

Name: \_\_\_\_\_

Class: \_\_\_\_\_

Date: \_\_\_\_\_

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

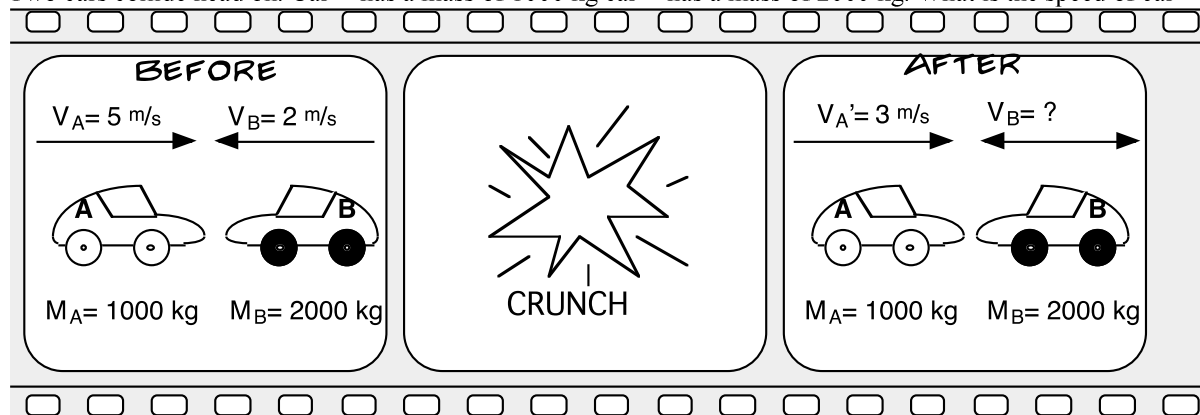
1. What is the momentum of a 70 kg runner traveling at  $10 \text{ m/s}$ ?
2. What is the momentum of a 800 kg car traveling at  $20 \text{ m/s}$ ?
3. What is the momentum of a 47 gram tennis ball that is traveling at  $40 \text{ m/s}$ ?
4. What is the momentum of a 54.4kg bicyclist that is traveling at  $11 \text{ m/s}$ ?
5. What is the momentum of a 680kg car that is traveling  $2.2 \text{ m/s}$ ?
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  $30 \text{ m/s}$ ?
9. How fast must a 150 g baseball be traveling to have the same momentum as the football in problem #8?

Changes in momentum,  $\Delta p$ .  $\Delta p = mv_{\text{final}} - mv_{\text{initial}}$ .

Direction counts! If the object switches directions then the  $\Delta p$  is added.

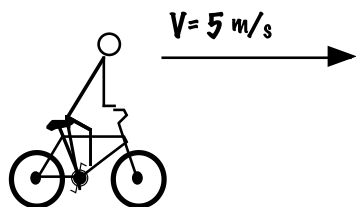
10. What is the change in momentum of a 950 kg car that travels from  $40 \text{ m/s}$  to  $31 \text{ m/s}$ ?
11. What is the change in momentum of a 40 kg runner that travels from  $5 \text{ m/s}$  to  $11 \text{ m/s}$ ?
12. A mud blob, 0.350 kg, is thrown at a wall at  $10 \text{ m/s}$ . The blob sticks to the wall. What is the change in momentum of the blob?
13. A 0.095 kg tennis ball is traveling  $40 \text{ m/s}$  when it bounces of a wall and travels in the opposite direction it came from. It left the wall with a speed of  $30 \text{ m/s}$ . What is the change in momentum of the ball?
14. A baseball, 167 grams, is pitched at  $50 \text{ m/s}$  when is hit by the batter. The ball travels in the opposite direction it was thrown from with a speed of  $70 \text{ m/s}$ . What is the change in momentum of the baseball?
15. In a football game a 70 kg player is running at  $10 \text{ m/s}$  when another player hits him. When the other player hits him he bounces off in the opposite direction at  $5 \text{ m/s}$ . What is the player's change in momentum?  
If the runner, in #11, took 30 seconds to change its speed, then what force caused the change?
17. If the car, in #10, 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?

Two cars collide head on. Car **A** has a mass of 1000 kg car **B** has a mass of 2000 kg. What is the speed of car **B** after the collision?



CALCULATE MOMENTUM, CHANGE IN MOMENTUM, AND IMPULSE( IF POSSIBLE) FOR EACH SYSTEM

**A**



$M_R = 60 \text{ kg}$

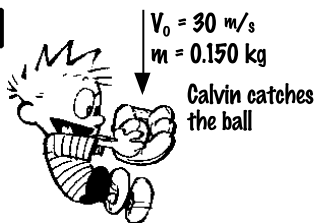
$M_B = 20 \text{ kg}$

Impulse: \_\_\_\_\_

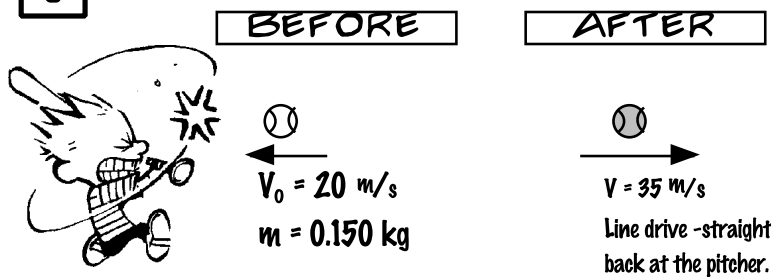
Momentum of the bike: \_\_\_\_\_

Momentum of the rider: \_\_\_\_\_

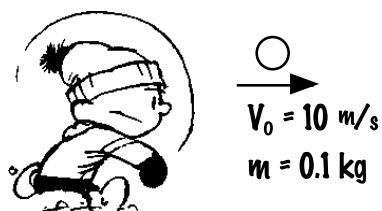
**B**



**C**



**D**



The snow ball hits Susie on the head and sticks there.

