

6.3 Momentum

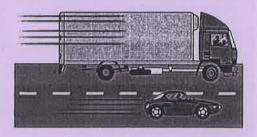






Which is more difficult to stop: A tractor-trailer truck barreling down the highway at 35 meters per second, or a small two-seater sports car traveling the same speed?

You probably guessed that it takes more force to stop a large truck than a small car. In physics terms, we say that the truck has greater momentum.



We can find momentum using this equation:

momentum = mass of object × velocity of object

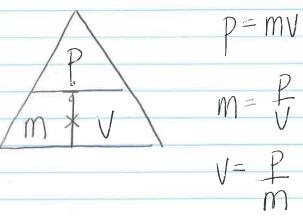
Velocity is a term that refers to both speed and direction. For our purposes we will assume that the vehicles are traveling in a straight line. In that case, velocity and speed are the same.

The equation for momentum is abbreviated like this: $\mathbf{Z} = m \times v = 0$

Momentum, symbolized with a \mathbb{Z} is expressed in units of kg · m/s; m is the mass of the object, in kilograms; and ν is the velocity of the object in m/s.

(momentum)
$$\vec{p} = m\vec{V} \leftarrow (velocity)$$

(mass)
 $sIunits: [lgm] = kgm$





PRACTICE >-Z

Use your knowledge about solving equations to work out the following problems:

- 1. If the truck has a mass of 4,000. kilograms, what is its momentum? Express your answer in kg · m/s.
- 2. If the car has a mass of 1,000. kilograms, what is its momentum?
- 3. An 8-kilogram bowling ball is rolling in a straight line toward you. If its momentum is 16 kg·m/s, how fast is it traveling?
- 4. A beach ball is rolling in a straight line toward you at a speed of 0.5 m/s. Its momentum is 0.25 kg · m/s. What is the mass of the beach ball?
- 5. A 4,500.-kilogram truck travels in a straight line at 10. m/s. What is its momentum?
- 6. A 1,500.-kilogram car is also traveling in a straight line. Its momentum is equal to that of the truck in the previous question. What is the velocity of the car?
- 7. Which would take more force to stop in 10. seconds: an 8.0-kilogram ball rolling in a straight line at a speed of 0.2 m/s or a 4.0-kilogram ball rolling along the same path at a speed of 1.0 m/s?
- 8. The momentum of a car traveling in a straight line at 25 m/s is 24,500 kg·m/s. What is the car's mass?
- 9. A 0.14-kilogram baseball is thrown in a straight line at a velocity of 30. m/s. What is the momentum of the baseball?
- 10. Another pitcher throws the same baseball in a straight line. Its momentum is 2.1 kg · m/s. What is the velocity of the ball?
- 11. A 1-kilogram turtle crawls in a straight line at a speed of 0.01 m/s. What is the turtle's momentum?