

Physics 10, Spring 2012  
Cabrillo Aptos, Tues 6 pm class



Problem Set #1: due Tuesday, Feb 14

These Problems are based on material we discussed in class, and/or on Hewitt Chapter 1: ("About Science") and Chapter 2 ("Newton's First Law of Motion: Inertia")

Please answer these questions on your own paper, and please write "Problem Set #1" at the top!

**Question #1:**

Consider Eratosthenes's experiment to measure the size of the Earth. If the Earth were a smaller planet -- but it was still 500 miles from Alexandria to Syene -- would the shadow of the stick in Syene at noon on the Summer Solstice have been longer, shorter, or the same?

*Hint:* If you're not sure (or even if you are), try drawing pictures!

**Question #2:**

Why did Eratosthenes arrange to make his measurements at noon on the summer solstice, instead of at some other random moment?

**Question #3:**

Describe at least one way in which Galileo disagreed with thinkers that went before him. (There are *lots* of possible answers.)

**Question #4**

If you are pushing a box across the floor, and you let go of it, it will soon stop moving.

- According to Aristotle, why does the box stop moving?
- According to Galileo or Newton, why did the box stop moving?

**Question #5:**

What was the major difference between Ptolemy's model of the solar system and Copernicus's?

**Question #6:**

Today, the consensus of most people is that the Earth is (very nearly) spherical. You probably believe this yourself...but do you know this from personal experience, or is it just what you've been told by others?

Try to think of one or more observations that you personally have made during your lifetime that would demonstrate that the Earth is a sphere. If you can't think of any, then propose an experiment or observation that you could easily make, that would convince you that you're on a spherical planet.

(There is no one right answer to this question; there are *many* ways to measure the shape of the Earth.)

**Question #7:**

A worker is dragging a desk across the room, moving at a constant velocity of 2 meters/second toward the east. Which is stronger: the force that the man exerts on the desk as he pulls it, or the friction that the floor exerts on the desk?

(Careful: The answer that Aristotle would give here is very different from the one Newton would give. Who is right?)

**Question #8:**

You are riding on a bus, which is traveling at constant velocity. Perhaps unwisely, you are wearing frictionless roller-skates. The driver hits the brakes, and you immediately begin to roll toward the front of the bus. (So far, the story ought to agree with your own intuition on what would happen in this situation.)

In terms of Newton's First Law, *why* did you roll toward the front of the bus?

**Question #9:**

You are trying to settle an argument between three scientists.

Amy is widely acknowledged to be a brilliant researcher, and has two Nobel Prizes, but she is also famous for playing practical jokes. She says that if you roll a marble and a soda can down a hill, the marble will reach the bottom first.

Bill is a younger physicist who just finished his PhD, and is known to be meticulously honest. He says that the soda can will get there first.

Carl is a medical researcher who has never studied physics, but his work on heart disease has saved countless lives. He says that the soda can and the marble will reach the bottom of the hill at the same time.

What is the best way to decide who is right?