Wentworth Institute of Technology Engineering Physics I, Fall 2015
Instructor: Dr. Marissa Vogt
Problem Set #8
Due: before 4:30 p.m. in my mailbox in Ira Allen 316 *or* turned in after class, Tuesday, November 10, 2015
Remember to write down the names of any classmates you worked with.

Problem 1 (15 points)

(Based on Y&F 8.7) A golf ball has a mass of 0.05 kg. It is initially at rest, but after being struck by a golf club it is given a speed of 30 m/s. The club and the ball are in contact for 2 ms (.002 seconds).

a) What is the average force acting on the ball?
b) What is the impulse of the net force on the golf ball during its contact with the golf club?

Problem 2 (15 points)

(Based on Y&F 8.18) Two figure skaters, initially at rest, push off against each other on frictionless ice. The first skater has a mass of 70 kg and travels at 1.5 m/s. The second skater has a mass of 60 kg.

a) What is the speed of the second skater?
b) What is the initial kinetic energy of the two skaters? What is their final kinetic energy? Are they the same? If not, where does the energy come from?

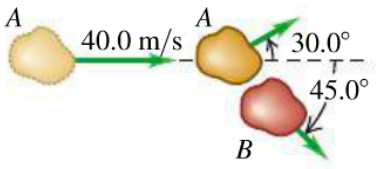
Problem 3 (15 points)

(Based on Y&F 8.21) On a frictionless table, ball 1 with mass 0.25 kg moves with a velocity in the $+\hat{x}$ direction towards ball 2, which has a mass of 0.35 kg and is initially at rest. After the collision, ball 1 has a velocity of –0.12 m/s $\hat{x}$.

a) If the collision is completely elastic, what is the initial velocity of ball 1 and the final velocity of ball 2 (express as a vector)?
b) If instead the collision is inelastic and ball 2 has a final velocity of 0.65 m/s $\hat{x}$, what is the initial velocity of ball 1? How does the kinetic energy of the system change during the collision?

Problem 4 (15 points)

Figure **E8.31**

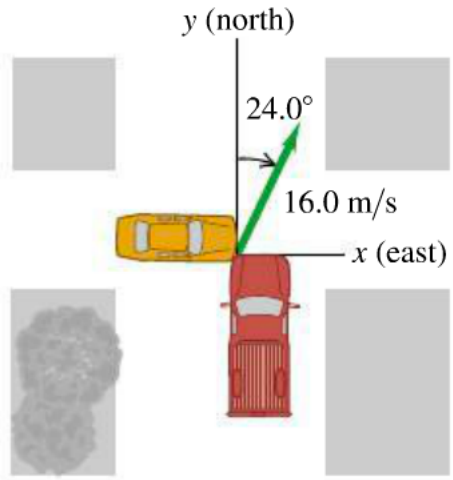


(Based on Y&F 8.31) Two asteroids of equal mass collide as shown in the figure. After the collision, asteroid A's trajectory is deflected by 30 degrees from its initial motion. Asteroid B is initially at rest and its final velocity makes a 45 degree angle with respect to the initial trajectory of asteroid A.

a) What is the final speed of each asteroid? Express your answer as a vector.
b) What fraction of asteroid A's initial kinetic energy dissipates during the collision?

Problem 5 (10 points)

Figure **E8.41**



(Based on Y&F 8.41) Two cars collide as shown in the figure. The yellow car is initially heading east and has a mass of 1000 kg. The red truck is initially heading north and has a mass of 2000 kg. The two vehicles collide, stick together, and veer off at a velocity of 16 m/s at a direction of 24 degrees east of north. You can ignore friction.

What is the speed of each car before the collision?

Problem 6 (15 points)

a) Where is the center of mass of the solar system?
b) Is it located inside or outside of the Sun?

Because Jupiter is so much more massive than the rest of the planets, you can approximate the mass and position of all of the planets by the mass and position of Jupiter. The mass of the Sun is 1.9×10^{30} kg and the mass of Jupiter is 1.9×10^{27} kg. Jupiter orbits the Sun at a distance of ~5.2 AU (1 AU = 1.496×10^{11} m). The Sun has a radius of 6.9×10^{5} km. (Based on Y&F 8.52)

Problem 7 (15 points)

(Based on Y&F 8.92) A 60-kg woman stands up in a 100-kg canoe that is 5 m long. She walks from a point that is 1 m from one end of the canoe to a point that is 1 m from the other end of the canoe as shown in the figure. Ignoring the resistance to motion of the canoe in the water, how far does the canoe move during the woman's walk?

Figure **P8.92**