Homework Discussion, Week 4

Physics 1301 Dr. Andersen

Chapter 5

42.) a) I set up my axes so that y is perpendicular to the surface of the incline (so, in the same direction as the normal force), and x along the incline. Set up this way, there are two forces with components in the y-direction; the normal force, and the weight. Since there is no acceleration in the y-direction, the y-component equation from $\mathbf{F} = m\mathbf{a}$ is

$$N - mg\cos 32^\circ = 0.$$

Just solve that equation for N. b) The normal force is equal to the cosine of the angle the incline makes with the horizontal times the weight, so since cosine decreases as the angle increases, the normal force will decrease as the angle increases also.
Answer: a) 22 N.

58.) a) If the speed the bag is raised with is constant, then there is no acceleration, so the total force acting must be zero, so that if F is the force the handle is experiencing, then $F - mg = 0$. b) If the bag is accelerated, then $\mathbf{F} = m\mathbf{a}$ reads (since this is a 1-D problem) $F - mg = ma$, where in this case $a = +1.35\ m/s^2$.
Answers: a) 5.20 kg, b) 4.57 kg.

Chapter 6

26.) a) The sum of the three forces acting on the picture must add to zero because the picture is suspended, and thus not accelerating. The only two forces with x-components (taking x to be horizontal) are the tensions in the strings, so the x-component equation for the forces is

$$-T_1\cos 65^\circ + T_2\cos 32^\circ = 0.$$

Since $\cos 65^\circ$ is less than $\cos 32^\circ$, T_2 must be less than T_1. b) Solve the equation in part (a). c) The y-component equation is

$$T_1\sin 65^\circ + T_2\sin 32^\circ - mg = 0.$$

Solve for mg.
Answers: b) 0.85 N, c) 2.0 N.

62.) a) Since the frictional force for kinetic friction is given by $F_{fr} = \mu_k N$, we need to find the normal force acting on the coin. I am going to take the x-axis to be upward along the incline, so that the y-axis is perpendicular to the incline. Then, the y-component equation is

$$N - mg\cos 15^\circ = 0$$

since the y-component of the acceleration is zero. Solve this for N and plug into the equation for the frictional force. Note that the since the coin is moving up the incline, the force of friction is acting downward along the incline. b) We can't simply use the results of (a) for part (b), because the force of static friction can take on a range of values. In this case, the frictional force will be equal and opposite to the sum of the forces pulling the coin down the ramp. To find the frictional force, we just need to look at the x-component equation, in this case

$$F_{fr} - mg\sin 15^\circ = 0.$$

Just solve for F_{fr} (note that you don't need the coefficient of static friction to solve the problem; diabolical indeed!) Note also that the force of static friction acts upward along the incline.
Answers: a) 0.026 N, b) 0.030 N.