

Momentum

Use the equation for momentum to describe an object's motion.

Imagine yourself speeding down a hill on your bicycle without using your brakes. As you reach the bottom of the hill, do you stop? No, you keep on going, until a force, such as the friction between your tires and the road or your brakes, brings you to a stop. The faster you are going or the more mass you have, the more force will be necessary to bring you to a stop. This property is **momentum** (p), which is the product of the mass of an object and its velocity. In an equation, it looks like this:

EQUATION:
$$\text{momentum} = \text{mass} \times \text{velocity}$$
$$p = m \times v$$


SAMPLE PROBLEM: A gymnast with a mass of 62 kg runs at a velocity of 11 m/s toward a pommel horse. What is her momentum?

$$\begin{aligned} \text{momentum} &= \text{mass} \times \text{velocity} \\ p &= 62 \text{ kg} \times 11 \text{ m/s} \\ p &= 682 \text{ kg} \times \text{m/s toward the pommel horse} \end{aligned}$$


Momentous Momentum

Use the equation for momentum to answer the following questions. Show your work.


1. Find the momentum of the different balls.



$m = 0.045 \text{ kg}$
 $v = 16 \text{ m/s upward}$



$m = 0.168 \text{ kg}$
 $v = 3 \text{ m/s forward}$



$m = 0.575 \text{ kg}$
 $v = 9.2 \text{ m/s east}$

$p =$ _____ $p =$ _____ $p =$ _____

2. At a rodeo, a bucking bronco throws an 81 kg rider into the air at a velocity of 10 m/s upward. What is the rider's momentum?

3. Two passengers are riding in a boat that has a mass of 1500 kg. The two passengers together have a mass of 180 kg. What is the momentum of the boat and passengers when the boat is traveling at a velocity of 15 m/s west?

Challenge Yourself!

4. What is the velocity of a 55 kg skater who has a momentum of 440 kg \times m/s forward?

