

Physics 102 - Fall 2009 - Recitation Module 2

- ① Why do basketball players seem to hang in the air near the top of their jump shot?
- ② 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?
- ③ 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?

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

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

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: $1 \text{ kg } \frac{\text{m}}{\text{s}^2} \equiv 1 \text{ Newton}$

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 ...

- ... just after his paws leave the sofa?
- ... at the exact instant he reaches his maximum height?
- ... 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.

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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?