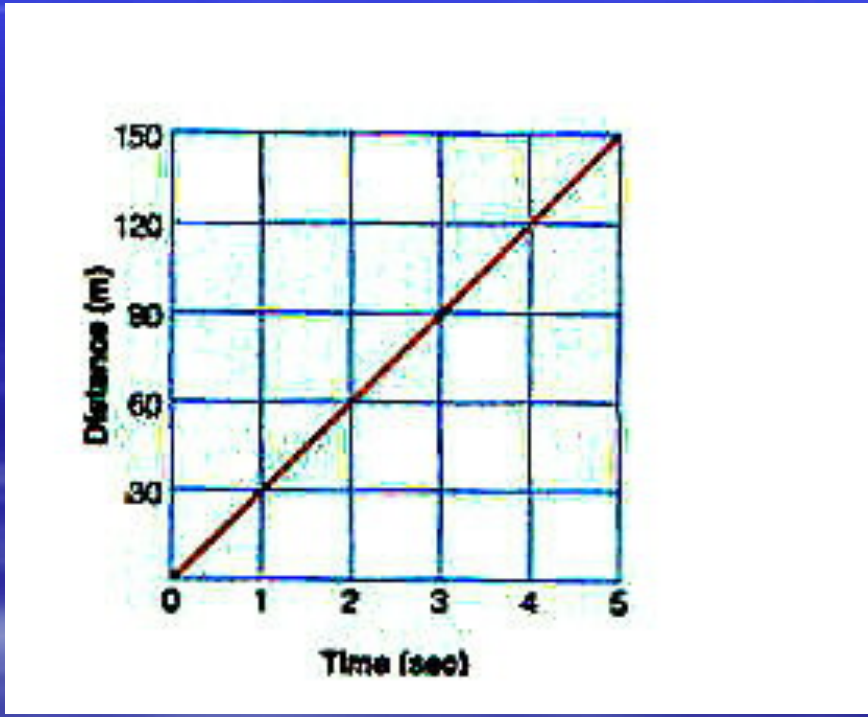
8th Grade Physical Science

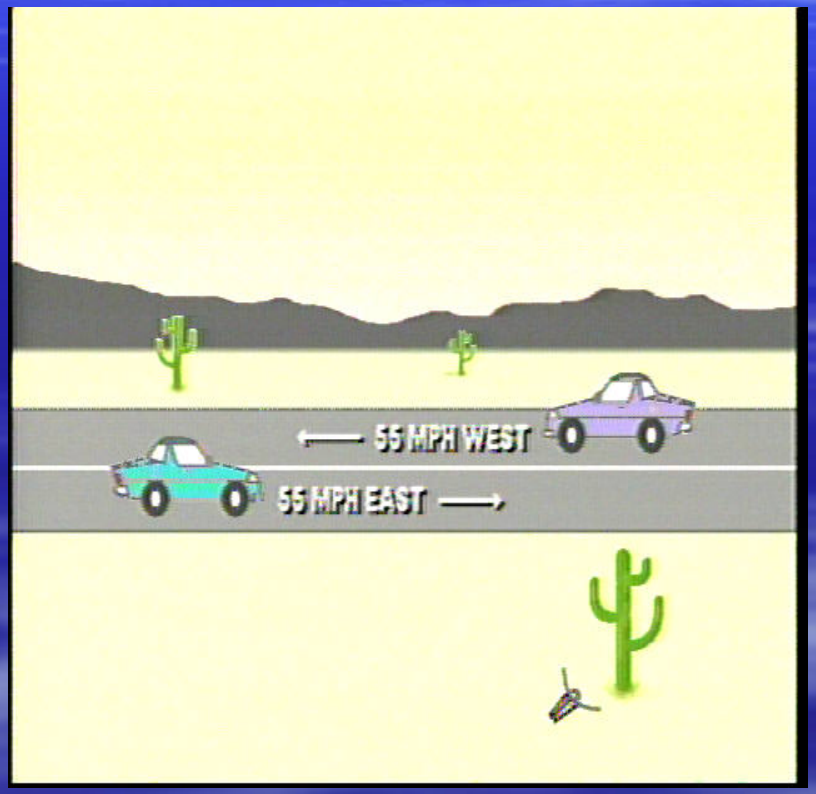
Force and Motion

- Speed is how fast an object is moving.
- Speed = $\frac{\text{Distance}}{\text{Time}}$
- You can also use this formula to find the distance or time as needed.
- Distance = Speed x Time
- Time = $\frac{\text{Distance}}{\text{Speed}}$
- Speed and velocity are very similar and are often used interchangeably.



