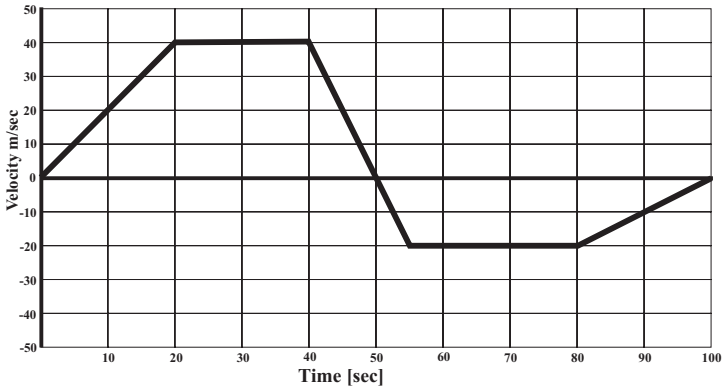
PHYSICS HOMEWORK #39 MECHANICS REVIEW

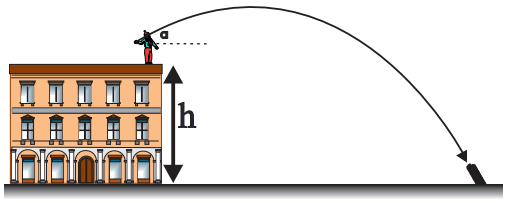
1. A car is moving down a highway with an initial velocity of 35.0 m/sec when the brakes are applied and the car begins to slow down at the rate of -5.0 m/sec^2.
   a. What will be the velocity of this car 4.0 seconds after the brakes are applied?
   b. How far will the car move during the first 4.0 seconds that the brakes are applied?
   c. What will be the average velocity of the car during these 4.0 seconds?
   d. How long will it take for this car to come to a halt?

2. A ball, which has a mass of 1.25 kg., is thrown straight up from the top of a building 86.0 meters tall with an initial velocity of 42.0 m/sec.
   a. What will be the velocity of this ball at the highest point?
   b. What will be the acceleration of this ball at the highest point?
   c. How long will it take for this ball to reach the highest point?
   d. What will be the height of this ball above the ground when it reaches the highest point?
   e. How long will it take for this ball to reach the ground?
   f. What will be the velocity of this ball when it reaches the ground?
   g. When will this ball be 144 meters above the ground?

3. A graph is made, as shown to the right, plotting the velocity of a car as a function of time.
   a. What is the velocity of this car when t = 30 seconds?
   b. How far did this car travel during the first 20 seconds?
   c. What is the acceleration of this car when t = 10 seconds?
   d. What is the displacement of this car between t = 50 seconds and t = 100 seconds?
   e. What is the acceleration of this car when t = 50 seconds?
   f. During which time interval/intervals does this car have zero acceleration?
   g. What are the units of the slope of this graph?
   h. Write the equation describing the velocity of this car between t = 40 seconds and t = 55 seconds.



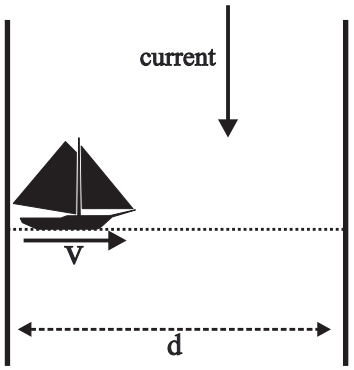
4. A baseball is thrown, with an initial velocity of 37.0 m/sec at an angle of 26.0^o above the horizontal, from the top of a building which is 72.0 meters high.
   a. What will be the horizontal and vertical components of this baseball's velocity?
   b. What will be the vertical velocity of this baseball at the highest point of its trajectory?
   c. What will be the horizontal velocity of this baseball at the highest point of its trajectory?
   d. What is the "trajectory"?
   e. How long will it take for this baseball to reach the highest point?
   f. What will be the highest point reached by this baseball?
   g. How long will it take for this baseball to reach the ground?
   h. How far from the base of the building will the baseball strike the ground?
   i. What will be the baseball's velocity just as it reaches the ground?



Answers to opposite side: 5a. 200 s b. 1000 m c. 2600 m at 22.6^o downstream d. 13 m/sec at 22.6^o downstream 5e. 24.6^o upstream f. 343 s 6. Fn - perpendicular to incline, Ff - parallel to and down the incline, Fa - up the incline 6a(cont). Fg - straight down b. 427 N c. 235 N d. 345 N e. 1380 J f. 441 J g. AMA = 1.28 h. IMA = 4 6i. 32% j. 940 J 7a. -1.08 Nm b. -2.57 Nm c. 2.57 Nm d. 1.75 kg e. 22.3 N 8a. 608 N b. 580 N & 665

PHYSICS HOMEWORK #40 MECHANICS REVIEW

5. A boat, which has a speed of 12.0 m/sec in still water, heads directly across a river which has a current of 5.00 m/sec and which is 240 meters wide.



