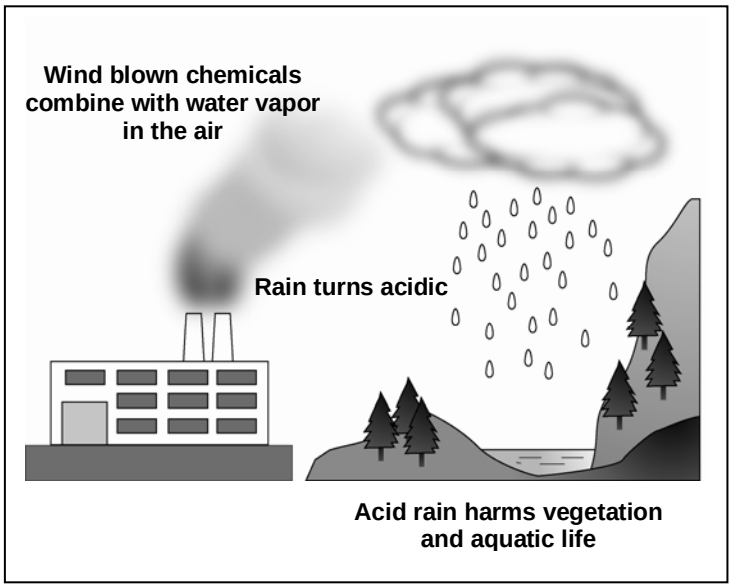
Acid Rain and Buffers

The burning of fossil fuels such as coal, heating oil and gasoline releases chemicals into the atmosphere. These chemicals combine with water vapor in the air to form acid rain that harms the environment.



The effect of acid rain on a lake may be reduced through natural buffers present in some materials on the bottom of the lake. **Buffers** are chemicals that act to keep the pH of a solution relatively constant.

In this activity, you will determine which type of lake bottom material (sand or limestone) is best for buffering the effects of acid rain.

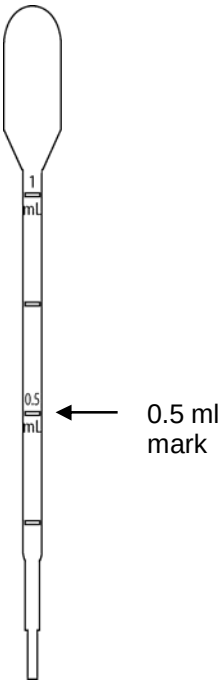
A. Investigate the effects of acid rain on lakes with sand bottoms

Prepare a model "lake" with sand:

1. Add 15 ml of tap water to the container of sand to represent a "lake."
2. Stir for 1 minute to mix the sand with the "lake" water. Allow 60 seconds for the sand to settle to the bottom of the "lake".
3. Use a strip of pH paper to test the initial pH of the "lake." Record your results in the Data Table on page 4.

Simulate acid rain by adding drops of acid to the model "lake"

4. Use a graduated dropper to add 0.5 mL of acid to the lake. Stir for 30 seconds. Measure and record the pH of the water.
5. Add an additional 0.5 mL of acid rain to the lake. Stir for 30 seconds. Measure and record the pH of the water in the Data Table.
6. Add an additional 0.5 mL of acid rain to the lake. Stir for 30 seconds. Measure and record the pH of the water in the Data Table.
7. Add an additional 0.5 mL of acid rain to the lake. Stir for 30 seconds. Measure and record the pH of the water in the Data Table.



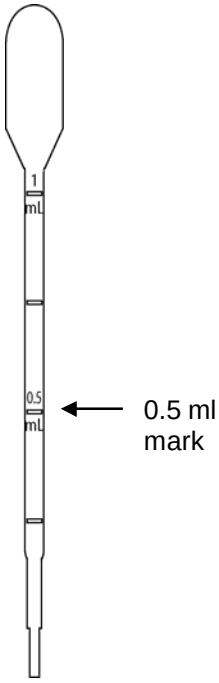
B. Investigate the effects of acid rain on lakes with limestone bottoms

Prepare a model "lake" with limestone:

1. Add 15 ml of tap water to the container of limestone to represent a "lake."
2. Stir for 1 minute to mix the limestone with the "lake" water. Allow 60 seconds for the limestone to settle to the bottom of the "lake".
3. Use a strip of pH paper to test the initial pH of the "lake." Record your results in the Data Table.