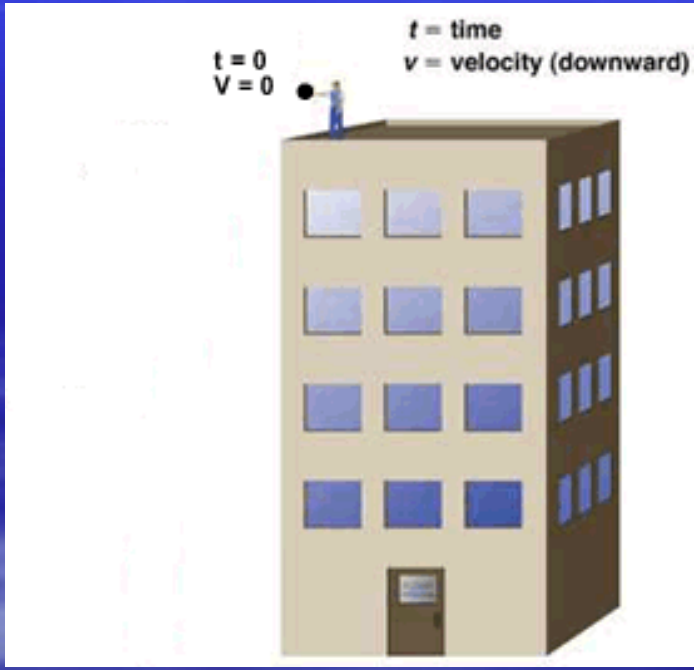
Force and Motion

- Velocity is the rate at which an object changes its position.
- Velocity = $\frac{\text{Displacement}}{\text{Speed}}$
- Speed and velocity are equal only if the distance an object travels is equal to its displacement (how far it is away from its original position).
- Velocity has direction!



Force and Motion

- Acceleration is the rate at which an object's velocity changes.
- $\text{Acceleration} = \dfrac{\text{Change in Velocity}}{\text{Time}}$
- Positive acceleration values mean that an object is speeding up
- Negative acceleration values mean that an object is slowing down.
- Negative acceleration is often called deceleration.



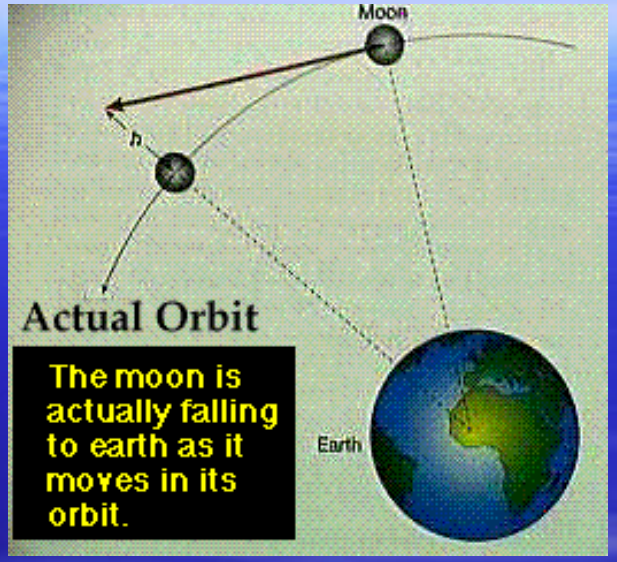
Force and Motion

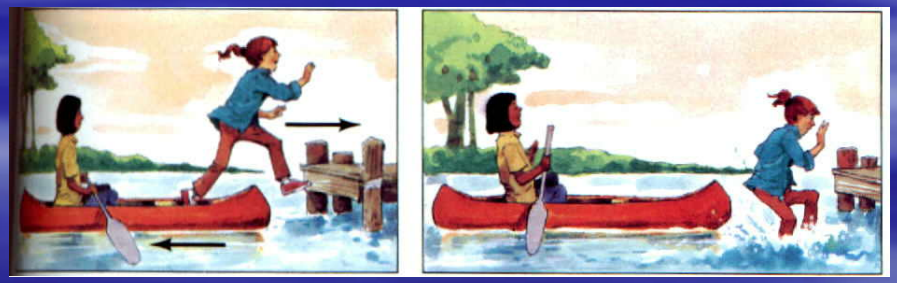
- A force is a push or pull that starts, stops, or changes the direction of an object.
- Some examples of contact forces are gravity and friction.
- Some examples of non-contact forces are magnetism and electricity.
- Gravity keeps the planets in orbit around the sun.
- Friction can slow down and stop objects in motion.
- Electricity and magnetism interact in motors and other devices.

Force and Motion

- Issac Newton stated three laws of motion that describe how forces affect us.
- Newton observed that an object at rest stays at rest until an outside force causes it to move. (1st Law of Motion)
- Force = Mass x Acceleration

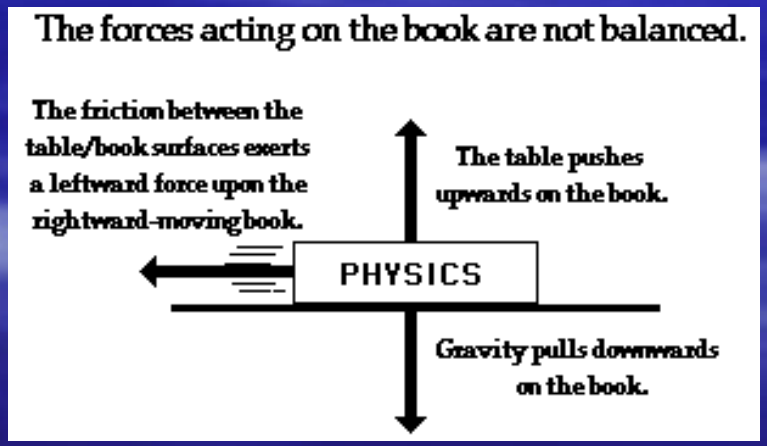
  In other words, Newton showed that the motion of an object changes, or accelerates, when a force acts on it. (2nd Law of Motion)
- Newton observed that when one object exerts a force upon another object, the second object exerts an equal and opposite force upon the first object. (3rd Law of Motion)





Force and Motion

- Forces can be balanced or unbalanced.
- Unbalanced forces cause an object to start moving (accelerate) but balanced forces do not.



