Name:_____

Discovering Newton's 2nd Law of Motion

In today's laboratory experience, I have provided each group with some laboratory equipment. At each station you will find a dynamics cart and track (with pulley, string and metric rule), various hanging masses, a stopwatch, two black metal bars (they fit in the dynamics cart), a motion detector and computer, and a triple beam balance for measuring mass. You may use other equipment if you deem it necessary and you may choose not to use some equipment, *but please return the lab station to its original condition when you leave.*

Use the equipment to design an experiment to answer the following beginning questions:

1) What is the mathematical relationship between an object's mass and its acceleration?

2) What is the mathematical relationship between the force applied to an object and its acceleration?

Remember to design each experiment such that you have a **controlled** variable, a **manipulated** variable and a **responding** variable.

Use the space below to draw *two* graphs to predict the effect of an object's mass on its acceleration and the effect force exerted on an object has on its acceleration.

Each individual student will write a lab report using the format your teacher describes. Use the space below to take notes on your experimental design for each of the two experiments you will be conducting. Remember to identify the *controlled* quantity, the *manipulated* quantity, and the *responding* quantity.

OK, now go to it! Remember the value of taking measurements multiple times and be sure and use rules for precision and significant figures in your measurements (after all that's why we have them).

Oh, one more thing…the SI unit (standard metric) for force is the Newton (N). A Newton is about the weight of an average apple and you can calculate an object's weight by simple multiplying its mass *in kilograms* by the local value of the acceleration due to gravity. $\overrightarrow{F_w} = m * \vec{g}$ You can put that one on your toolbox and also use it to calculate the pulling force created by the masses on the end of the string.

Use the space below to record and analyze data: (tables are good ways to help with organization…)

Answer the following questions:

1. If you double the force causing the acceleration, what happens to the acceleration? How about tripling it?

2. If you double the system's mass, what happens to the acceleration? How about tripling it?

3. Based on your answers above, write Newton's 2nd Law in equation form:

$$\vec{a} = \text{——}$$