

Momentum

Lesson Notes

Learning Outcomes

- What does the quantity momentum mean?
- What factors contribute to the amount of momentum an object possesses?

The BIG Idea

- **Momentum** is a quantity describing the mass and velocity of an object.
- Momentum can be used to analyze and predict the result of **collisions** and **explosions**.

How is Momentum Described?

- In Physics, momentum is referred to as the **quantity of motion** possessed by an object.
- As in sports, objects that are *on the move*, possess momentum. And the more *on the move* that they are, the more momentum they possess.
- Like sports teams with momentum, objects with momentum are difficult to stop.

Momentum as Mass in Motion

Momentum is sometimes defined as *mass in motion*.

The amount of momentum (**p**) possessed by an object depends upon ...

- ... how much mass is moving (**m**)
- ... and how fast that mass is moving (**v**)

$$\text{Momentum} = \text{Mass} \cdot \text{Velocity} \quad \text{or} \quad p = m \cdot v$$

Unit of momentum: **kg • m/s**

Momentum as a Vector Quantity

Momentum is a vector quantity. That is, it has a direction associated with it.

The direction of a object's momentum is in whatever direction that the object is moving.

An object that is ...

- ... moving east has an eastward momentum
- ... moving down has a downward momentum
- ... moving left has a leftward momentum
- ... moving left (and slowing down) has a leftward momentum

Momentum Depends on Speed

Momentum depends on **Speed**, so ...

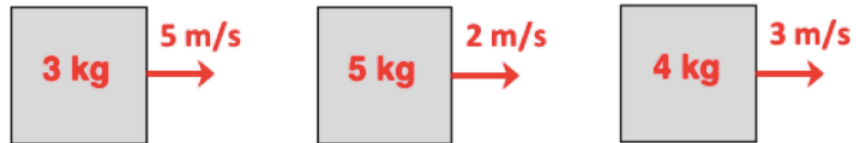
- ... increasing speed means increasing momentum
- ... decreasing speed means decreasing momentum
- ... constant speed means constant momentum
- ... zero speed means zero momentum

Calculating Momentum

The momentum equation is ...

$$\text{Momentum} = \text{Mass} \cdot \text{Velocity} \quad \text{or} \quad p = m \cdot v$$

Calculate the momentum of the following objects:



Thinking About Momentum

Compare the momentum of objects A and B:



Compare the momentum of objects C and D:

