PHYS 106 Spring 2003
"How Things Work" Problem Set #1

Concise explanations of 1 or 2 sentences for each part are best.

1. Study the photograph, on page 1 of the text, of the "tablecloth" trick. Notice that the dishes move a little bit during the time the tablecloth slides under them.

   (a) What provides the force that pushes the dishes to the right?
   (b) How does the inertia of the dishes make this trick work?
   (c) What would happen if the dishes didn't have any inertia?

2. Consider what it would be like if you went to the surface of the Moon, as compared to the surface of the Earth where you are now.

   (a) Explain, in general, the difference between the weight of an object and its mass.
   (b) Is your weight the same on the Moon as on the Earth? What about your mass?
   (c) Explain a simple way to check your weight on the Earth and your weight on the Moon, assuming you could travel to the Moon.
   (d) Explain a simple way to check and see if your mass is the same on the Earth as on the Moon, again assuming you could travel to the Moon. There is more than one possible answer. Your test should not involve vertical motions, since that brings in gravity.

3. "Case 2" on page 36 of your text (Diving platform). Do all parts a, b, c, d, e and f. Be careful with part f. "Speed" means total speed in whatever direction you are travelling, not just the horizontal part or just the vertical part.

4. This is a follow-up to "Case 2" above. If you jump upward as you leave the platform, you will momentarily come to rest at the top of the motion. In what direction is your acceleration at that moment, or is it zero? Explain.

5. "Case 6" on page 37 of your text (Bicycle trip). Do only parts a, b, c, and d. Omit part e.

6. Consider an ordinary seesaw with negligible friction at the pivot. It is a total of 10 meters long, or in other words 5 meters from the pivot to each end. With no children on it, it is perfectly balanced.

   (a) Now a 32 kg child sits at the very left end. How far to the right of the pivot must a 40 kg child sit to balance the seesaw? You must show the equation you are using to get your answer.

(b) The 32 kg child remains at the left end, but the 40 kg now moves all the way to the right end, so that the seesaw is unbalanced. A third child, of mass 20 kg, wants to climb aboard. How far to the left of the pivot must this child sit to balance the seesaw? All three children are now on the seesaw. Again, show your equation.

7. A car is driving on a level road at 51 mph. It is chasing a truck moving at 50 mph. The truck has a gently sloping ramp hanging from the back, and once the car reaches the truck it attempts to drive up the ramp into the truck. Can this safely work, or will the car be moving so fast once it enters the truck that it crashes into the passenger compartment at the front of the truck? Explain.

8. "Case 2" on page 75 of your text (Revolving door). Do all parts a, b, c, d, and e.