

PHY 101 Lab 1: Forces

Your name:

Other team members:

Goals:

To explore the nature of forces and the variety of ways in which they can be produced.

Materials:

Spring scales

Masses

Variety of force-producing systems.

Activity:

Getting used to Newtons

The newton (N) is the unit of force in the Systeme Internationale (SI), and thus in PHY 101 and 111. Still, it is unfamiliar to most beginning students of physics. It is time to train yourself to estimate forces in Newtons.

Pick a mass that weighs about 1 N. How much mass is that?

Check with either your spring scale. Did you get it right?

Hold the mass in your hand, and think about how much force your hand has to exert to hold it up. You may want to try holding it on you index finger, between thumb and forefinger, or in the palm of your hand. Does the mass feel heavy or light? Do you think you could recognize it again?

Now repeat the procedure with a mass that weighs about 10 N. How much mass is that?

Check with scale. Did you get it right?

Hold the mass. Does it feel heavy or light?

For a stronger force, pull on your scale until you have stretched it to its full range. How much is that? How hard does it feel to pull?

What is your weight in newtons, and that of your teammates? (It is OK to fib a bit, but not too much!) If no appropriate measuring device is available, use the rule that 2.2 pounds equals 10 Newtons.

How strong a force can you exert? How do you know? (Can you lift your own weight? A lot more?) Please don't break a scale or force probe to demonstrate!

Exploring and characterizing forces

Here is the exploratory part of the lab. There are a number of different force-generating devices or systems that you can bring back to your station to study. Your team should bring back one at a time, then fill out the lab sheet according to these instructions:

- a. Describe the kind of force.
- b. How strong is the force? What does that strength depend on? (for example: distance between something and another thing, velocity, mass, electric charge, weight, chemistry, amount of squeeze/stretch,...) Does the force depend on contact between things?
- c. What is the direction of the force? (for example: attractive, repulsive, against direction of motion, upwards, downwards, outwards, ...) Note that by asking you to give the magnitude and direction of the force, we are asking you to characterize a *vector*.

Your TA will show you your choices, and will also give you guidance on how many to study. Here is a list of possibilities:

Examples of Forces:

1. Muscles
2. Tension in strings or ropes
3. Force between two magnets
4. Magnet interaction with Earth's magnetic field (magnetic compass)
5. Electrostatic force (two balloons, charged by rubbing on hair or on sweater)
6. Buoyancy (boat floating in water)
7. Air pressure (air pump and bicycle tire)
8. Air pressure rocket (balloon)
9. Chemical bonds that keep a thread from breaking
10. Sliding friction
11. Air friction
12. Fluid friction

Record your results here:

Kind of force:

Strength of force, and what strength depends on:

Direction of force:

Kind of force:

Strength of force, and what strength depends on:

Direction of force:

Kind of force:

Strength of force, and what strength depends on:

Direction of force:

Kind of force:

Strength of force, and what strength depends on:

Direction of force:

Kind of force:

Strength of force, and what strength depends on:

Direction of force:

Kind of force:

Strength of force, and what strength depends on:

Direction of force:

Kind of force:

Strength of force, and what strength depends on:

Direction of force:

Kind of force:

Strength of force, and what strength depends on:

Direction of force:

Kind of force:

Strength of force, and what strength depends on:

Direction of force:

Kind of force:

Strength of force, and what strength depends on:

Direction of force: