

4B 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:

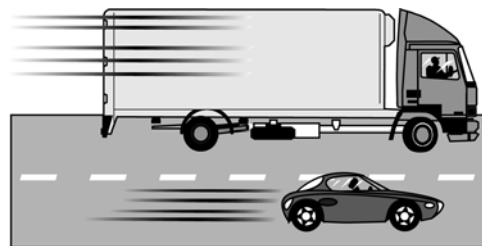
1. If the truck has a mass of 4,000 kilograms, what is its momentum? Express your answer in $\text{kg} \cdot \text{m/s}$.

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?
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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?
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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?
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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?
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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?
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11. A 1-kilogram turtle crawls in a straight line at a speed of 0.01 m/s. What is the turtle's momentum?
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