

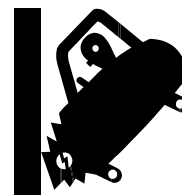
Module 9

Physics

Assignment #1

Read pages 287 - 304.

1. An object's velocity is 16 m/s at 30° . What is the direction of its momentum vector?
2. Car A has more mass than Car B. How can Car B have the same momentum as Car A?
3. A Mini Cooper and a semi truck are traveling with equal amounts of kinetic energy. Do the vehicles have the same momentum? Explain.
4. If the speed of an object is doubled, by what factor is its momentum changed?
5. Write the Law of Conservation of Momentum.
6. A 0.1-kg ball is thrown straight up into the air with an initial speed of 15 m/s.
 - a. Find its initial momentum.
 - b. Find its momentum at its maximum height.
7. A 40-kg child standing on a frozen pond throws a 0.5-kg stone to the east with a speed of 5 m/s. Ignoring friction, calculate the recoil velocity of the child.
8. A pitcher claims he can throw a baseball with as much momentum as a 3.0-gram bullet moving with a speed of 1500 m/s. A baseball has a mass of 0.145 kg. What must be the speed of the pitcher's throw if he is telling the truth?
9. A 3.0-kg steel ball strikes a wall with a speed of 10 m/s. It bounces off with the same speed and angle. If the ball is in contact with the wall for 0.2 seconds, what is the average force exerted on the ball by the wall?
10. A wad of clay (mass = 450 grams) is thrown at a wall with a speed of 6 m/s. How long does it take to stop the clay if the wall exerts a force of 9 Newtons?
11. A 500-kg car traveling north at a speed of 30 m/s runs into a 900-kg truck traveling south at a speed of 20 m/s. The two vehicles lock together when they crash. What is the final velocity of the two vehicles? Be sure to include the velocity's magnitude and direction.
12. A 10-gram bullet is fired into a stationary block of wood (mass = 5.0 kg). The bullet stops inside the block of wood and the speed of the wood-bullet combination immediately after the collision is 0.6 m/s. What was the original speed of the bullet?
13. Honors: A 1500-kg car collides with a wall. The initial velocity of the car is 15 m/s and the final velocity is -2.6 m/s. If the collision lasted for 0.15 seconds, find the average force exerted by the wall on the car.



14. What is the difference between an elastic collision and an inelastic collision?
15. What is the difference between an inelastic collision and a perfectly inelastic collision?
16. Indicate whether the collision is elastic, inelastic or perfectly inelastic:
 - a. Two wads of clay are thrown at each other and stick together.
 - b. A rubber ball collides with the ground and loses a little energy each bounce.
 - c. Two air hockey pucks hit each other and bounce back.
17. A sharpshooter fires a rifle while standing with the butt of the gun against her shoulder. If the forward momentum of the bullet is the same as the backward momentum of the gun, why is it not as dangerous to be hit by the gun as by the bullet?
18. In some motorcycle races, the riders drive over small hills and the motorcycles become airborne for a short time. If the motorcycle racer keeps the throttle open while leaving the hill and going into the air, the motorcycle tends to land upright, instead of tilting to the side. Why does this happen?
19. Often when a high diver wants to execute a flip in midair, she draws her legs up against her chest. Why does this make her rotate faster?
20. A 70-kg ice skater starts a spin with his arms out (radius = 1 meter) at a speed of 4 meters per second. If he brings his arms in (radius = 0.3 m), how fast will he be spinning?
21. Honors: A 1500-kg car traveling east with a speed of 28 m/s collides at an intersection with a 2500-kg van traveling north at a speed of 20 m/s. Find the direction and magnitude of the velocity of the wreckage if the two vehicles lock together when they collide.

