

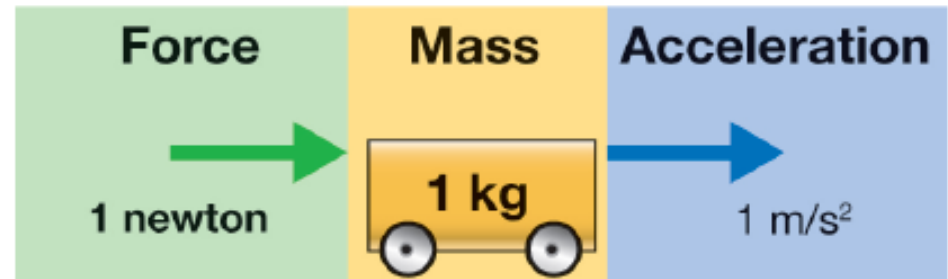
- The acceleration caused by a net force is directly proportional to the force and inversely proportional to the mass.

NEWTON'S SECOND LAW

$$\text{Acceleration (m/s}^2\text{)} \text{ — } \mathbf{a} = \frac{\mathbf{F}}{\mathbf{m}} \text{ — Force (N) / Mass (kg)}$$

- Force is *directly proportional* to acceleration.

What it means to say
“Acceleration is proportional to force.”

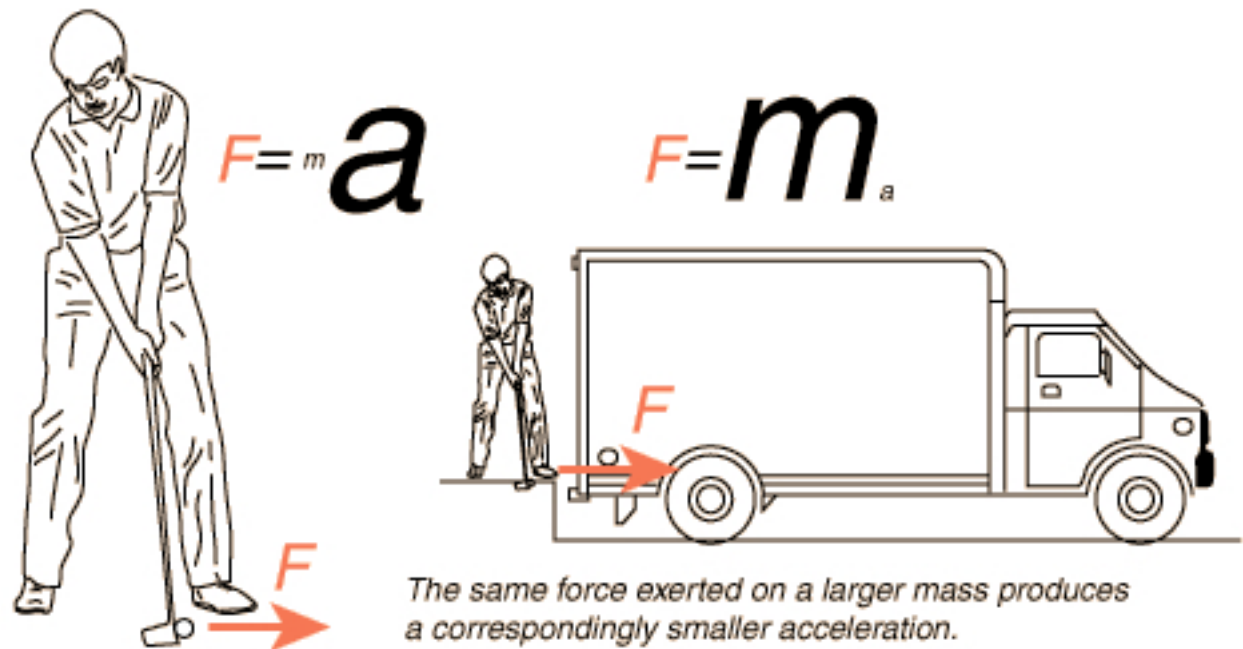


If twice the force is applied, the acceleration is twice as great.