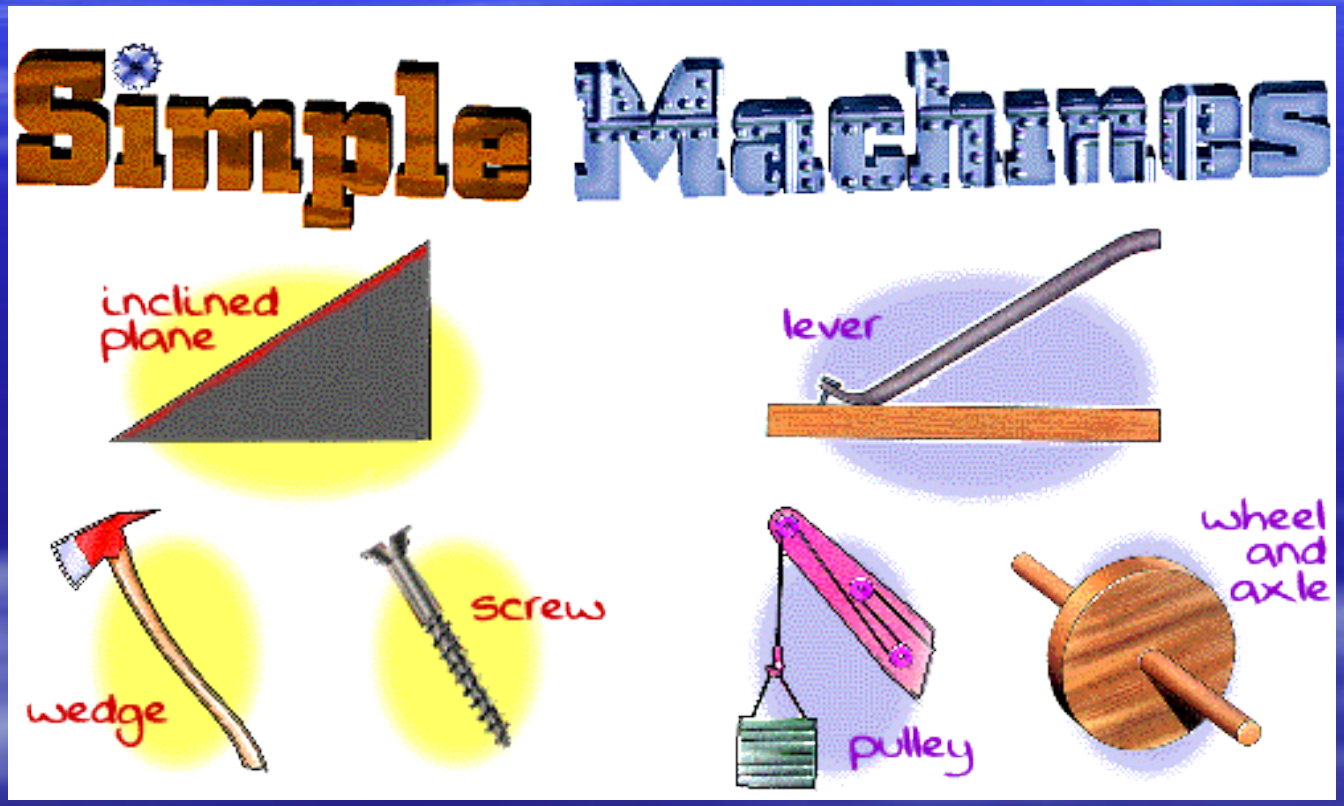
Work and Simple Machines

- Work occurs when an object moves and a force acts on the object in the same direction that it moves.
- Work = Force x Distance
- Power is the rate at which work is done.
- Power = Work / Time

Work and Simple Machines

- A machine is a device that does work. Machines do not increase the amount of work done, but they do make work easier.
- Machines make work easier by changing force or distance, or by changing the direction of the force.
- There are three simple machines: the lever, the pulley, and the inclined plane.
- The wheel and axle, the wedge, and the screw are modifications of the three simple machines.
- A complex machine is a machine made up of two or more simple machines.

