

Chp 3.3

Momentum

Momentum

- Momentum is the mass of an object multiplied by its speed or velocity.
- If you increase the mass or the speed of an object, you increase its momentum.
- Units are kg m/s

Mass (kg)

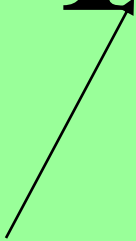


$$p = mv$$



Velocity (m/s)

Momentum (kgm/s)



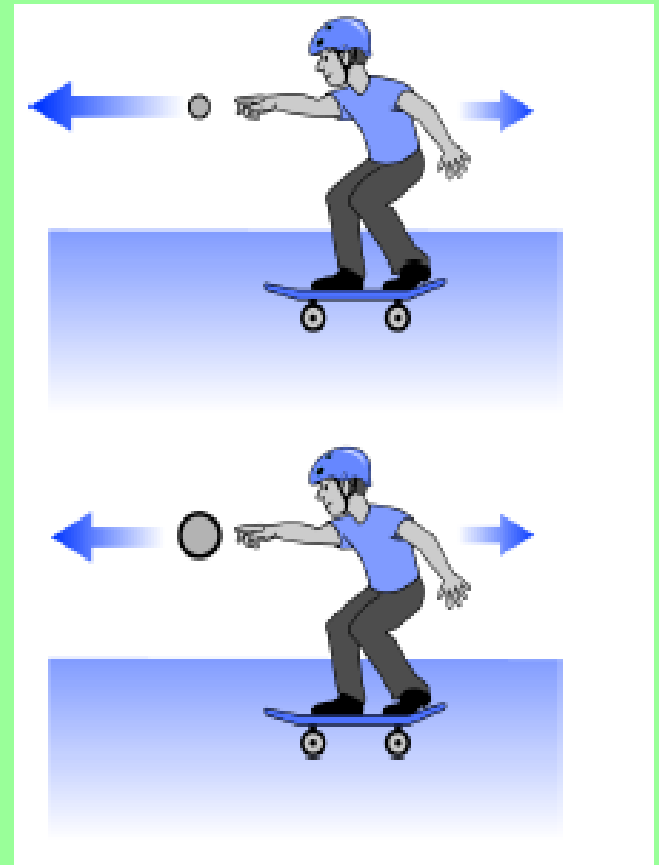
The motion of objects

- If you throw a ball from your skateboard, you must apply a force to the ball.
- The 3rd law says the ball exerts a force an equal and opposite force on you.
- Your force makes the ball accelerate in one direction and the reaction makes you accelerate in the opposite direction.



What happens if you throw a heavier ball?

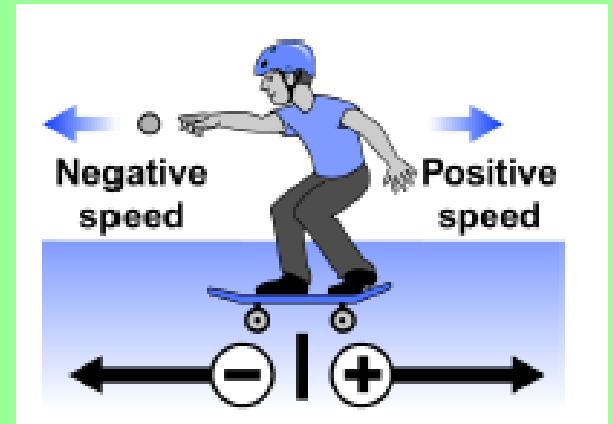
- If you throw the ball away very fast, your backward acceleration is higher than if you throw the ball away slowly.
- If you throw a heavier ball away fast, your backward acceleration is greater than if you throw a lighter ball.
- The backward acceleration is called recoil.



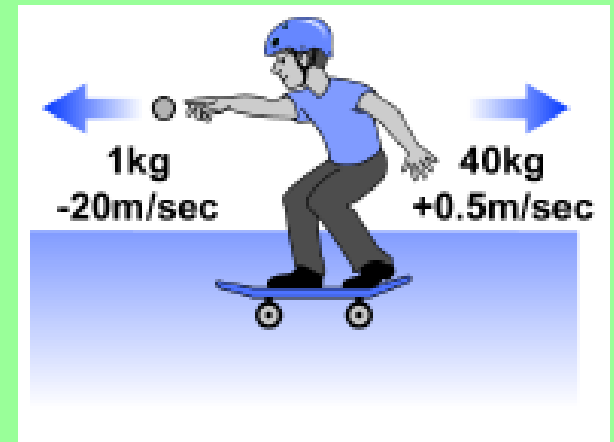
Law of Conservation of Momentum

- The law of the conservation of momentum says that the total momentum of a system can not change.
- That means that the momentum of the system prior an action must equal the momentum after the action.

- Positive and negative signs are used to tell the direction of the motion. That means momentum can be positive (moving to the right) or negative (moving to the left)



- Before you throw the ball, your and the ball's momentum is zero. In order for conservation of momentum to be true, after you throw the ball the total momentum must be zero.



$$(1 \text{ kg})(-20 \text{ m/s}) + (40\text{kg})(0.5\text{m/s}) = 0$$

Homework 19

- Compare the momentums of a 65 kg dolphin swimming 11.3 m/s and a 6500 kg elephant walking 0.11 m/s.

Homework 23

- A girl is riding her bike at a speed of 6 m/sec. She then slows down to a speed of 2.5 m/sec. The combined mass of the girl and bicycle is 50 kilograms.
 - a. What is her initial momentum?
 - b. What is her final momentum?
 - c. What is the change in momentum?