

Chapter 16: Forces and Motion

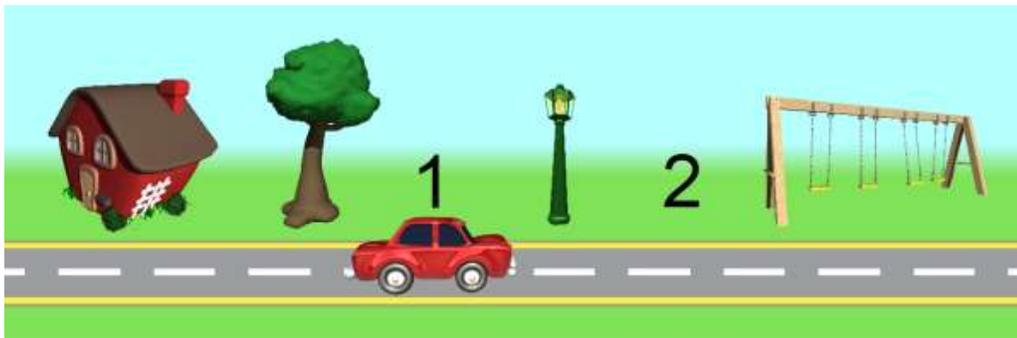
pages 654-689

Test on MONDAY, DECEMBER 21st

POSITION	MOTION
<p><i>the location of an object</i></p>  <p><i>The deer's position could be described as: in the forest, to the right of the stream.</i></p>	<p><i>the change in position of an object</i></p>  <p><i>The car is in motion. When in motion, the car is constantly changing its position.</i></p>

FRAME of REFERENCE

A frame of reference uses another object (as a reference point) to decide if there is motion.



If we wanted to see if there is motion, we would need a reference point. **The light pole can be the reference point.** In the picture, the car is to the left of the light pole. Later, we can use the light pole to see if there was motion.

SPEED

The change in position during a unit of time (*how fast something is moving*).

EQUATION

$$\text{speed} = \text{distance} \div \text{time}$$

For example, suppose you're going by car to a campground for a vacation. You travel 225 kilometers in 3 hours. Here is how you find the speed:

Equation: speed = distance \div time
speed = 225 kilometers \div 3 hours

Answer: speed = 75 kilometers per hour

VELOCITY

the speed **and** direction of an object



examples: **32 km per hour, north**
983 meters per minute, south

ACCELERATION

any change in speed (faster or slower) **OR** direction; any change in velocity



FORCES

are any pushes or pulls. Forces are measured in Newtons (N).



In this example, the force for both teams are equal (300 N). Since the force is equal, neither team will win.



In this example, the forces are unequal. The team on the left has 400 N of force, and the team on the right has only 300 N of force. Since the team on the left has a stronger force, the other team will be pulled in their direction.

Forces change motion. Any change in speed or direction requires a force. So that means:
FORCES cause acceleration.

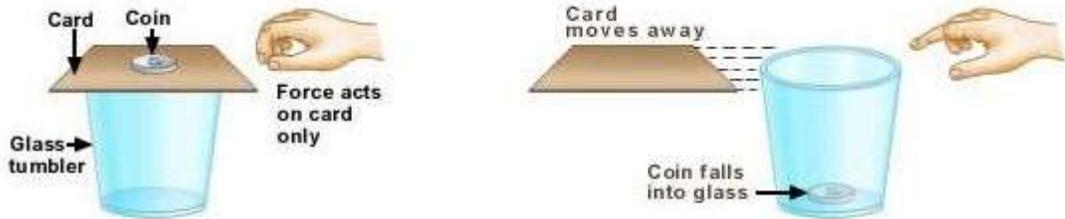
The larger the force, the larger the acceleration. The smaller the force, the smaller the acceleration. The direction of the force will also determine the direction of the acceleration.



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Inertia

The property of matter that keeps objects moving in a straight line or keeps unmoving objects at rest. *Sir Isaac Newton's 1st Law of Motion.*



Experiment to demonstrate inertia

Another example of inertia can be the 'trick' of the tablecloth and the dishes. A person can pull the tablecloth off the table without moving the plates. Inertia makes this happen. Since the tablecloth is the only object that has a force applied, it is the only object to move. Everything else on the table stays at rest.