Simulate acid rain by adding drops of acid to the model "lake"

4. Use a graduated dropper to add 0.5 mL of acid to the lake. Stir for 30 seconds. Measure and record the pH of the water.
5. Add an additional 0.5 mL of acid rain to the lake. Stir for 30 seconds. Measure and record the pH of the water in the Data Table.
6. Add an additional 0.5 mL of acid rain to the lake. Stir for 30 seconds. Measure and record the pH of the water in the Data Table.
7. Add an additional 0.5 mL of acid rain to the lake. Stir for 30 seconds. Measure and record the pH of the water in the Data Table.
8. On the grid on the next page, prepare a **line graph** that summarizes the results of your data. Mark appropriate scales on the graph axes. You should have 2 lines on your graph – one line for the lake with sand and one line for the lake with limestone.



Data Table:

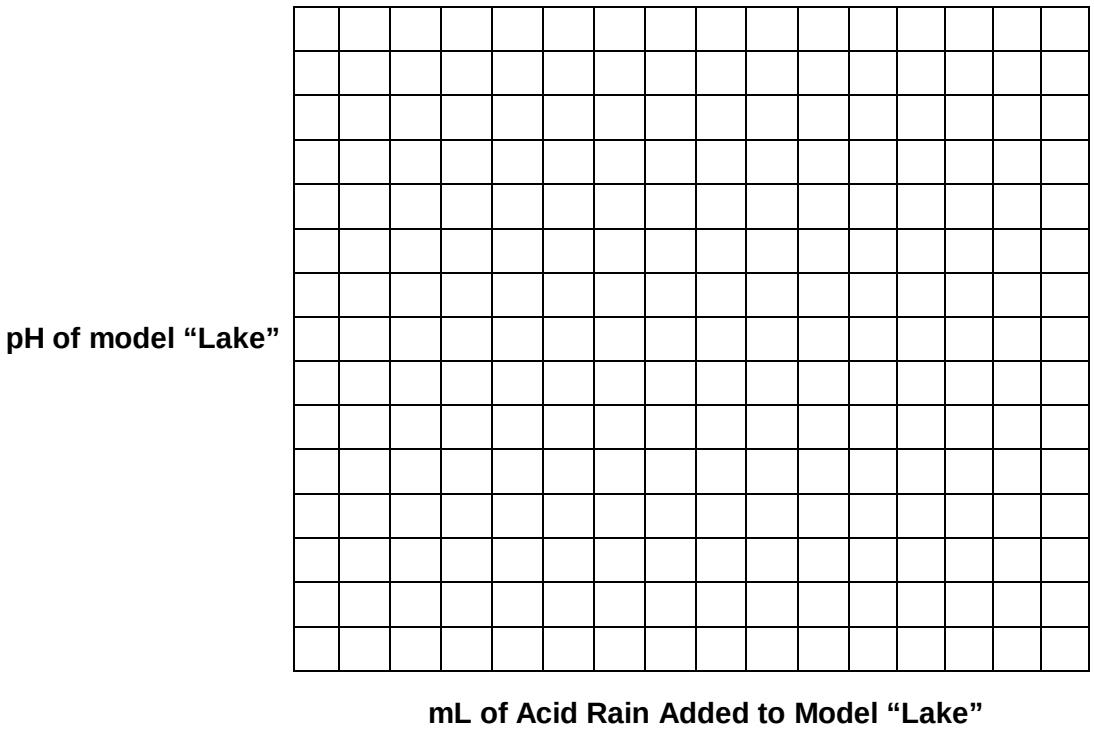
The Effect of "Acid Rain" on the pH of model lakes with different lake bottom materials

mL of "Acid Rain" added to "Lake"	pH of Model "Lake"	
	Sand	Limestone
0 (initial)		
0.5 mL		
1.0 mL		
1.5 mL		
2.0 mL		

Graph:

The Effect of "Acid Rain" on the pH of model lakes with different lake bottom materials

Key: Lake bottom materials
Sand
Limestone



Conclusions

1. What is a buffer?

   _____

   _____

2. Does adding "acid rain" increase or decrease the "lake's" pH? _____

3. Which "lake" bottom material was best at buffering the effects of acid rain? Support your answer with evidence from your data table or graph.

   _____

   _____

   _____

4. Your blood contains proteins and other chemicals that act as buffers. Why might having buffers in your blood be important for maintaining homeostasis?

   _____

   _____