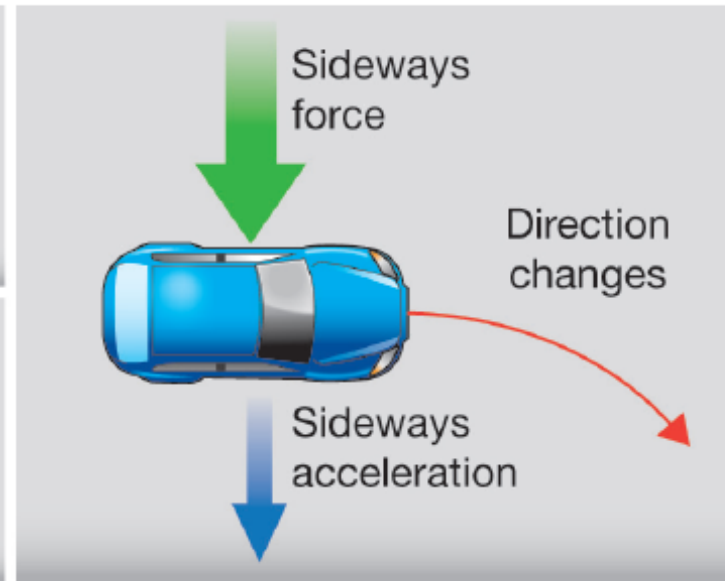
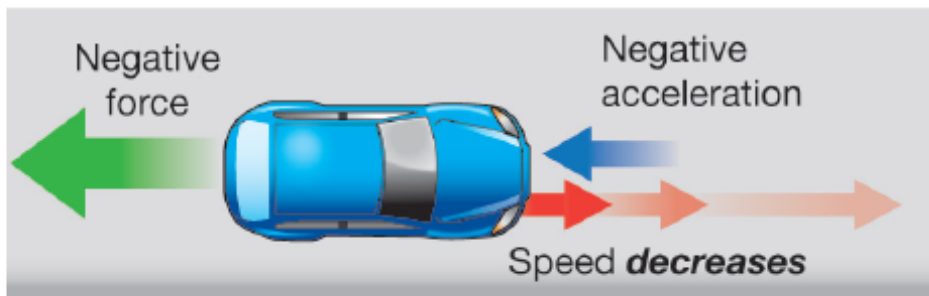
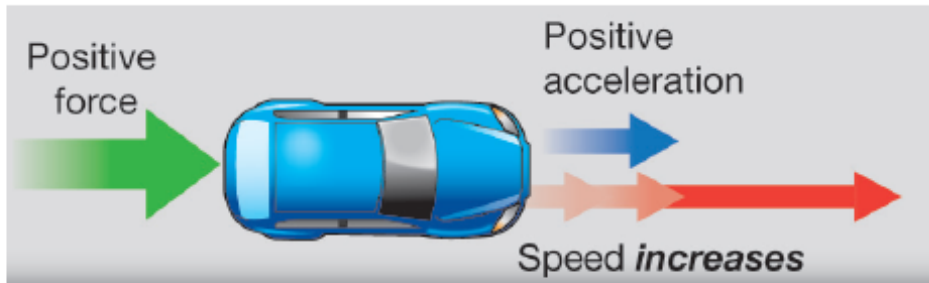


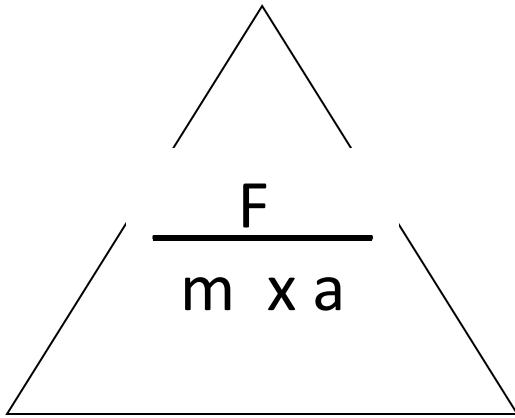
- Acceleration is inversely proportional to mass.

An object with twice the mass will have half the acceleration if the same force is applied.



- Acceleration is always in the *same direction* as the net force.





- Formula for acceleration
 - $a = F/m$
- Formula for force
 - $F=(m)(a)$
- Formula for mass
 - $m = F/a$



- Just give the equation
- A boy gets pushed on a sled with a force of _____ N. The boy and the sled together have a mass of _____ kg. Ignoring friction, what is the acceleration of the boy on the sled?
- $a = F/m$



- A boy gets pushed on a sled with a force of 120 N. The boy and the sled together have a mass of 60 kg. Ignoring friction, what is the acceleration of the boy on the sled?
- $a = F/m$
- $a = 120 \text{ N}/60 \text{ kg}$
- $a = 2 \text{ m/s}^2$





- Just give the equation
- A rock with a mass of _____ kg is accelerating at the rate of _____ m/s^2 How much force does it have?
- $F = (m)(a)$



- A rock with a mass of 500 kg is accelerating at the rate of 2 m/s^2 How much force does it have?

- $F = (m)(a)$

- $F = (500 \text{ kg})(2 \text{ m/s}^2)$

- $F = 1,000 \text{ N}$



- Just give the equation
- A person lifts a barbell above his head with an acceleration of _____ m/s^2 . The barbell exerts a force of _____ N. What is the mass of the barbell?
- $m = F/a$



- A person lifts a barbell above his head with an acceleration of 2 m/s^2 . The barbell exerts a force of 400 N . What is the mass of the barbell?
- $m = F/a$
- $m = 400 / 2$
- $m = 200 \text{ kg}$



○ What is the force of a _____ kg sandbag in a free fall?

○ $F = (m)(a)$



○ What is the force of a 500 kg sandbag in a free fall?

○ $F = (m)(a)$

○ $F = (500 \text{ kg})(9.8 \text{ m/s}^2)$

○ $F = 4900 \text{ N}$



WHICH CART WILL ACCELERATE MORE?

1. A cart pushed by a toddler. (The toddler is pushing as hard as he can.)



2. The same cart pushed by a body builder. (The body builder is pushing as hard as he can)



- 1. The cart pushed by the body builder
- **Why?**
- More force = more acceleration



WHEN PUSHED WITH THE SAME FORCE, WHICH CART WILL ACCELERATE MORE?

○ Cart A



○ Cart B



○ Cart B

○ **Why?**

- Greater mass = less acceleration

