Chem 197
Fall 2019

measurement exercise viii

Although Galileo did not develop a universal mathematical model for the relationship between distance and time for an object moving on an inclined plane, as we learned in me_vi, his data can be used for this purpose. In that exercise we analyzed data reported by Settle—data he collected using the tools available to Galileo—finding that

$$d = \frac{1}{2} \times a \times t^2$$

where *d* is the distance traveled during time, *t*, and where *a* is the acceleration of the ball as it moves down the ramp. In this lab exercise we will gather data on two systems and analyze that data to arrive at predictive models that deepen our understanding of these systems.

System 1: The Cooling of Hot Water

When I pour a cup of hot coffee into a mug it immediately begins to cool, eventually reaching the temperature of its surroundings. But, how does it cool over time? Does its temperature change in a uniform way? Does it cool more quickly at the beginning, slowing down as it loses heat? Does it cool more quickly as it approaches room temperature? In this experiment we will first collect data as a beaker of water cools. We will then seek an empirical mathematical model that reasonably explains the data. Finally, we will try to give meaning to the empirical model by trying to map its variables onto properties of the system.

System 2: The Behavior of Gases

For our second system, we will explore the relationship between the pressure and volume, the pressure and temperature, and the volume and temperature of a gas. We will build an empirical model for each of these relationships and then try to combine the three empirical models into a single mathematical model. For this second system, you will each prepare a report as an informal writing assignment, the details of which will be provided later.