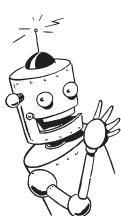


# **Conservation of Momentum**

## **Pre-Test - Post-Test**

- A cannon recoils from launching a cannonball. The speed of the cannon's recoil is small because the \_\_\_\_\_.
    - cannon has far more mass than the cannonball.
    - force against the cannon is relatively small.
    - momentum of the cannon is unchanged.
    - impulse on the cannon is less than the impulse on the cannonball.
    - none of the above
  - If all people, animals, trains and trucks all over the world began to walk or run towards the east, then \_\_\_\_\_.
    - the earth would spin a bit slower.
    - the earth would spin a bit faster.
    - the earth's spin would not be affected at all.
  - Superman is at rest in space when he throws an asteroid that has more mass than he does. Which moves faster, Superman or the asteroid?
    - The asteroid.
    - Superman.
    - They both move at the same speed.
  - A cannon fires a cannonball. The speed of the cannonball will be the same as the speed of the recoiling cannon \_\_\_\_\_.
    - because momentum is conserved.
    - because both velocity and momentum are conserved.
    - because velocity is conserved.
    - if the mass of the cannonball equals the mass of the cannon.
  - A collision is considered elastic if \_\_\_\_\_.
    - after the collision, the objects have the same shape as before the collision.
    - there is no sound generated during the collision.
    - there is no lasting deformation.
    - the objects that collide don't get hot.
    - all of the above
  - A moving freight car runs into an identical car at rest on the track. The cars couple together. Compared to the velocity of the first car before the collision, the velocity of the combined cars after the collision is \_\_\_\_\_.
    - the same.
    - zero.
    - twice as large.
    - one half as large.

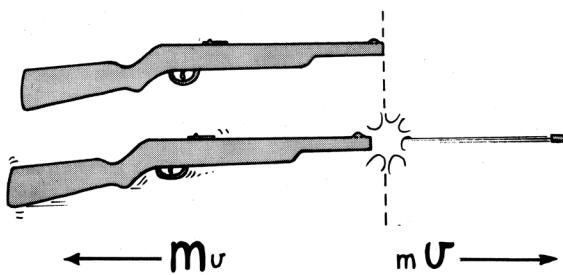


## Chapter 7 Impulse and Momentum

**Conservation of Momentum****Conservation of Momentum**

1. State the law of conservation of momentum?

2. When a bullet is fired, its momentum indeed changes! Also the momentum of the recoiling rifle changes. So momentum is not conserved for the bullet, and momentum is not conserved for the rifle. In what sense do we say that momentum is conserved?



3. In terms of momentum conservation, why does a gun recoil when fired?

4. Why is it difficult for a firefighter to hold a hose that ejects large amounts of high-speed water?

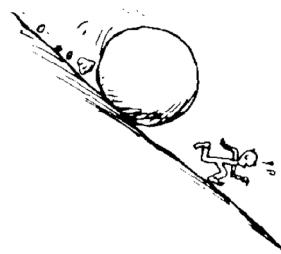
5. If a ball is projected upward from the ground with 10 units of momentum, explain what happens to the momentum of world.

6. From the previous problem, why don't we feel the recoil of the Earth?

7. When an apple falls from a tree and strikes the ground without bouncing, what happens to its momentum?

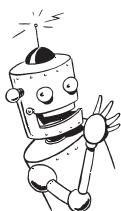
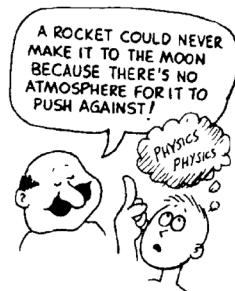
8. If you throw a ball horizontally while standing on roller skates, you roll backward with a momentum that matches that of the ball. Will you roll backward if you go through the motions of throwing the ball, but instead hold on to it? Explain.

9. Your friend says that the law of momentum conservation is violated when a ball rolls down a hill and gains momentum. What do you say?



10. What happens to the earth as you walk in one direction?

11. A popular misconception is that rockets need air to push against in order to work. This of course is not true. How is a rocket propelled in a region completely devoid of an atmosphere?



**Chapter 7 Impulse and Momentum****Collisions**

**12.** Collisions are classified into two types, list the two types of collisions.

**13.** What is the difference between elastic and inelastic collisions.

**14.** Would a head-on collision between two cars be more damaging to the occupants if the cars stuck together or if the cars rebounded upon impact?

**15.** Are rubber bumpers a good idea or bad idea on cars, explain.

**16.** In designing a car, would it be better to design vehicles to stick together during collisions or to bounce? Explain

**17.** You are going to be in a collision between a heavy car and a light car, if the vehicles stick together after the collision would it be better to be in the light vehicle or the heavy vehicle?

**18.** You are going to be in a collision between a heavy car and a light car, if the vehicles bounce away from one another after the collision would it be better to be in the light vehicle or the heavy vehicle?

**19.** A big truck and a small car have a head-on collision.

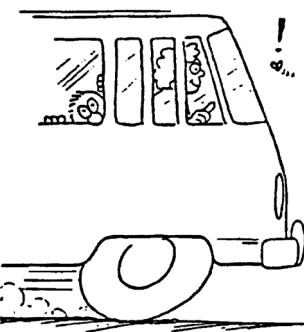


a) Which vehicle will experience the greater impulse?

b) Which vehicle will experience the greater change in its momentum?

c) Which vehicle will experience the greater acceleration?

**20.** A bug is smashed into the windshield of a fast-moving bus. Tell whether the following statements are true or false.

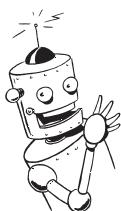


a) The forces of impact on the bug and on the bus are the same size.

b) The impulses on the bug and on the bus are the same size.

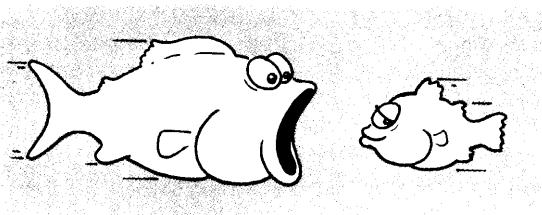
c) The changes in speed of the bug and of the bus are the same.

d) The changes in momentum of the bug and of the bus are the same size.



**Chapter 7 Impulse and Momentum**

21. A 5 kg fish swimming 1 m/s swallows an absent-minded 1 kg fish at rest.

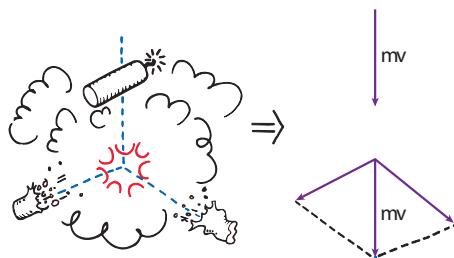


- a) What is the speed of the large fish immediately after lunch?
  
  
  
  
  
  
- b) What would the large fish's speed be if the small fish were swimming toward it at 4 m/s?

**Momentum Vectors**

23. Two cars are headed towards a collision, one of the cars is traveling east and the other is traveling north. Explain with vectors how conservation of momentum still holds true in this situation.

24. A falling firecracker explodes sending fragments in all directions. Explain with vectors how conservation of momentum still holds true in this situation.

**Newtonian Demonstrator**

22. Would it be a violation of the law of conservation of momentum if two balls are dropped and only one ball came out the other side but with twice the speed? Explain

