Physics: Expectations for Inertia and Forces

1. Students should understand the principle of Inertia and be able to use it to predict the behavior of objects

2. Students should understand the laboratory evidence for Newton's 2nd law (F=ma or a=F/m)

3. Students should understand the graphs of F vs a, m vs a (i.e. what the graphs tell about the relationships between these variables)

4. Students should understand Newton's 2nd Law and be able to use it to solve problems and predict the behavior or objects.

5. Students should be familiar with the units of force (Netwons)

6. Students should understand how to label forces appropriately and find the Net Force on an object. They should be able to distinguish between Applied Forces, Frictional Forces, and Net forces. They should understand which of these forces causes acceleration.

7. Students should understand that Forces come in equal and opposite pairs. However, that these pairs of forces operates on 2 separate objects.

8. Students should be able to draw free body diagrams.

9. Students should be able to show they are using the problem solving strategies introduced in class

10. Honors: Students should understand the physical meaning the slope and intercept of F vs a graph, and 1/m vs a. Honors students should also be able to solve multi-step complex problems involving all the concepts we have covered so far.

Practice problems:

1. A kid is riding a skateboard and eating an ice cream cone.
    a. If he is traveling at a constant speed, and accidentally drops the cone, where will it land? On his foot, slightly behind his foot, or slightly in front of his foot.
    b. Same question as part a, except this time he hits a big stick and stops the split second after he drops the cone.
2. Describe why headrests are a good idea in cars (think inertia).
3. Describe what types of crashes seat belts and air bags are most useful for.
4. Describe the how the acceleration of a rocket changes as it flies further and further from the earth. How do the mass, force, and acceleration change?
5. You are riding a bicycle on a level road.
    a. Draw a freebody diagram for when you are traveling a constant velocity. What is Fnet?
    b. Draw a freebody diagram for when you are accelerating. What is Fnet?
6. IF mass goes up and acceleration remains constant, the force must…
7. If mass doubles, and force remains constant the acceleration …
8. If acceleration is tripled, while force is cut in half, the mass must have …
9. Describe the ideal conditions for the "pulling the tablecloth out" trick.
10. A truck with mass 1200Kg sits at a stoplight. It accelerates from a stop and reaches 40 miles per hour in 9 seconds, then continues at that speed.
    a. If we ignore friction, then what force did the truck produce during the acceleration.
    b. If we don't ignore friction how does that change your answer?
    c. If the truck is hauling a 600Kg trailer, how does this effect your answer?
    d. If the truck has a more powerful engine, how does this effect your answer?
11. Honors: A climber is using a pulley system to haul her gear up the side of a cliff. The gear has a mass of 20 kg. The climber finds that she has to use force of 278N to get the bag to move up the cliff at a constant velocity. If she pulls with a constant force of 324 N, what will the motion of the bag be? Draw freebody diagrams for the gear, the climber, and the pulley below.