Name _____ Date _____ Period _____

Lab: Introduction to Forces

C O N C E P T U A L P H Y S I C S : U N I T 1

Introduction: There are five mechanical forces that we will encounter throughout the year. This lab is designed to introduce you to these mechanical forces through different activities. Before we start the activities, we need to know what these forces are:

WEIGHT (GRAVITY)-Weight is an interaction between any two objects with mass. Weight acts between all objects on earth, regardless of their motion. The weight of an object on the earth acts toward the center of the earth—straight down. The weight of an object depends on its mass and acceleration due to gravity: W=mg

NORMAL-This force represents any compression of any two surfaces against each other. A book resting on a table is prevented from falling to the ground (due to its weight) because the table exerts an upward normal force on the book. The **normal force** exerted by a surface is always perpendicular to that surface. The normal force is sometimes *–but certainly not always*—equal in magnitude and opposite in direction to weight.

TENSION-When a force is transmitted through a string, rope, or wire, etc., the force is called **tension.** Tension tends to stretch the string and will break the string if it becomes too great. The tension in a string is constant throughout the string. There is no direct equation for tension.

FRI CTION-Friction arises when an object is being "urged" to slide across a surface or when an object actually is sliding across a surface. If the object isn't moving, the friction force is called *static friction*. If the object is moving, the frictional force is called kinetic friction. If the object is moving, the frictional force is called *kinetic friction*.

DRAG-Whenever a fluid encounters a solid object (or *vice versa)*, the force of **drag** appears. It could be that the solid object is moving through a fluid or that a fluid is moving past a stationary solid object. For example, a car moving along the highway is pushed back by the air it runs into.

OTHER FORCES-There are, of course, other forces that act throughout the universe, but those listed above are the common mechanical forces. Please note that weight, tension, friction, etc., are simple the *names* of the forces. We have not yet discussed the underlying *nature* of these forces.

Procedure: During the lab, you will be asked to perform tasks and answer questions. Please **do NOT** use the ***names*** of the forces in the response until you are specifically asked to do so!

Part A- Push down on the table with your hand.

1. The table feels the downward push of your hand. What do you feel?

2. If there were no friction between your hand and the table, could you still exert this force?

3. In what direction does this force act? Draw a diagram of your hand pushing down on the

table. Draw ONLY the vector (arrow) representing the force the table exerts on you (not the force you exert on the table).

4. How would you describe the angle of the force relative to the surface of the table?

5. What would happen to the normal force between you and the ground in the following 2 situations. What would happen to the magnitude of that force if someone were standing on top of you? If you were holding a large bunch of helium balloons? (**Now you may use the name of forces)**

Part B – Hold on end of the string while your partner holds the other end. GENTLY pull.
1. Suppose you pull while your partner simply holds. Who feels more of this force, or is it equal for both of you?

2. In what direction does this force act? Draw a diagram of your hand and the string. Then draw a vector (arrow) showing the force as it acts on your hand (do not show the force your hand exerts on the string).

3. We need to consider the distribution of forces on the string.
a. Consider a chain of rubber bands. If the ends of the chain are pulled, which rubber bands will stretch the most? (Check the correct answer)

_____ The one at the pulled end.
_____ The ones near either end of the chain.
_____ All the rubber bands in the chain.

b. What does this mean about the whereabouts of this force in the string?

c. What is the name of this force? (**Now you may use the name of forces)**

d. Under what condition does this force occur?

e. List one other example of this force?

Part C—Rub your hands together.
1. What factors appear to be important for this force? (What makes it bigger or smaller?)

2. List one other situation in which this force occurs.

3. Does this force act at one point or is it spread out somehow? Explain; include a diagram.

4. In what direction does this force seem to act? Draw a diagram of a book sliding across the table, moving to the right. Show the total effect of the force acting on the book by drawing a vector.

5. What is the name of this force? (**Now you may use the name of forces)**

Part D—Suppose Wile E. Coyote were to run off a cliff
1. What force would lead to his demise? (**Now you may use the name of forces)**

2. What factors appear to be important for this force? (What makes it bigger or smaller?)

3. In what direction does this force act? Draw a diagram of Wile E. Coyote; draw the vector for this force.

4. Does this force act over long distances through space? (Between the Earth and the Sun, for example?

Part E—Hold the coffee filter above the table and drop it.
1. What two forces are operating here? (**Now you may use the name of forces)**

2. Which force would not be as apparent if the coffee filter were crumpled up? (**Now you may use the name of forces)**

3. In which direction does this force act? Draw a diagram of the falling coffee filter showing the vector (arrow) for the total effect of this force. Show the vector (arrow) for the other force you mentioned in number 1, too.

4. Would this force affect a rock falling to the bottom of a pond? A feather falling on the moon (**Now you may use the name of forces)**?

5. List other situations in which this force occurs or is particularly important?

6. What factors appear to be important for this force? (What makes it bigger or smaller?) (**Now you may use the name of forces)**