

Momentum: property an object has due to its _____.

- A dump truck and a toy dump truck are moving at the same speed.
 - Which one requires more force to stop?
 - The “real” dump truck because it has a greater momentum.

Formula for Momentum:

$$\text{Momentum} = \text{mass} \times \text{velocity} \text{ OR } p = \underline{\hspace{2cm}}$$

Units: kg X m/s

Question: If a large and small truck were involved in a collision what would happen?

Answer: The small truck would have damage because _____ of the large truck is greater.

Conserving Momentum:

- Momentum does not change unless its velocity, mass, or both are changed.
- Momentum does have the ability to transfer some or all of its momentum

Example: The game of pool

- In the beginning, the cue ball and the rack of balls have no motion.
 - The cue ball is hit. (It has a change in momentum.)
 - The cue ball hits the rack of balls.
 - The cue ball slows down and _____ momentum.
 - The rack of balls _____ momentum.
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- The momentum that the cue ball lost is _____ to the momentum that the rack of balls gained.
 - Momentum was **CONSERVED**

Law of Conservation of Momentum: the total amount of momentum on an object will not change until an outside force acts on the object.

Example: After the pool balls were hit, they did begin to slow down.

- The outside force was friction.

Momentum

Directions: Answer the following questions using your book and your notes.

1. Define momentum.

2. Why does it take a large truck longer to stop than a compact car, even though both are traveling at the same velocity?

3. The product of the mass and velocity of an object is called _____.

4. Explain the law of conservation of momentum.

5. Which of the following has the smallest amount of momentum?

- a. A loaded truck driven at highway speed
- b. A track athlete running a race
- c. A baby crawling on the floor
- d. A jet airplane being towed toward an airport.

6. What is the equation used to calculate momentum?

7. Calculate the momentum of a 2.5kg puppy that is running with a velocity of 4.8m/s south. Show all your work below.

8. If a cue ball hits a billiard ball so that the billiard ball starts moving and the cue ball stops, what happens to the cue ball's momentum?
 - a. Some of the cue ball's momentum has transferred from the billiard ball.
 - b. All of the cue ball's momentum has transferred from the billiard ball.
 - c. All of the cue ball's momentum has transferred to the billiard ball.
 - d. Some of the cue ball's momentum has transferred to the billiard ball.

9. What usually happens to momentum when objects collide?
 - a. Momentum of each object remains the same.
 - b. Momentum of each object increases.
 - c. Momentum of each object becomes equal
 - d. Momentum transfers from one object to another.

10. How is the collision of a cue ball and a billiard ball an example of Newton's 3rd law?

Name _____ Date _____ Period _____

Momentum Practice

Background - Momentum gives us football games and fender-benders. Specifically, it is inertia, or an object's "resistance" to changing its current path and speed. It is represented by the letter p , and it is equal to the object's mass times its velocity ($p = m \times v$). Mathematically, it's all rather simple. Some things that you have to remember about momentum are: momentum can only be changed by changing the object's velocity or its mass and the units for momentum are $kg \times m/s$, $kg \times km/h$, or $g \times m/s$.

1. There is a car accident between a car and a truck. The car has a mass of 1000 kg and is speeding through the intersection at a velocity of 30 km/hr. west. The truck has a mass of 10,000 kg and slows down to 10 km/hr. north. Which vehicle has more momentum?

Momentum of Car

$$P = m \times v$$

$$P =$$

$$P =$$

Momentum of Truck

$$P = m \times v$$

$$P =$$

$$P =$$

Which has the larger momentum? Why?

2. If you had two football players, one with a mass of 100 kg and another with a mass of 125 kg, who would have the larger momentum? Why?

3. How could you increase the momentum of pool balls? _____

4. How could you increase the momentum of a baseball? _____

NOTES on Momentum

5. What is the momentum of a 35 g bullet moving at a speed of 475 m/s?

6. What is the momentum of an elephant with a speed of 5 km/hr and a mass of 5000 kg?

7. Compare the momentum of a dolphin and a whale. The dolphin has a mass of 160 kg and a speed of 18 m/s. The whale has a speed of 6 m/s and a mass of 50,000 kg.

8. A boy has a speed of 10 m/s and a mass of 50 kg. A girl has a speed of 15 m/s and a mass of 40 kg. Who has a greater momentum?

9. There are two football players. The first player has a mass of 45 kg and a speed of 7 m/s. The other has a mass of 70 kg and a speed of 2 m/s. Which player has a greater momentum?

10. How could you change the momentum of the football players without changing their mass?
