

CHAPTER 9

1. A machinist drills a 3 cm diameter hole in a 12 cm by 12 cm piece of metal. The coordinates of the hole measured from the lower left hand corner are (4,5)
 - a. Find the x coordinate of the center of mass.
 - b. Find the y coordinate of the center of mass.

2. A 12 kg mass is traveling to the east at a speed of 14 m/s. It collides with a 14 kg mass traveling west at a speed of 8 m/s.
 - a. If they stick together what is their speed just after the collision?
 - b. How much kinetic energy is lost in the collision?
 - c. If the second mass was travelling north instead of west what would the speed of the two masses be just after they collided and stuck together?

3. A 5 kg mass is travelling at a speed of 6 m/s collides with a stationary 4 kg mass.
 - a. Find the speed of each mass if the collision is elastic.
 - b. Find the final speed of the masses if they stick together.
 - c. What percentage of the original kinetic energy is lost?
 - d. What is the average force if the collision lasts for 10 ms?

4. A 120 g tennis ball is travelling to the right at a speed of 30 m/s and bounces off a wall in the opposite direction at a speed of 24 m/s. The ball is in contact with the wall for 14 ms. What is the average force exerted by the wall?

5. A 1200 kg car traveling north at 20 m/s collides with a 1600 kg car travelling east at 30 m/s.
 - a. If the two cars stick together what is their velocity just after the collision (before they slow down)? Write the velocity in component notation.
 - b. What is the magnitude of this velocity?
 - c. What is the direction of the velocity after the collision?

6. M1 has a mass of 2 kg and is moving to the right at a speed of 7 m/s. M2 has a mass of 3 kg and is moving to the right at a speed of 5 m/s. After the collision M1 is moving to the right at a speed of 4 m/s.
 - a. What is the speed of M2 after the collision?
 - b. What is the impulse that M1 exerts on M2?
 - c. If the collision lasted for 0.015 s what is the average force that M1 exerts on M2?

7. A 1200 kg car travelling north at 20 m/s collides with a 1600 kg car travelling south at 30

m/s.

- a. If the two cars stick together what is speed just after the collision?
 - b. What fraction of the original kinetic energy is lost in the collision?
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8. A mass of 8 kg is located at a position of (3,1), a 6 kg mass is located at (4,5), and a 12 kg mass is located at (1,3). What are the coordinates of the center of mass?

 9. A 160 lb skater at rest pushes against his 110 lb partner and gives her a speed of 10 ft/s. What was his speed just after he pushed her away?