PhyzLab Springboard: Feel the Forces

There are five mechanical forces that we will encounter throughout the year. This sheet and the corresponding activities serve as an introduction to these mechanical forces:

Drag **Friction** **Normal** **Tension** **Weight**

For the moment, each of these words is *taboo*—you may not use any of them in your responses below until you are specifically asked to do so. This is **important**!

1. Push down on the table with your hand.

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

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

c. Draw a diagram of your hand pushing down on the table.
Draw ONLY the vector representing the force the table exerts on you (not the force you exert on the table).

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

e. Mathematicians sometimes call a line that is perpendicular to a plane a ***normal***. List other situations in which the normal force occurs.

f. Under what conditions does normal force occur?

2. Rub your hands together.
a. What factors appear to be important for this force? (What makes it bigger or smaller?)

b. List other situations in which this force occurs.

c. Forces are vector quantities; they have definite directions. 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.

d. Give the name (from the list above) and an operational definition for this force.

3. a. Suppose Wile E. Coyote were to run off a cliff. What force would *lead* to his demise?

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

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

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

4. Hold one end of the string while your partner holds the other end.

a. Suppose you gently pull while your partner simply holds. Who pulls harder if the string remains at rest?

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

c. Does the force act at one end of the string, both ends of the string, or everywhere throughout the string?

i. Consider a chain of rubber bands. If the ends of the chain are pulled, which rubber bands will stretch the most?

__The ones at the pulled end.
__The ones near either end of the chain.
__All the rubber bands in the chain.

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

d. i. What is the name of this force?

ii. Under what circumstances does this force occur?

iii. List other examples of this force.

5. Hold the coffee filter above the table and drop it.

a. What two forces are operating as the coffee filter falls?

b. Which force would not be as apparent if the coffee filter were crumpled up?

c. In what direction does this force act? Draw a diagram of the falling coffee filter showing the vector for the total effect of this force. Show the vector for the other force mentioned in part a, too.

d. What is the nature of this force? What's interacting with what?

e. Would this force affect

i. a rock falling to the bottom of a pond?

ii. a feather falling on the moon?

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

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

6. Draw the vectors for the forces acting *on* the runner.

- Drag hint: where does a solid object move through fluid?
- Friction hint: where might two surfaces slip?
- Normal hint: where are two objects in compression?
- Tension hint: where is an object being stretched (pulled apart)?
- Weight hint: where is an object being attracted to the earth?