Name: _____ Date: _____

Creepy Silly Putty Data Analysis Answers

Answer the following questions on a separate sheet of paper to turn in for grading. Remember to include labels and units on all graphs.

1. Create a bar plot in Excel of the silly putty viscoelasticity data you collected. Use an average formula to calculate the average creep rate for each concentration. Plot the average creep time (fall time) (y-axis) vs. borax concentration (x-axis). Make sure that each bar has a label indicating the borax concentration (low, medium, high).

   Check that students plotted their data and labeled their axes. There should only be three bars (not nine). In Excel, students should have used the formula "=average()" to calculate the average creep time for each concentration.

2. Answer the following questions regarding your graphs and data:

   a. Calculate the standard deviation of creep time for each sample concentration in Excel.

      In Excel, students should have use the formula "=stdev()" to calculate this answer. They should show a standard deviation for each concentration.

   b. Looking at your silly putty data (standard deviation), do you see a large or small variation in the time it took the silly putty to fall to the table when you repeated the experiment for the same concentration? If you have a large variation, what factors could have caused this? Discuss this for each concentration.

      If a student has a large variation (check by looking at the standard deviation reported in the previous question), then it could be caused by human error. Error might have been introduced by not forming the silly putty into a uniform cross section cylinder, not having the same diameter each time they formed a new cylinder, not holding the cylinder in the same spot every time, moving his/her hand while waiting for the sample to creep 6 inches, etc. This should be discussed for each concentration.

   c. Are the average creep times different between borax concentrations? Why or why not? Hint: What does the concentration of borax do to the viscoelastic properties of silly putty?

      The average creep time increased with increasing borax concentration. Expect answers to include predictions as to why they think the borax altered the mechanical properties of the silly putty. The correct answer is: because borax cross-links the polymer strands in glue to form silly putty. Therefore, the more borax you add, the more stands that are cross-linked (bound together) resulting in a stiffer material.