PHY100 — Recitation #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) If you lift a book in the air and let it go, it falls... or accelerates downwards at $g=9.8 m/s^2$. This is the constant you measured in the last recitation and it is independent of the mass of the falling object (It is the value of the field of gravity at Earth's surface).

Why does the book not fall when it's sitting on a horizontal surface?

We call the force of one surface on another the “normal” force. What is the size of the normal force that a table must exert on a book with a mass of 1 kg to keep the book from falling? What is the book weight? What is the difference between mass and weight?

5) Zorro the cat sleeps soundly on the arm of a sofa. Suddenly a firecracker explodes nearby and Zorro jumps straight 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) 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 textbook 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 book 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?

7) Groups should take turns going to an elevator and experiencing your reduced apparent weight.

Describe your “weight” when:

a) the elevator is at rest

b) elevator is accelerating upwards during trip to higher floor

c) elevator is slowing down during trip to higher floor

d) elevator is moving at constant speed during trip to higher floor

e) elevator is accelerating downward during trip to lower floor

f) elevator is slowing down during trip to lower floor

g) elevator is moving at constant speed during trip to lower floor

Can you make sense of your observations using Newton's laws?