Impulse Momentum Theorem Worksheet

**Momentum**, p, is the product of mv. The mass and velocity must be put in standard SI units.

p = mv

1. What is the momentum of a 70 kg runner traveling at 10 m/s?

2. What is the momentum of a 800 kg car traveling at 20 m/s?

3. What is the momentum of a 47 gram tennis ball that is traveling at 40 m/s?

4. What is the momentum of a 120 pound bicyclist that is traveling at 25 mph?

5. What is the momentum of a 1500 pound car that is traveling 5 mph?

6. What is the speed of a 0.050 kg bullet that is to have the same momentum as the car in problem #5?

7. What is the speed of a 60 kg runner that travels with the same momentum as the car in problem #5?

8. What is the momentum of a 453 gram football that is thrown with a speed of 30 m/s?

9. How fast must a 150 g baseball be traveling to have the same momentum as the football in problem#8?

**Changes in momentum, p.**

Direction counts! if the objects switches directions then the p is added.

**p = mvfinal - mvinitial**

10. What is the change in momentum of a 950 kg car that travels from 40 m/s to 31 m/s?

11. What is the change in momentum of a 40 kg runner that travels from 5 m/s to 11 m/s?

12. A mud blob, 0.350 kg, is thrown at a wall at 10 m/s. The blob sticks to the wall. What is the change in momentum of the blob?

13. A 0.095 kg tennis ball is traveling 40 m/s when it bounces off a wall and travels in the opposite direction it came from. The bounced leaving the wall with a speed of 30 m/s. What is the change in momentum of the ball?

14. A baseball, 167 grams, is pitched at 50 m/s when is hit by the batter. The ball travels in the opposite direction it was thrown from with a speed of 70 m/s. What is the change in momentum of the baseball?

15. In a football game a 70 kg player is running at 10 m/s when he is hit by another player. When he is hit by the other player he bounces off in the opposite direction at 5 m/s. What is the players change in momentum?

**IMPULSE (J = Ft** = **p)**

16. If the runner, in #10, took 30 seconds to change its speed, then what force caused the change?

17. If the car, in #11, took 2 minutes to change its speed, then what force caused the change?

18. How much time was taken to stop the blob in #12 if the mud blob was stopped by 400 N force?

19. Contact with the ball in #13 lasts for 0.05 seconds. What force caused the ball’s change in speed?

20. The baseball in #14 is hit by a 1608 N force. How long is the ball in contact with the bat?

21. When the two players collide in #15, there contact took 0.05 seconds. What force was exerted by each player in the collision?

22. Baseball pitcher throws a fast ball with a 100 Ns impulse. If he applied the force in

0.15 seconds. What force did he apply.

23. A hockey puck is hit by a hockey player at the goalie. The puck is hit with a 1200 N force. The stick made contact for 0.1 seconds. What impulse was given to the puck?

If a goalie stopped it with a force that acts for 0.65 seconds, then what force did he apply?

24. In a lacrosse game a ball is thrown with a force of 2000 N. the throwing force acted for 0.8 seconds. Another player stopped the ball in 0.3 seconds with their helmet.

What force did their helmet use to stop the ball?

25. A 1000 kg car crashed into a bearer. The car changed speed from 30 m/s to 20 m/s in 2 seconds. What force did the bearer apply to stop the car?

26. A 60 kg skateboarder accelerated from 5 m/s to 12 m/s. She applied a force of 4200 N. How quickly did she accelerate?

27. An outfielder stops a ball that is originally hit with an impulse of 2000 Ns. The balls mass is 0.25 kg. What was the ball's change in speed when the outfielder stopped it?