**Primary Topic:** Model and Systems with Excel

**Supporting Topics:** Units and Cell References

**Technical Objectives:**

* *Fit and interpret* trend lines to data using Microsoft Excel
* *Utilize* cell referencing to perform calculations
* *Perform* unit calculations

**Directions:**

Questions will be answered on the canvas quiz. It will be due next Monday.

**All graphs and charts must be legible and have labels to receive full credit!**

1. **In an Ideal World…**

Last week you recreated Benoît Paul Émile Clapeyron’s discovery of the Ideal Gas Law (Equation 1) in 1834. You gathered a number of experimental measurements of pressure *P*, volume *V*, amount *n* (in number of moles), and temperature *T* of nitrogen (N2) for various conditions. To determine the ideal gas constant (*R*), you plotted the relationship between *P\*V* and *n\*T*. Now, fit a linear trend line to the data and determine the value of *R* from the data provided.

(1)

1. **Disp-Vel-Acc**

Time-displacement data are given for an object being acted on by external forces. Plot the data using a scatterplot and fit an exponential trend line. What are the values of m and b for this trend line where the form of the equation is given as:

Next, calculate the velocity in m/s for each data point (starting with the second point) and the acceleration in ***g*s** (starting with the third point). What is the maximum acceleration in terms of *g*s?

1. **Lin-Pow-Exp**

Independent variable data are provided in column A. For the given m and b parameters, calculate the corresponding y data for linear, power, and exponential functions. Plot each function using a scatter plot and alter the axes if necessary so the data look linear. The form of the equations are as follows:

Linear:

Power:

Exponential:

1. **Springs**

The stiffness of a spring dictates the amount of force that is required to extend or compress the spring, according to Hooke’s Law. When two springs are combined in **parallel**, their effective **stiffness is increased**. When they are combined in **series,** their **effective stiffness is decreased**. Calculate the corresponding forces for the provided displacements when the given springs are added in parallel and in series.

1. **Predictions from a Model**

The size of gut bacteria in some cases is inversely related to the total number within the body. Data are provided for bacteria length (in microns) and count. Plot the data, fit an appropriate model (linear, power, or exponential) and show the equation on the chart. (See Problem C for the forms of these equations.) Use the equation to estimate the number of gut bacteria which have a length of 10,000 microns. Does this number seem reasonable?