Physics 100 - Fall 2007 - Recitation Module 2

(1) A spaceship passes you moving at a speed of 0.95c. You measure its length to be 10 meters. How long would this spaceship be if it were at rest next to you?

(2) Why do basketball players seem to hang in the air near the top of their jumpshot?

(3) Your car hits a mosquito. How does the force of your windshield on the mosquito compare to the force of the mosquito on your windshield?

(4)

Last recitation you measured the acceleration of objects due to the force of gravitation near the earth's surface. It is a CONSTANT $9.8\ m/s^2$, independent of the mass of the falling object (Assuming no air resistance).

Newton tells us $F = ma$.

So for our falling object

$$F = mg, \text{ where } g = 9.8\ m/s^2$$

If you lift a book in the air and let it go, it falls ... or accelerates downward at $9.8\ m/s^2$.

Why does the book NOT fall when it is sitting on a horizontal surface?

We call the force of one surface on another the "normal" force.

If a book sitting on a table has a mass of 1 kg, what is the size of the normal force that must be exerted by the table on the book to keep the book from falling?

What is the book's weight?

Terminology: $1\ kg\ m/s^2 \equiv 1$ Newton

This is the unit of force in the MKS metric system of units

The pound (lb) is the unit of force in the English system of units

How does weight differ from Mass?

(5) Zorro the cat sleeps soundly on the arm of a sofa. Suddenly a firecracker explodes nearby and Zorro jumps straight up in the air. What is Zorro's acceleration . . .

a) . . . just after his paws leave the sofa?

b) . . . at the exact INSTANT he reaches his Maximum height?

c) . . . just before he lands on the sofa?

(6) Your TA will supply your group with "bathroom" scales that you can stand on to measure your weight. Groups should take turns taking the scales into the B+L elevator. Note the "weight" of a volunteer student when:

- The elevator is at rest
- The elevator is accelerating upward during trip to a higher floor
- The elevator is slowing down during trip to higher floor
- The elevator is moving at CONSTANT speed during trip to higher floor
- the elevator is accelerating downward during trip to lower floor
- The elevator is slowing down during Trip to lower floor
- The elevator is moving at CONSTANT speed during trip to lower floor.

Now, see if you can make sense of your observations using Newton's Laws.

(7)

Divide into groups of two. One member of each group should hold a textbook in the air while the other member arranges their hands out flat some distance below the textbook.

Drop the text into the "catcher's" hands from a distance of 5 inches above the hands while the "catcher" tries to hold their hands very steady when the textbook hits their hands

Repeat for drop distance of 10 inches

Repeat for both distances ... but this time the catcher allows their hands to move in order to stop the textbook over a longer time.

For each drop event the catcher should describe the force they exert to stop the book (relative).

Can you make sense of your observations using Newton's Laws and the concepts of force, velocity, and acceleration?