not resting at the bottom of the beaker.

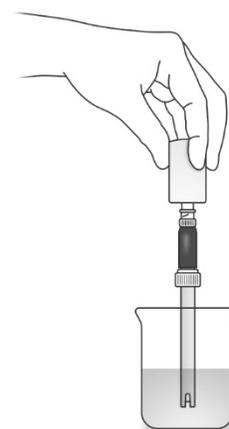


Figure 1: pH sensor position

6. Monitor the pH in the live sensor reading located below the graph on the left side. Wait for the pH reading to stabilize, then record the initial pH in Table 1.
7. Predict whether pH will increase, decrease, or stay the same when lemon juice is added to the beaker. Record your prediction in Table 1.
8. Select Start to begin collecting data. Use a pipet to add 30 drops of lemon juice to the beaker while stirring. Avoid contact with the pH sensor while stirring.

9. Continue stirring for 30 seconds after the last drop has been added, then stop collecting data. Record the final pH in Table 1.
 10. Rinse the stirring rod and pH probe thoroughly with distilled water.
 11. Place the probe in the "water-detergent" beaker. Repeat Steps 6 through 10 with detergent instead of lemon juice.
- Note: Do not mix up the lemon juice and detergent pipets. Use one pipet for each solution.*
12. Label 2 beakers "buffer-lemon" and "buffer-detergent". Add 25 mL of buffer solution to each beaker, then rinse the graduated cylinder thoroughly with distilled water.
 13. Place the probe in the "buffer-lemon" beaker. Repeat steps 6 through 10 with lemon juice.
 14. Place the probe in the "buffer-detergent" beaker. Repeat steps 6 through 10 with detergent instead of lemon juice.
 15. Label 2 beakers "liver-lemon" and "liver-detergent". Add 25 mL of liver suspension to each beaker, then rinse the graduated cylinder thoroughly with distilled water.
 16. Place the probe in the "liver-lemon" beaker. Repeat steps 6 through 10 with lemon juice.
 17. Place the probe in the "liver-detergent" beaker. Repeat steps 6 through 10 with detergent instead of lemon juice.
 18. Replace the storage solution and cap on the pH sensor. Complete Table 1 by calculating the actual pH change for each run by subtracting the final pH from the initial pH:

$$\text{Actual pH change} = \text{Final pH} - \text{Initial pH}$$

Data Collection

Table 1: pH test results

Initial beaker contents	Solution added	Initial pH	Predicted pH change	Final pH	Actual pH change
Distilled water	Lemon juice				
Distilled water	Detergent				
Buffer solution	Lemon juice				
Buffer solution	Detergent				
Liver suspension	Lemon juice				
Liver suspension	Detergent				