Work and Simple Machines

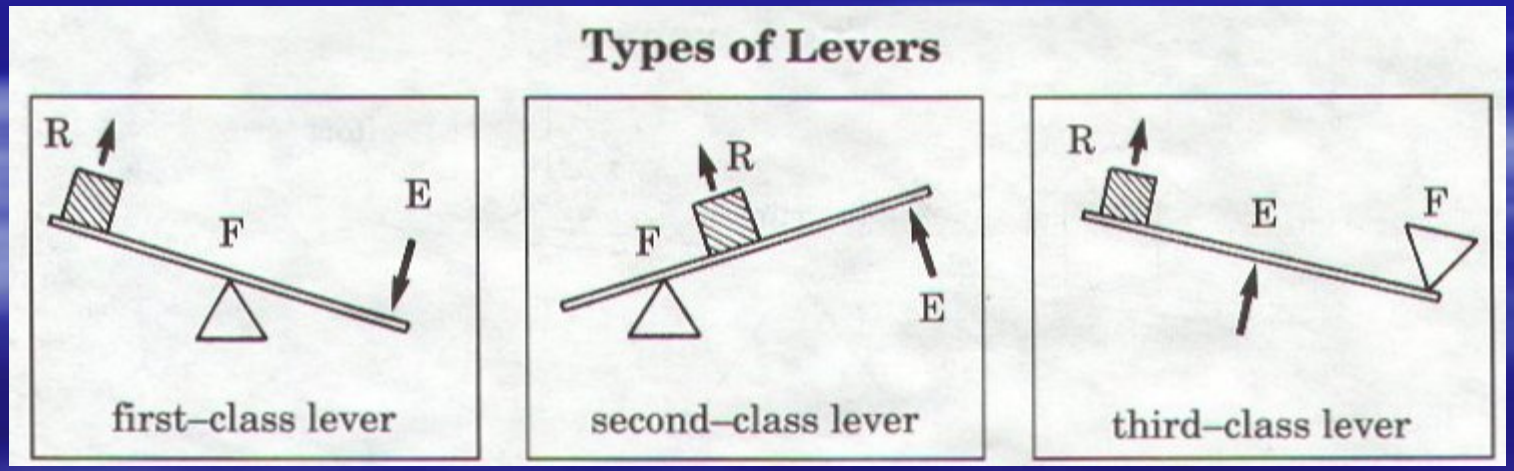


Work and Simple Machines

- Most machines multiply the force of your efforts.
- The force applied to the machine is called the effort force
- The force opposing the effort force is the resistance force.
- The number of times that a machine multiplies an effort force is its mechanical advantage (M.A.).
- A machine with a M.A. of 2 doubles your effort force.
- M.A. = Resistance Force / Effort Force
- The mechanical efficiency (M.E.) of a machine compares its work output with the work input.
- M.E. = Work Output / Work Input x 100%
- Because the work output is always less than the work input, the mechanical efficiency of a machine is always less than 100%.

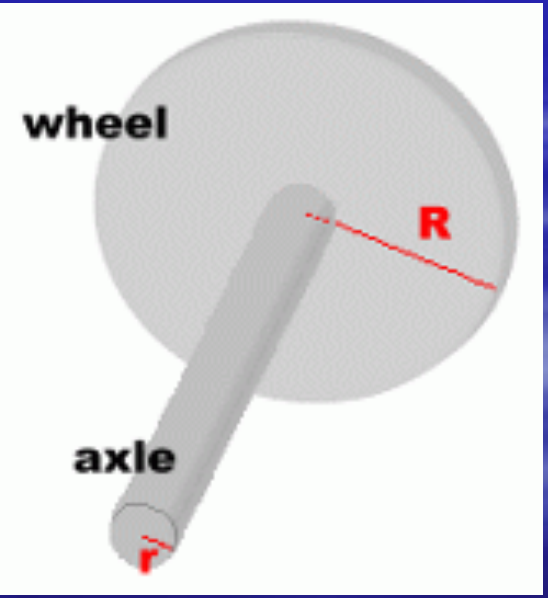
Work and Simple Machines

- There are three kinds of levers.
- The M.A. of a lever is calculated by dividing the effort distance by the resistance distance.



Work and Simple Machines

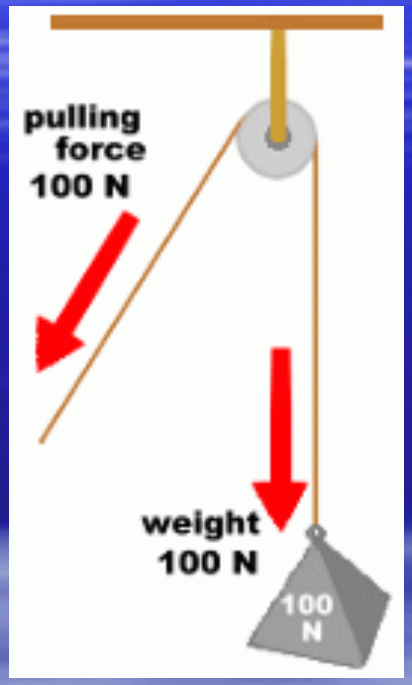
- The M.A. of a wheel and axle is equal to the radius of the wheel divided by the radius of the axle.

