

Grade 6 Science
Week of February 1 – February 5

Newton's Second Law

As we learned with Newton's First Law, it takes an unbalanced force to move an object; and the greater the mass of an object, the greater the force needed to set it in motion. This is directly connected to Newton's Second Law of motion!

Newton's Second Law states that the **more mass** an object has, the **more force** it will take to **accelerate** the object.

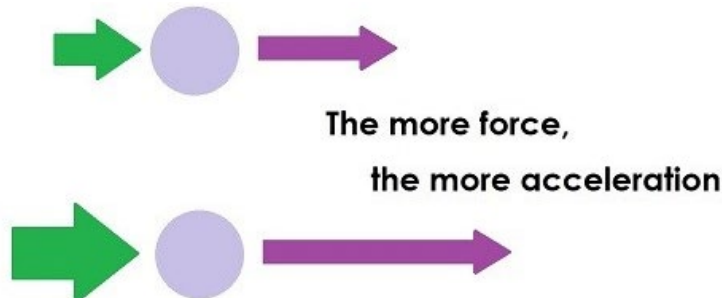


Less mass = easier acceleration

More mass = more difficult acceleration

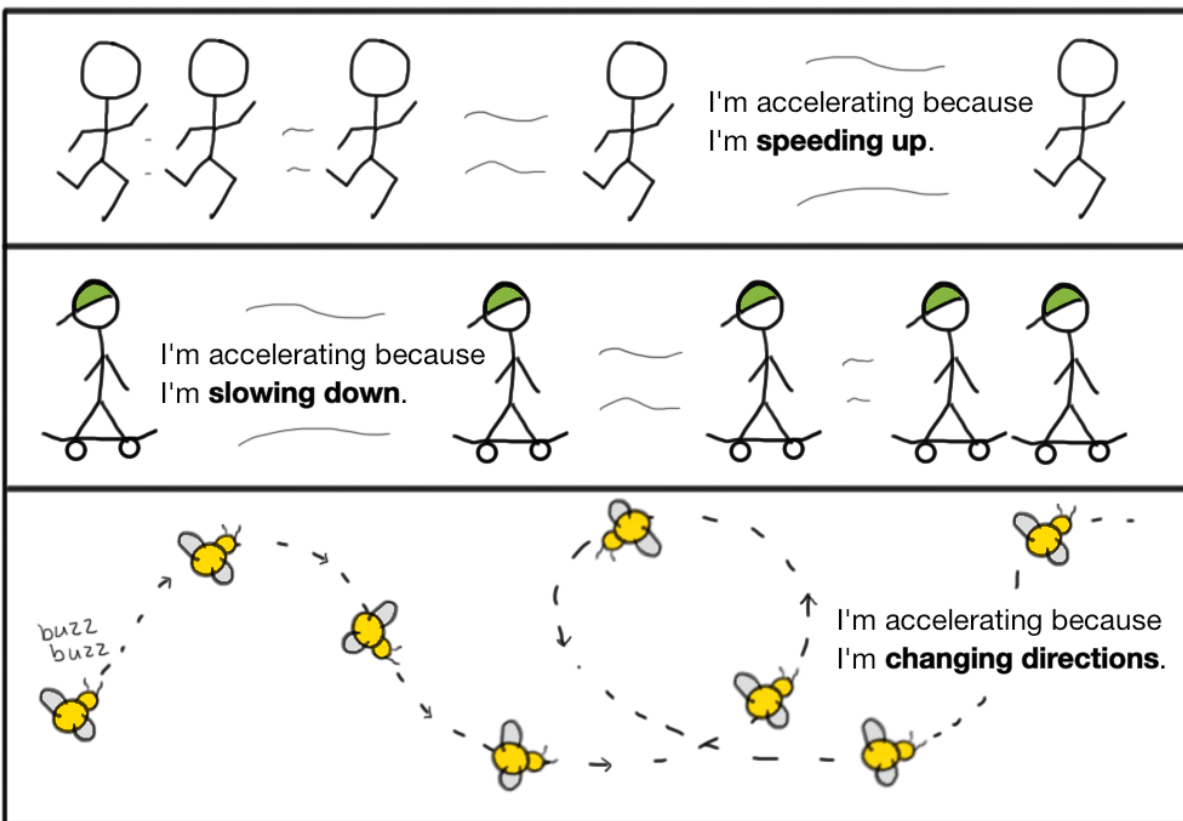
As you know, the **greater the mass** of an object, the **greater the force** needed to put it in motion. Imagine if you had a soccer ball and a bowling ball, and you pushed both of them on your front lawn using the same amount of force. Which one would accelerate easier? Which would accelerate faster and farther? The soccer ball, because it has less mass, making acceleration easier!

Now, imagine you have two of the exact same soccer balls on your front lawn. You kick one of them with **all of your force**, and the other one with **1/2 the amount of force**. Well, the ball that was kicked with **1/2 your force will go 1/2 as far** as the ball kicked with all your force. That's because, the more force there is, the more acceleration there will be.



What is Acceleration?

Most of the time, people think that acceleration means making things go faster. Like a car accelerating from 30 km/h to 50 km/h. This is an example of acceleration, but, did you know that acceleration is actually just **a change in speed and/or direction** of any kind? So, if a car changes speed from 80 km/h to 40 km/h (slows down), it is accelerating. If the car makes a left turn and changes the direction in which it's traveling, it is accelerating.



