

Momentum: Explain - Part I Answer Key

1. What is momentum?
The product of an object's mass and its velocity.
2. How is the Physics definition of momentum different from the "colloquial" use of momentum?
(Colloquial means the everyday use, for instance saying that our football team has built up momentum through all their recent wins.)
Answers will vary. Students may say that the colloquial use means difficult to stop while the Physics definition is a specific measurable quantity that depends on an objects motion.
3. How is momentum calculated?
momentum = mass x velocity
4. What is the symbol for momentum?
p
5. What are the standard units for momentum?
kg * m/s
6. Momentum is directly proportional to an objects mass and its velocity, meaning that if either the mass or the velocity increases, the momentum will also increase.
7. What do we mean when we say that momentum is a "vector"?
It has both magnitude and direction.

Practice

8. A 300 kg tiger is prowling with a velocity of 3 m/s westward. What is the momentum of the tiger?
 $p = 900 \text{ kg}\cdot\text{m/s}$ westward
9. A car and a bicyclist are both moving at 10 m/s. Which has more momentum? Explain.
The car because it has a greater mass.
10. Why does a rocket have such a great momentum even if it is moving at a slow speed?
It has a very large mass. Momentum is directly proportional to mass.
11. You and a friend are discussing momentum after class. Your friend believes that objects with more mass always have a greater momentum. After thinking about today's lesson, you tell him that you can come up with two different ways that a baseball and a truck could have the same momentum. What are the two possible ways?
They could both be at rest or the baseball could be moving much faster than the truck.
12. A 1000 kg car is moving south with a speed of 20 m/s.
 - a. What is the momentum of the car?
 $p = 2000 \text{ kg}\cdot\text{m/s}$
 - b. How fast would a 100 kg bicyclist have to travel in order to have the same momentum?
 $v = 20 \text{ m/s}$ south
 - c. How fast would a 10 kg bowling ball have to travel in order to have the same momentum?
 $v = 200 \text{ m/s}$ south
 - d. How fast would a 0.1 kg baseball have to travel in order to have the same momentum?
 $v = 20\,000 \text{ m/s}$ south