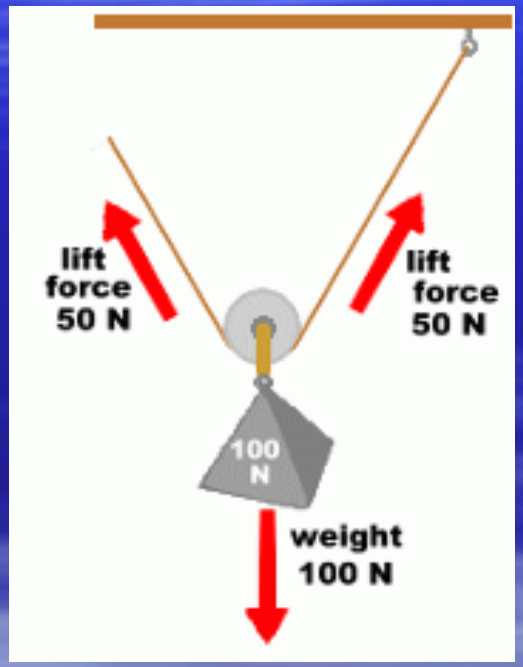


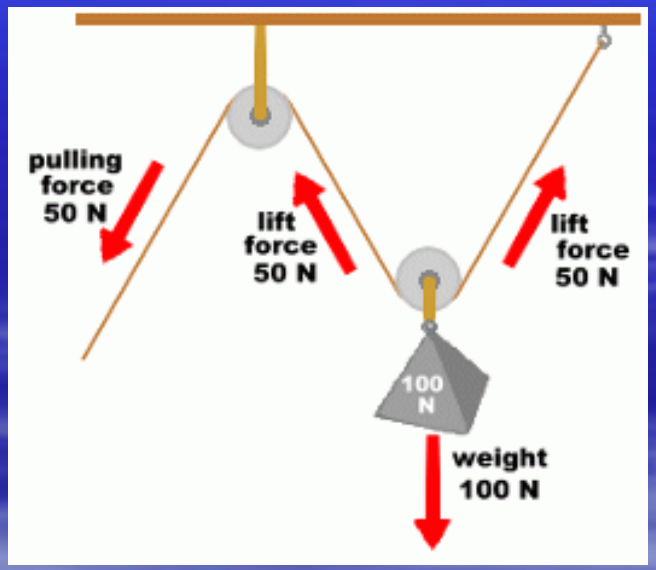
Work and Simple Machines

- The two main types of pulleys are fixed pulleys and movable pulleys.
- A fixed pulley is attached to a stationary structure.
- The M.A. is 1 because it does not multiply the effort force. It only changes the direction of the force.
- A movable pulley is hung on a rope and hooked to a weight.
- The M.A. is 2 because it doubles the effort force. It also changes the direction of the force.
- A pulley system combines two or more pulleys.
- The M.A of a pulley system is equal to the number of rope segments pulling up on the weight.

Work and Simple Machines



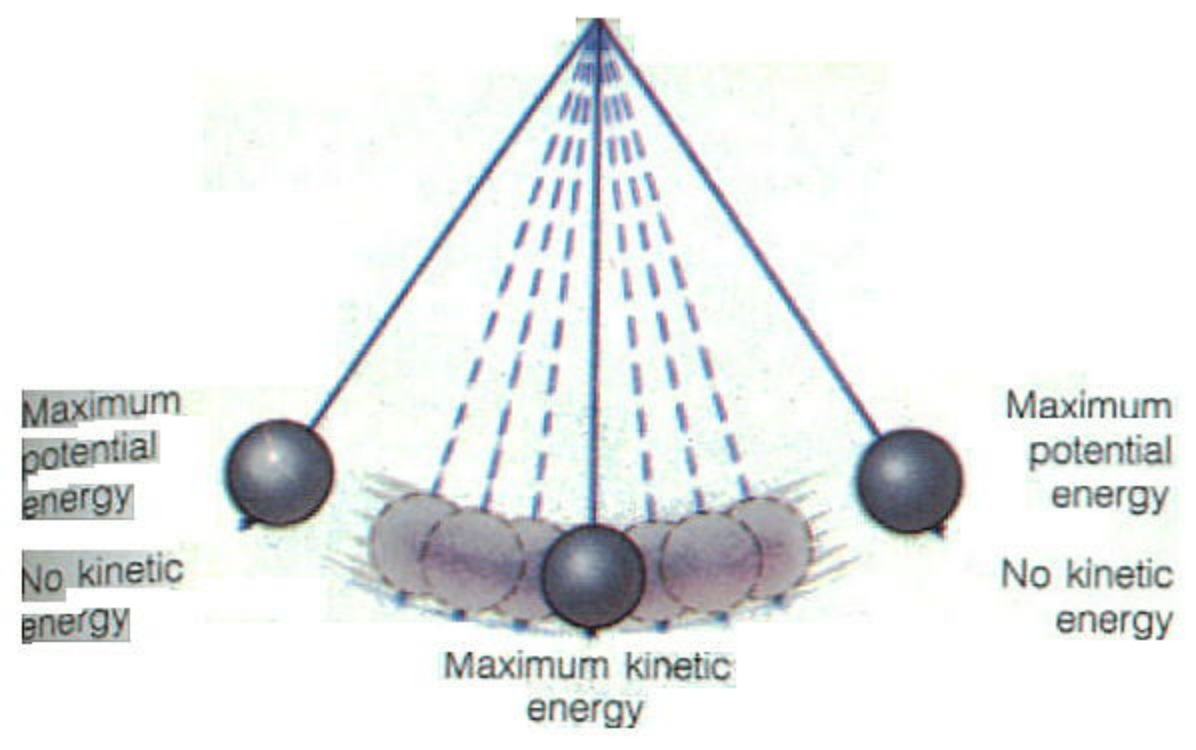




Energy

- Energy is the ability to cause change or do work.
- There are five main types of energy: mechanical, nuclear, chemical, electromagnetic, and thermal.
- The mechanical energy of a moving object is called its kinetic energy.
- The mechanical energy of an object due to its position is called its potential energy.

Energy


Maximum potential energy
No kinetic energy
Maximum potential energy
No kinetic energy
Maximum kinetic energy

Energy

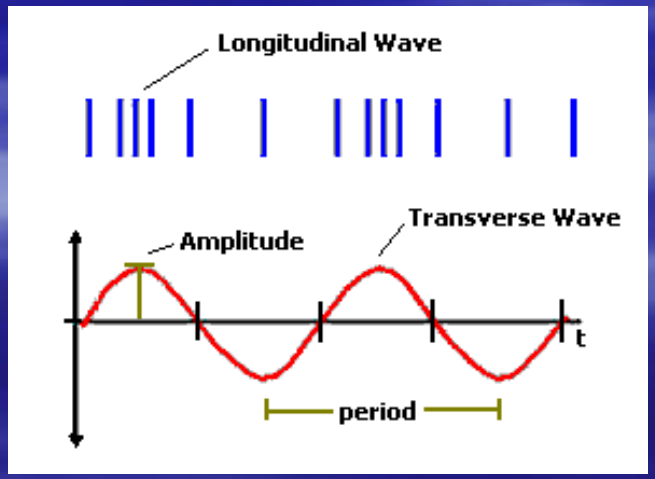
- Energy is constantly changing from one form to another.
- As energy changes from one form to another, it is never created or destroyed.
- Many times it takes a whole series of energy conversions to do a certain job.
- For example, just to get the energy to make a piece of toast, there are several energy conversions involved.
- Chemical energy stored in coal is released as heat and light energy when the coal is burned.
- The heat energy is used to produce steam and is changed into mechanical energy in a generator.
- The generator converts mechanical energy into electric energy that travels through power lines into your home.
- When you use your toaster, that electric energy is again changed into heat energy.