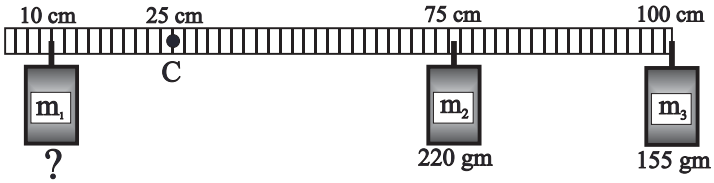
   a. How long will it take for this boat to reach the opposite shore of the river?
   b. How far downstream will this boat reach the opposite shore of the river?
   c. What will be the final displacement of this boat when it reaches the opposite shore of the river?
   d. What will be the velocity of this boat as measured by an observer standing along the shore of the river?
   e. In direction should this boat be aimed if it is to go directly across the river?

   Suppose that this boat was aimed directly up stream.

   f. How long will it take for this boat to go 240 meters upstream?

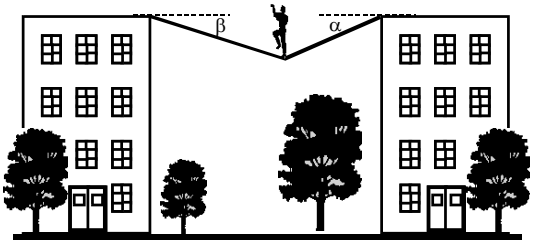
6. A 45.0 kg crate is sitting at the bottom of an inclined plane which is 4.00 meters long and 1.0 meters high. This crate is then pushed up the incline at a constant force. The coefficient of friction between the crate and the incline is $\mu = 0.550$.
   a. Complete the freebody diagram showing all of the forces acting on this crate.
   b. What will be the magnitude of the normal force acting on this crate as it slides up the incline at a constant speed?
   c. What will be the frictional force acting on this crate as it slides up the incline at a constant speed?
   d. What is the magnitude of the force required to push this crate up the incline at a constant speed?
   e. How much work will be done by the applied force on the crate as it is pushed to the top of the incline?
   f. How much gravitational potential energy will this crate have when it reaches the top of the incline?
   g. What is the AMA of this inclined plane?
   h. What is the IMA of this inclined plane?
   i. What is the efficiency of this inclined plane?
   j. How much energy was wasted by the frictional force in pushing the crate to the top of the incline?

7. Three weights are hung from a meterstick, which has a mass of 145 grams, as shown in the diagram to the right. The system is at equilibrium.



   a. What is the torque supplied by the 220 gram mass about the 25.0 cm mark on the meterstick?
   b. What is the total clockwise torque about the 25.0 cm mark of the meterstick?
   c. What is the total counterclockwise torque about the 25.0 cm mark of the meterstick?
   d. What is the mass m_1 required to produce equilibrium about the 25.0 cm mark of the meterstick?
   e. How much upward force must be applied to this meterstick at the 25.0 cm mark in order to generate equilibrium?

8. A tightrope walker, who has a mass of 62.0 kg., is standing on a cable stretched between two buildings as shown to the right where the angles formed by the cable and a horizontal line between the two buildings are $\beta = 22.0^o$ and $\alpha = 36.0^o$.



   a. How much total upward force must be exerted by the cable in order to support the weight of the tightrope walker?
   b. What will be the tensions, T_β and T_α, in the sections of the cable to the left and right of the tightrope walker?

Answers to opposite side: 1a. 15.0 m/sec b. 100 m c. 25 m/sec d. 7.0 s 2a. 0.0 m/sec b. -9.8 m/sec^2 2c. 4.28 s 2d. 176 m e. 10.3 s f. -58.7 m/sec g. 6.84 s & 1.73 s 3a. 40 m/sec b. 400 m c. 2.0 m/sec^2 3d. -750 m 3e. -4.00 m/sec^2 f. 20 s < t < 40 s & 55 s < t <80 s g. m/sec^2 h. v = -4t + 200 4a. 16.2 m/sec 4b. 0.0 m/sec 4c. 33.3 m/sec d. path followed by projectile e. 1.65 s f. 85.4 m g. 5.83 s h. 194 m i. 53 m/sec at -51°