

PHYS 1511 Discussion Section: Week 4

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Relevant Equations

$$v = \frac{\Delta x}{\Delta t} \quad (1)$$

$$v_f = v_o + at \quad (2)$$

$$\Delta x = x_f - x_o = v_o t + \frac{1}{2}at^2 \quad (3)$$

$$v_f^2 = v_o^2 + 2a\Delta x \quad (4)$$

Newton's 2nd Law:

$$\Sigma \vec{F} = m\vec{a} \quad (5)$$

Review

Newton's Laws:

- 1) An object stays at rest (or constant velocity) unless acted upon by exterior net force.
- 2) When a net force ($\Sigma \vec{F}$) is exerted, an acceleration \vec{a} results and is given by: $\vec{a} = \frac{\Sigma \vec{F}}{m}$
- 3) *****Whenever one object exerts a force on another, the 2nd object exerts an equal and opposite force on the first object.**

Question #1

Relative Velocity

Your car is traveling behind a jeep. Both are moving at the same speed, so the velocity of the jeep relative to you is zero. A spare tire is strapped to the back of the jeep. Suddenly the strap breaks, and the tire falls off the jeep. Will your car hit the spare tire before the tire hits the road? Assume that air resistance is absent.

- (a) Yes. As long as the car doesn't slow down, it will hit the tire.
- (b) No. The car will not hit the tire before the tire hits the ground, no matter how close you are to the jeep.
- (c) If the tire falls from a great enough height, the car will hit the tire.
- (d) If the car is far enough behind the jeep, the car will not hit the tire.

Question #2

3rd Law Force

Which one of the following is true, according to Newton's laws of motion? Ignore friction.

- (a) A sports utility vehicle (SUV) hits a stationary motorcycle. Since it is stationary, the motorcycle sustains a greater force than the SUV does.
- (b) A semitrailer truck crashes all the way through a wall. Since the wall collapses, the wall sustains a greater force than the truck does.
- (c) Sam (18 years old) and his sister (9 years old) go ice skating. They push off against each other and fly apart. Sam flies off with the greater acceleration.
- (d) Two astronauts on a space walk are throwing a ball back and forth between each other. In this game of catch the distance between them remains constant.
- (e) None of the above is true, according to the third law.

Question #3

Dangerous Physics

In the javelin throw at a track-and-field event, the javelin is launched at a speed of 29 m/s at an angle of 36° above the horizontal. As the javelin travels upward, its velocity points above the horizontal at an angle that decreases as time passes.

How much time is required for the angle to be reduced from 36° at launch to 18° ? (ignore air resistance)

Question #4

Such a Drag

When a parachute opens, the air exerts a large drag force on it. This upward force is initially greater than the weight of the sky diver and, thus, slows him down. Suppose the weight of the sky diver is 915 N and the drag force has a magnitude of 1027 N . The mass of the sky diver is 93.4 kg .

- (a) What are the magnitude and direction of his acceleration?
- (b) If a hole appeared in the parachute and the drag force now has half its magnitude. Is the diver accelerating or decelerating downward?

Question #5

Ratio Question

Two ice skaters, Paul and Tom, are each holding on to opposite ends of the same rope. Each pulls the other toward him. The magnitude of Paul's acceleration is 1.25 times greater than the magnitude of Tom's acceleration. What is the ratio of Paul's mass to Tom's mass?

- (a) 0.67
- (b) 0.80
- (c) 0.25
- (d) 1.25
- (e) 0.50