Waves, Sound, and Light

- A wave is a disturbance that transfers energy through matter or through space.
- Mechanical waves move through a medium which can be a solid, liquid, or gas.
- Sound waves, water waves, and earthquakes are all mechanical waves.
- Electromagnetic waves do not require a medium.
- Light waves are electromagnetic waves.
- Thus, light can travel through the vacuum of outer space but sound cannot.

Waves, Sound, and Light

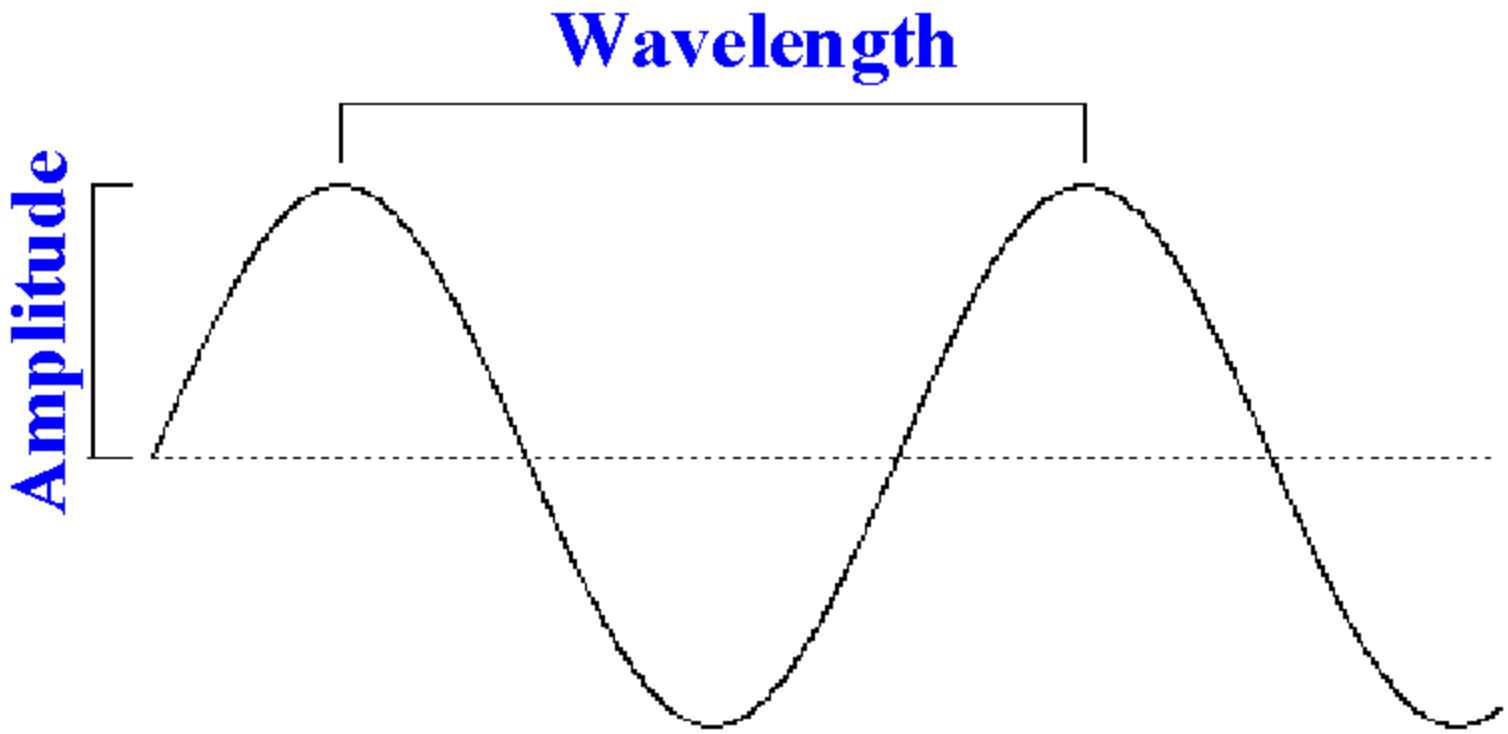
- There are two types of mechanical waves, transverse waves and longitudinal waves.
- Transverse waves have crests and troughs.
- Longitudinal waves have compressions and rarefactions.