Gravity

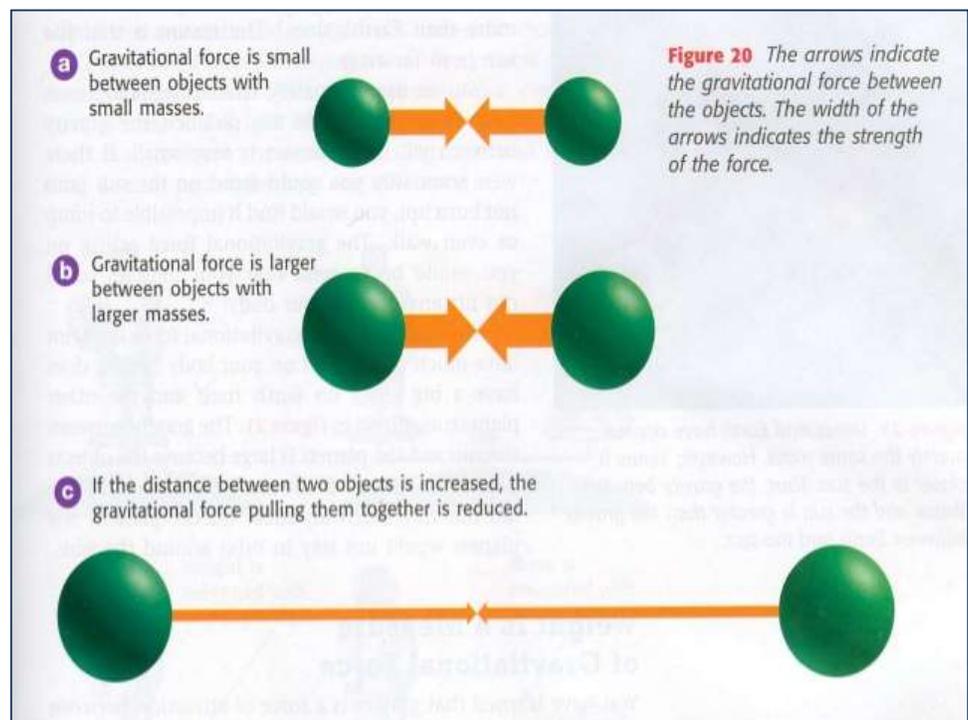
Gravity is the force that *pulls* objects towards Earth.

If you toss a ball into the air, gravity will pull it back down to the ground.



Gravitation is a force that acts between all objects that have mass. All objects are attracted to each other.

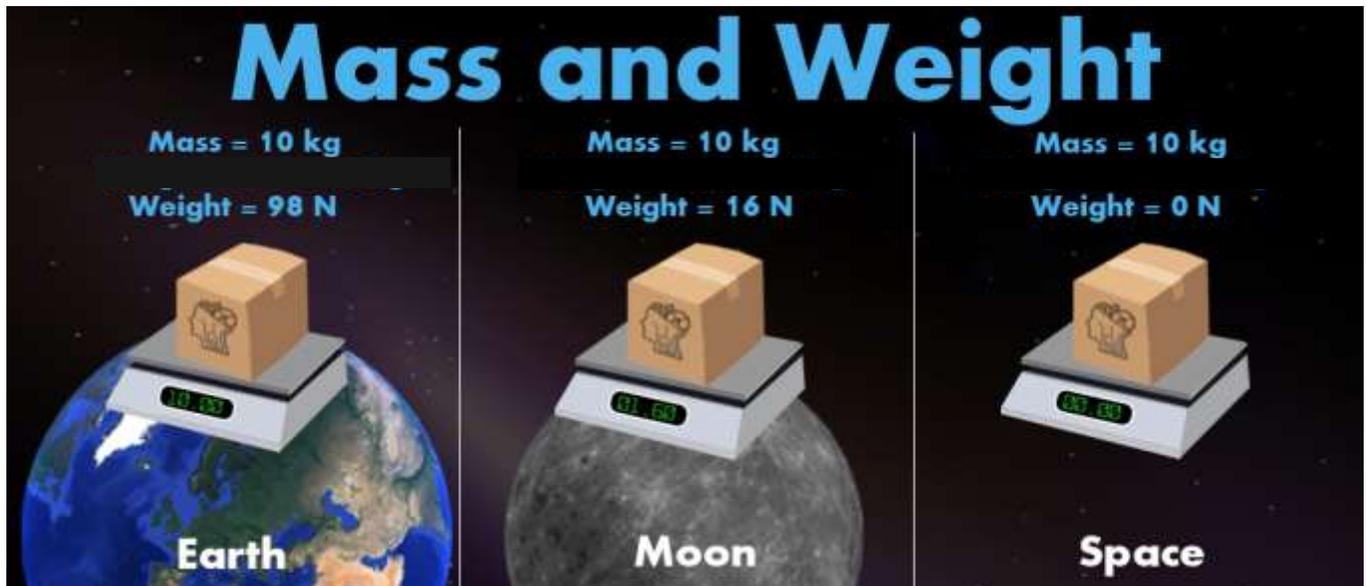
The larger the mass, the larger the gravitational force. The smaller the mass, the smaller the gravitational force.



Mass vs. Weight

mass – the amount of matter in an object (measured in grams)

weight – the amount of gravitational force on an object (measured in Newtons)



In the picture above, the mass DOES NOT change anywhere in the universe. The amount of matter in an object does not change when it moves locations. However, the weight of an object depends on the amount of gravity. Since there is only a small amount of gravity on the moon, the weight decreases. Since there is NO gravity in space, an object has no weight! That's pretty cool!

Friction

Friction is a force that resists motion between objects that are touching.



Picture A (ice) has less friction. There is less resistance so the boy will move faster.

Picture B (grass) has more friction. There is more resistance and force stopping the boy so he will not go down the hill as fast.