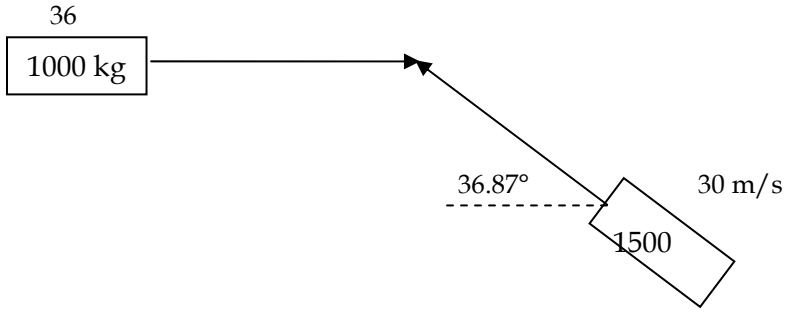
W7.06

MOMENTUM

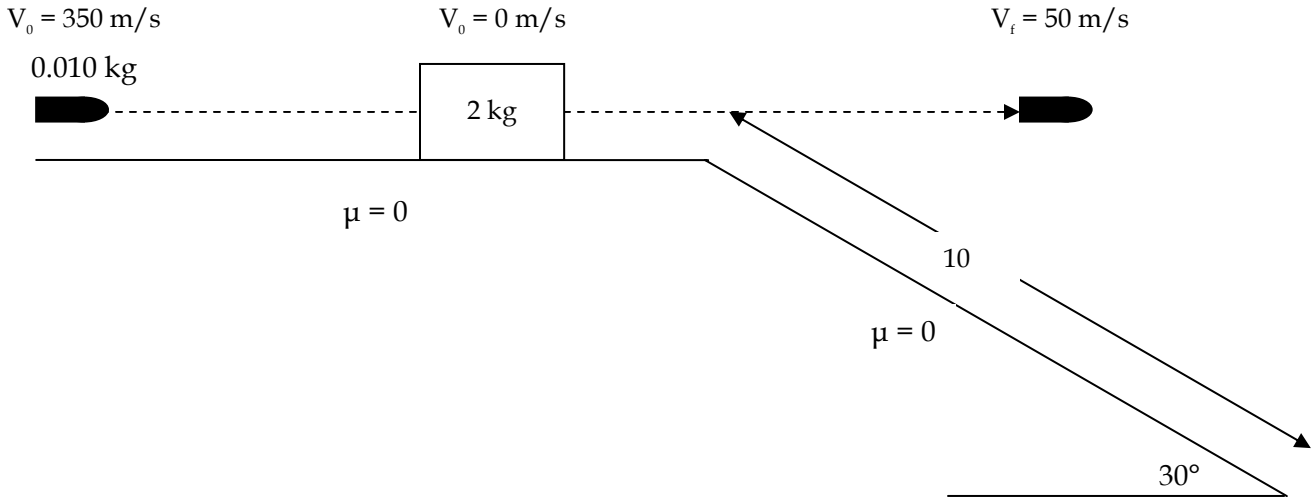
Problems-II

1. A soccer player uses his head to hit a 1 kg ball that is traveling northward at 15 m/s. Assume that the impact lasts 0.01 sec and that he heads the ball southward at 15 m/s. What is the average force on his head during the impact?

2. A 1000 kg car moving at 27 m/s from left to right collides head-on with a 1500 kg car moving at 30 m/s from right to left.
   a. Determine the magnitude and direction of the velocity of the wreckage after the collision.
   b. If a 1000 kg car moving at 36 m/s from left to right collides with a 1500 kg car moving at 30 m/s at 36.87° N of W (as pictured below), what is the speed and direction of the wreckage?



3. A 0.010 kg bullet traveling at 350 m/s passes horizontally through a 2 kg block (initially at rest) that rests on a frictionless surface. The bullet emerges with a speed of 50 m/s.



   a. Determine the speed of the 2 kg block after the collision.
   b. The 2 kg slides across the horizontal surface and then down a frictionless 30° incline. Given that the length of the incline is 10 m, determine the speed of the block at the bottom of the incline using:
      i. working and energy methods
      ii. dynamics/kinematics
   c. Bonus: What is the speed of the block at the bottom of the incline if the coefficient of friction for the incline is 0.115?

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1. 3000 N

2. a. 7.2 m/s to left
   b.10. 8 m/s due north

3. a. 1.5 m/s
   b. 10.1 m/s
   c. 9.07 m/s