TEACHER INFORMATION

Sour Chemistry: The Exponential pH Change

1. There are currently 2 different combinations of equipment that will work for collecting pH data. The most common method, which works for both the TI-83 Plus and TI-84 Plus families of calculators, is to use a pH Sensor attached to a CBL 2 or LabPro.

   The TI-84 Plus calculator has a USB port located at the top right corner. Using the USB port, an EasyLink with a pH Sensor can be connected to collect pH data. For more information on EasyLink refer to Page *ix* located in the front section of this book.

2. When connecting an EasyLink to a TI-84 Plus calculator using USB, the EasyData application automatically launches when the calculator is turned on and at the home screen.

3. The antacid tablet used must contain sodium bicarbonate. Some antacids don't dissolve readily in water, making them useless for this activity. Test antacids before using them in class.

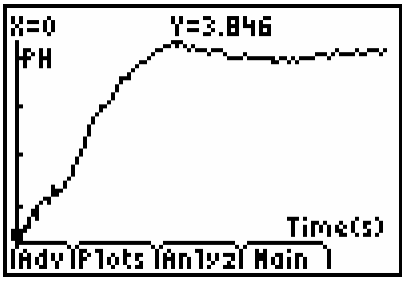
4. Distilled water, which ideally has no buffering capacity, is much better than tap water for this activity. The variable buffering capacities of tap water will affect the initial pH of the starting solution. All water should be at room temperature.

5. Note that distilled water does not necessarily have a pH of 7 due to dissolved gasses.

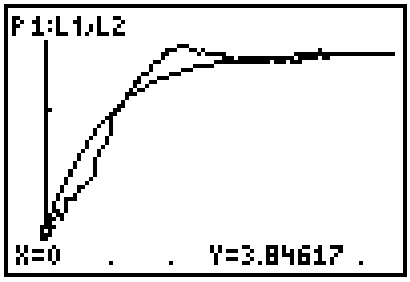
6. Clean glassware is critical in this activity.

7. At the completion of the activity, use distilled water to rinse the pH electrode. Tightly secure the storage solution bottle on the electrode tip. Refer to the data sheet that came with the pH Sensor for detailed storage information.

SAMPLE RESULTS



Raw data in EasyData



Data with model

DATA TABLE

y*-intercept *C	3.84
pH approach value	5.5
A	1.66
optimized *B*	0.9

ANSWERS TO QUESTIONS

1. If $0 < B < 1$, then for large x, B^x approaches zero, so $y = A (1 – 0) + C = A + C$.

2. A larger value of B results in a slower rise in pH.

3. Adding more lemon juice drops would make the starting solution more acidic, and so a have a lower pH. Thus C would be smaller since it represents the starting pH. A might or might not be different since the final pH could still be the same, or it could be lower.

4. Adding more antacid tablets would presumably make the pH level rise more rapidly, so B would be smaller.

5. A better antacid tablet would be fast (with a smaller B). A good tablet would also make the pH rise to an appropriate level for comfort, so A would have to be larger than some minimum value, but also smaller than some maximum value, as the stomach pH must not rise *above* the comfort level.