Physics 513 Name _____
Momentum & Impulse

1. What is the change in momentum caused by a 35 Newton force to the right acting on a mass for 5 sec?

2. A freight train moves with a velocity of 17 m/s to the North. The mass of the train is 6×10^6 kg. What would have to be the velocity of a 2000 kg car if the car were to have the same momentum?

3. A force acting on a 5 kg body increases its speed uniformly from 2.0 m/s to 8.0 m/s through 5 seconds.
a) What is the initial and final momentum of the body?
b) What impulse did the body receive?
c) What is the net force acting on it?

4. A 75 kg skateboarder is initially going 5 m/s to the right. He slows to a stop over 10 seconds.
a) What is the direction and magnitude of the net force that causes this change?
b) If the skateboarder had to stop over 2 seconds rather than 10 seconds, what would need to be the direction and magnitude of the net force?
c) When we changed the time over which the skateboarder had to stop, did the impulse experienced by the skateboarder change? Why or why not?

5. A woman drives a 45 gram golf ball off of a tee and gives the ball a velocity of 28 m/s to the right. The impact of the club on the ball lasts for 0.006 seconds.
a) What is the change in momentum of the ball?
b) What is the impulse that acts on the club?
c) What is the force of the club on the ball?
d) What is the force of the ball on the club?

6. A 0.3 kg tennis ball is travelling west with a speed of 4 m/s and bounces off a wall. After bouncing, the ball is travelling east at 2 m/s. The tennis ball was in contact with the wall for 0.004 seconds.
a) What is the initial and final momentum of the ball?
b) What is the direction and magnitude of the force the ball experienced due to the wall?
c) What is the direction and magnitude of the force the wall experienced due to the ball?
9. A volleyball is spiked so that its incoming velocity of 4 m/s is changed to an outgoing velocity of 17 m/s. If the mass of the ball is 0.6 kg, what is the impulse provided?

7. A 50 kg person steps off of a 1 meter tall desk.
a) Assuming they started at rest, how fast are they going JUST before they hit the ground?
b) What would be the momentum of this person, JUST before they hit the ground?
c) The interaction with the ground causes the person to stop. What was the magnitude and direction of the impulse received by the person from the ground?

d) Let's say two different people with identical masses step off simultaneously, Betty and Sally. Betty is smart and listened in physics classes so when she hits the ground, she bends her knees causing her to stop over 1.2 seconds. Sally is dumb and doesn't bend her knees, meaning she stops abruptly over 0.2 seconds.

i) Who receives the bigger impulse, Betty or Sally? Explain

ii) Who experiences the larger stopping force, Betty or Sally? Explain.

8. Mass A (10 kg) is travelling west at 8 m/s and collides and sticks to Mass B (30 kg) which is travelling east at 4 m/s.

a) Find the final velocity of both masses after the collision

b) Calculate the change in momentum of mass A.

c) Calculate the change in momentum of mass B

d) What is the impulse mass A experiences?

e) If the collision lasts for 0.06 seconds, find the net force on mass A.

9. A 10 kg bomb is sliding across an ice rink southward at 6 m/s. It explodes. Piece 1 with a mass of 2 kg moves southward at 12 m/s. Find the direction and magnitude of the velocity of mass 2.

10. A 5 kg ball is moving 4 m/s to the right when it collides with a 2 kg ball moving at 6 m/s to the left. After the collision, the 5 kg ball is moving 0.8 m/s to the right.

a) What is the final velocity of the 2 kg ball?

b) What is the impulse received by the 5 kg ball?