Waves, Sound, and Light

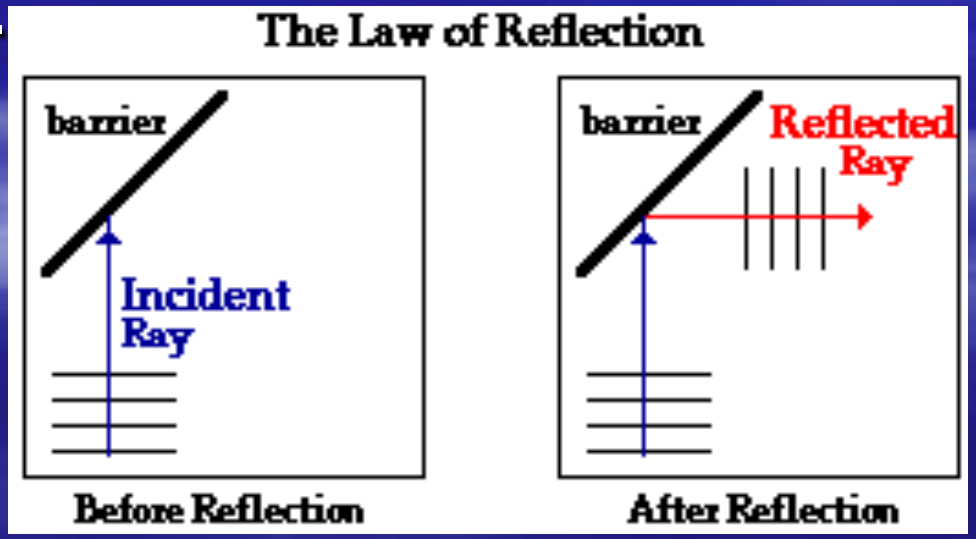
- All waves have a wavelength, amplitude, frequency, and speed.
- On a transverse wave, the wavelength is the distance between two consecutive crests or troughs.
- On a longitudinal wave, the wavelength is the distance between two consecutive compressions or rarefactions.
- The amplitude of a transverse wave is the vertical distance between the line of origin and each crest or trough.
- The frequency of a wave is the number of wavelengths that pass a point in a given amount of time.
- The speed of a wave is equal to the frequency times the wavelength.

Waves, Sound, and Light



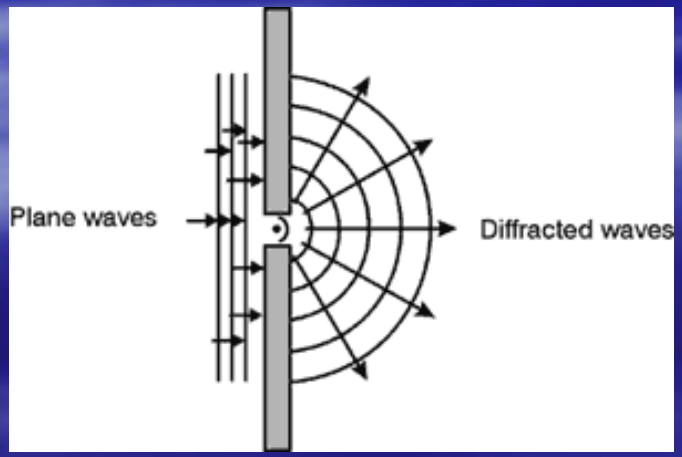
Waves, Sound, and Light

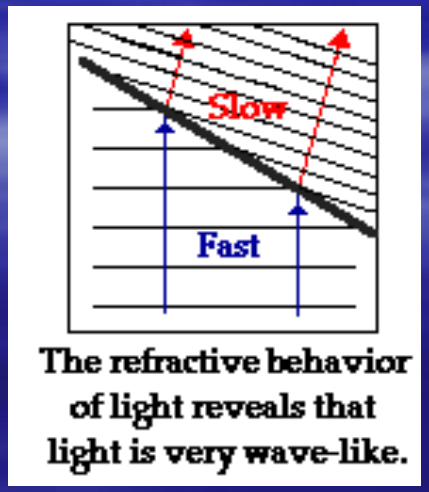
- There are four kinds of wave interactions, reflection, diffraction, refraction, and interference.
- Reflection occurs when a wave bounces off a surface.



