Name:\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Investigation: Types of Forces

**Station 1: Tension Forces**

*Cables, strings and ropes can all exert a tension force on the object which the rope is attached. This force is directed along the line of the string and is in the same magnitude throughout the length of a (massless) rope.*

At this station, you should find a weight hung by two strings with spring scales attached. The spring scales measure the tension in the strings (in Newtons).

Procedure:

1. Read the tension in the strings when the object is hung straight down from the spring scales.
2. Now pull the scales farther apart so that they are attached at a wider angle. What happened to the tension force? Explain why you think this change occurred.

**Station II: Normal Forces**

*If two objects are in contact, they may each exert a force on the other. The component of this contact force that is perpendicular (normal) to the surfaces in contact is called a normal force. Normal forces always tend to push two objects apart never pull them together.*

At this station, a weight is placed on a scale. The reading on the scale gives the value of the Normal force acting on the weight.

Procedure:

1. What is the value of the Normal force when the object is sitting on the scale?
2. Now push downward on the weight. What happened to the Normal force? Explain why this change took place.
3. Now pull horizontally on the weight. Did the Normal force change significantly? Explain why or why not.
4. Now tilt the scale up on an incline. What happened to the Normal force? What happens to the force as the incline gets steeper and steeper? Explain why this change took place.

**Station III: Friction Forces**

*Friction is the force that opposes a sliding motion. Friction is due to microscopic irregularities in even the smoothest of surfaces.*

Procedure:

This is a computer-based lab. The computer should have a simulation open with a crate. Click on the crate and drag to the right to apply a force.

1. Apply a force to the crate. Continue increasing the force until the crate begins moving.
   1. While the crate is still, what type of friction is acting?
   2. How does the friction force compare to the applied force?
2. Apply a force to the crate again. Continue increasing the force until the crate begins moving.
   1. What happens to the magnitude of the friction force when at the instant that the crate beings moving?
   2. What does this tell you about static friction force compared to the kinetic friction force?