

6.3 Momentum

READ



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*.

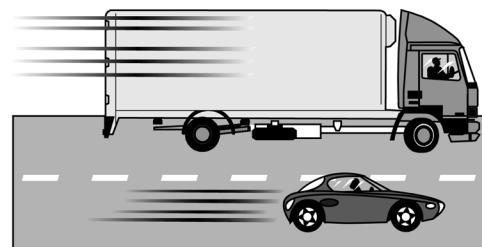
We can find momentum using this equation:

$$\text{momentum} = \text{mass of object} \times \text{velocity of object}$$

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: $P = m \times v$.

Momentum, symbolized with a P , is expressed in units of $\text{kg} \cdot \text{m/s}$; m is the mass of the object, in kilograms; and v is the velocity of the object in m/s .



PRACTICE



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 $\text{kg} \cdot \text{m/s}$.
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 $16 \text{ kg} \cdot \text{m/s}$, 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 $0.25 \text{ kg} \cdot \text{m/s}$. What is the mass of the beach ball?
5. A 4,500.-kilogram truck travels in a straight line at $10. \text{ m/s}$. 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 $24,500 \text{ kg} \cdot \text{m/s}$. What is the car's mass?
9. A 0.14-kilogram baseball is thrown in a straight line at a velocity of $30. \text{ m/s}$. What is the momentum of the baseball?
10. Another pitcher throws the same baseball in a straight line. Its momentum is $2.1 \text{ kg} \cdot \text{m/s}$. 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?