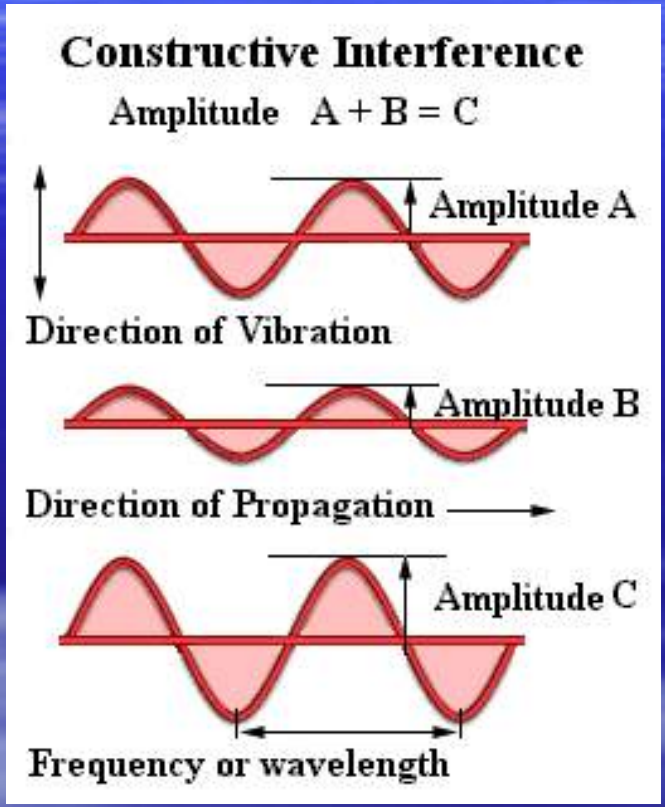
Waves, Sound, and Light

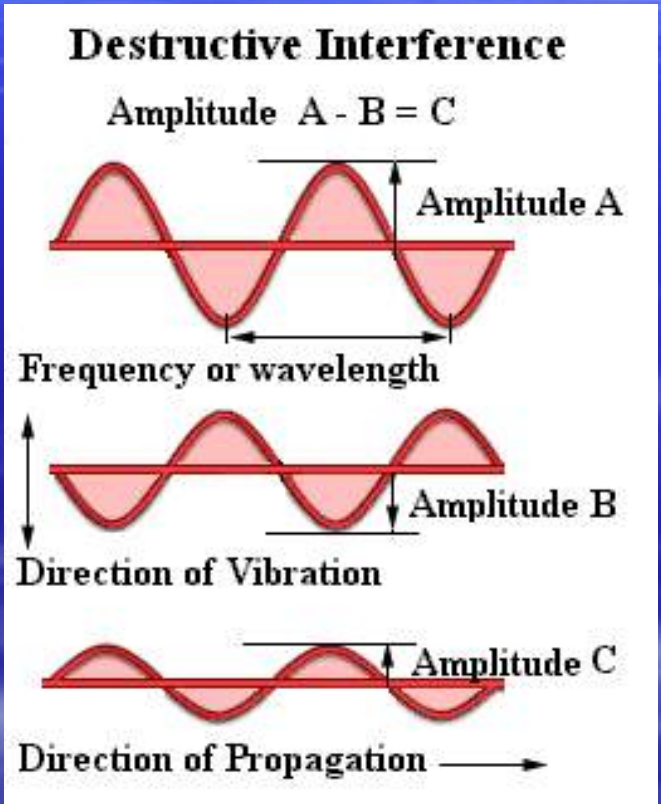
- The bending of a wave as a result of the interaction between a wave and the edge of an object is called diffraction.
- The bending of a wave as a result of a change in speed is called refraction.





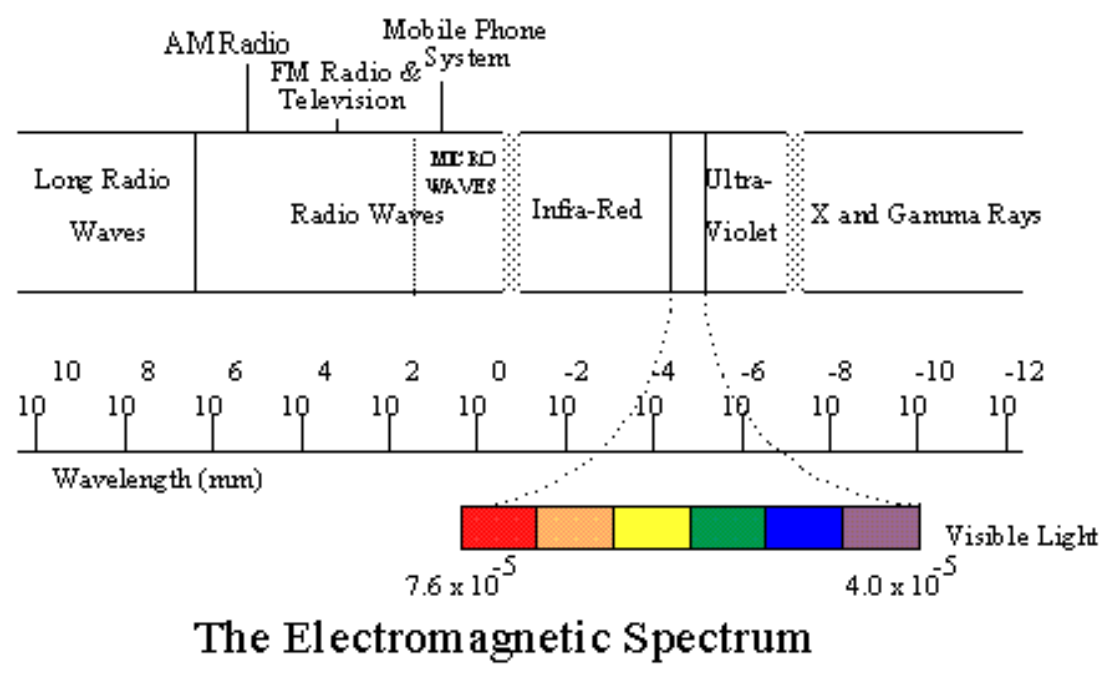
Waves, Sound, and Light





Waves, Sound, and Light

- Light acts as a particle and as a wave.
- Light waves act like transverse waves.
- Light waves are called electromagnetic waves.
- Electromagnetic waves are arranged in order of their wavelength and frequency.



The Electromagnetic Spectrum

Waves, Sound, and Light

- Sound waves are longitudinal waves.
- The speed of sound waves depends on the medium through which they move, not the source.
- Temperature, elasticity, and density of the medium all affect the speed of sound waves.
- When the temperature of the air increases, the speed of sound increases.
- Sound waves move quickly through matter that is elastic.
- Sound waves also move quickly through matter that is dense.

The End

- Remember to use your FCAT Science Reference Sheet!
- Most of the equations you will need will be on this sheet. Any others should be provided in the questions themselves.
- Be sure to spend enough time and effort on the short and extended response questions.
- Good luck!