Preconditioning Balloons Data Analysis Worksheet **Answers**

On a separate sheet of paper to turn in, answer the following questions.
Remember to include labels and units on all graphs.

1. Create a scatter plot in Excel of the balloon preconditioning data you collected.
   Plot force (y-axis) vs. cycle number (x-axis).

   Check that students plotted their data and labeled their graph axes.

2. Answer the following questions about your graph and data:

   a. Did the force to displace the balloon change with repeated cycles?
      If so, how did it change (increase or decrease) and why?

      The force to displace the balloon decreased with repeated cycles because balloons are polymers, which are viscoelastic and they experience preconditioning.

   b. What is the percent difference between the force for cycle 1 and the force for cycle 10?

      *% difference = (difference between two forces / average of two forces) * 100*

      *% difference = ($Force_{Cycle\ 1}$ − $Force_{Cycle\ 10}$) / {($Force_{Cycle\ 1}$ + $Force_{Cycle\ 10}$) / 2} * 100*

      Check to make sure students show their equation and their work to verify that they did the problem correctly and to earn full credit.

   c. At what cycle did the balloon reach equilibrium?
      How can you use this information next time you need to inflate a balloon?

      The point of equilibrium is when the force no longer changes with repeated cycles. Double-check their graphs from problem 1 to make sure their answers make sense. They can use this information to know how many times a balloon needs to be stretched to maximize the decrease in force without having to stretch it too many times.