What is the Difference between Velocity and Acceleration?

Velocity is the measure of speed *and* direction of an object.

Acceleration is the measure of the change in the speed and direction of an object.

Watch the following video to further understand acceleration. Make sure you follow along in your Learning Guide!



Acceleration: https://youtu.be/t17DDbwI_ag

$$F = ma$$

Newton's Second Law of Motion is also known as Force = mass acceleration, or

$$F_{\text{net}} = ma$$

Where:

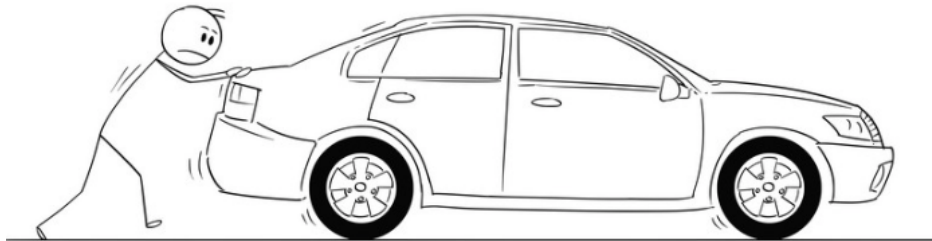
- **F_{net}** = Net Force being applied to the object (Measured in **Newtons**)
- **m** = Mass of the object (Measured in **kilograms**)
- **a** = Acceleration of the object (Measured in **meters per second squared**)

The acceleration of an object is dependent on the amount of mass an object has, and the amount of force being applied to the object. Check out this video, and make sure you follow along in your Learning Guide!



Accelerating Mass: <https://youtu.be/WHEeGO9HVPc>

Remember: **Net Force** refers to *all* of the forces being applied to an object



Take a look at Bob who is trying to push his broken-down car. Bob's car's mass is 1500 kg and it is accelerating at a rate of 0.5 m/s. What is the Net Force being applied to the car?

$$F = ma$$

$$F = 1500 \text{ kg} \times 0.5 \text{ m/s}^2$$

$$F = 750 \text{ N}$$

The Net Force being applied to Bob's car is 750 Newtons.

Reflection



Physics – Newton’s Second Law: <https://youtu.be/6045k8dANsg>

Newton's Second Law deals with the problem of what happens if an unbalanced force acts on a body. Isaac Newton’s conclusions regarding the motion of bodies acted on by unbalanced forces are expressed in his second law of motion.

Newton’s Second Law of Motion (Unbalanced Forces)

If an unbalanced force acts upon a body, it will accelerate in this direction. The rate at which it accelerates depends directly on the unbalanced force and inversely on the mass of the body.

The most important formula of this unit results, ie:

$$\mathbf{F}_{\text{NET}} = \mathbf{ma}$$

Newton’s Second Law of Motion

Newton's Second Law:

1. Fill in the blanks:

_____ mass = easier acceleration

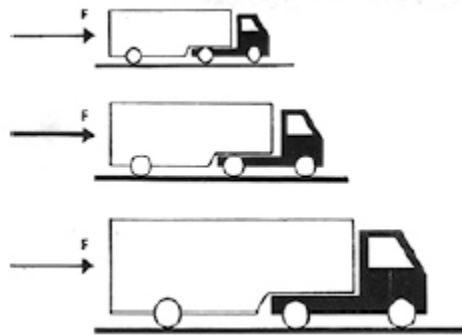
More mass = _____ acceleration

2. True or False: If you have 2 baseballs, and you throw the 1st baseball with the force of **100N**, and you throw the 2nd baseball with the force of **200N**, the 2nd baseball will go **twice as far** as the first.

a. True

b. False

3. The same amount of force is being applied to these 3 vehicles. Which vehicle will have more acceleration? Explain why.



4. True or False:

A car is traveling at a constant speed of 30 km/h, then it makes a sharp right turn. This is an example of acceleration.

- a. True
- b. False

A rollercoaster goes from travelling 50 km/h to 20 km/h up a hill. This is an example of acceleration.

- a. True
- b. False

A ball continues to travel at the same rate in space, indefinitely because of a lack of forces acting upon it. This is an example of acceleration.

- a. True
- b. False

A bicker quickly applies their breaks, screeching to a halt so that they don't run over a cat. This is an example of acceleration.

- a. True
- b. False

5. Define the following terms:

Velocity:

Acceleration:

5. Watch the following video to answer the following questions.

Video: Newtons 2nd Law of Motion – Acceleration

1) Fill in the blanks:

_____ force = _____ in speed = _____

2) True or false:

Acceleration is a change in velocity.

- a. True
- b. False

Until an unbalanced force is applied to accelerate an object, inertia is at play.

- a. True
- b. False

6. Newtons Second Law of Motion is also known as:

7. Where:

F= _____

m= _____

a= _____

8. Watch the following video to answer the following questions.

Video: Accelerating Mass: $F=ma$

1) Fill in the blanks:

Mass is a measure of an object's ability to _____ being accelerated by a _____.

2) True or false:

The more mass an object has, the harder it is to stop it if it's moving

a. True

b. False

The bigger something is, the bigger mass it has.

a. True

b. False