

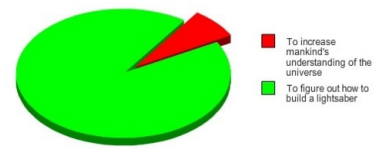
Warm Up -Think about yesterday's lab

- 1.) In the "Colliding Cars" activities, when was momentum conserved and when was it lost? How did you know?
- 2.) In the "What Changes Motion" activity, what happened to the car vs the washers? What caused the change in motion?
- 3.) Which activities used rolling friction to demonstrate how forces can affect an object's motion?

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Energy and Energy Transfer

Why I Am Majoring in Physics





- To increase mankind's understanding of the universe
- To figure out how to build a lightsaber

GraphJam.com

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Energy


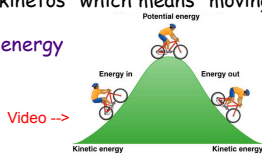
- > The ability to do work or cause change.
- > Work is the transfer of energy.
- > Energy is measured in Joules (J), the same unit as work.
- > If the transfer of energy is work....then power is the rate at which energy is transferred or the amount of energy transferred in a unit of time.

$$Power = \frac{Energy_Transferred}{Time}$$



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2 Major Types of Energy

- Kinetic energy
 - "the energy of motion"
 - Comes from the Greek work "kinetos" which means "moving."
 - 2 factors that affect kinetic energy
 - > Mass
 - > Velocity
 - Kinetic energy increases if either mass or velocity increases.

$$Kinetic_energy = \frac{1}{2} \bullet Mass \bullet Velocity^2$$



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2 Major Types of Energy

- Potential energy
 - > "stored energy"
 - > Gravitational potential energy
 - > Potential energy related to an object's height.
 - > Equal to the amount of work done to lift an object.



$$Work = Force \bullet Dist.$$

Affected by 2 factors

- Height of the object
- Weight of the object (Pull of gravity on object)
- Work formula can be modified; substituting Weight of the object for Force, & height for distance object is moved.

$$Gravitational_Potential_Energy = Weight \bullet Height$$

- > Elastic potential energy
 - > Potential energy associated with objects that can be stretched or compressed.





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Warm Up


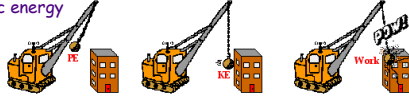
- 1.) What is the difference between kinetic and potential energy?
 - kinetic energy is energy of motion; potential energy is stored energy
- 2.) What unit is energy measured in?
 - Joules (J)
- 3.) What is power?
 - the rate at which energy is transferred

Click picture to review kinetic and potential energy



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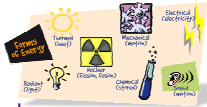


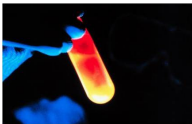
- Mechanical energy
 - The form of energy associated with the position and motion of an object.
 - An object with mechanical energy can do work on another object.
 - The more mechanical energy an object has the more work it can do.
 - Combination of the potential energy and kinetic energy of the object.
 - Mechanical energy = Potential energy + Kinetic energy

The massive ball of a demolition machine possesses mechanical energy - the ability to do work. When held at a height, it possesses mechanical energy in the form of potential energy. As it falls, it exhibits mechanical energy in the form of kinetic energy. As it strikes the structure to be demolished, it applies a force to displace the structure - i.e., it does work upon the structure.




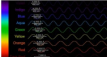
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- Other forms of energy
 - Thermal energy
 - > The energy a substance or system has related to its temperature
 - Electrical energy
 - > The energy of electric charges (protons, electrons, neutrons)
 - Ex.) lightning, batteries, power-lines
 - Chemical energy
 - > Potential energy stored in the chemical bonds.
 - Ex.) Food, matches, cells

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- Nuclear energy
 - > Energy stored in the nucleus of an atom.
 - Nuclear fission
 - Reaction inside the nucleus of an atom in which the nucleus splits into smaller nuclei
 - « Ex.) Nuclear power plants
 - Nuclear fusion
 - Reaction inside the nucleus of an atom in which smaller nuclei fuse (join) together to form a heavier nucleus.
 - « Ex.) Surface of the sun.
 - Both process produce large amounts of energy.
 - Nuclear fusion is more stable and safe but harder to reproduce
- Electromagnetic energy
 - > The energy of light and other forms of radiation.
 - Ex.) Ultraviolet radiation, infrared radiation, microwaves, etc.







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- A. Mechanical energy (motion) → ↻
- B. Thermal energy (heat) 🔥
- C. Electrical energy ⚡
- D. Fluid power ↻
- E. Chemical energy ⚗
- F. Solar/light energy ☀
- G. Nuclear energy ☢
- H. Sound energy 🔊

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- Energy transformation
 - A change from one form of energy to another.
 - > Ex.) potential → kinetic → potential
 - Energy in a system may be transformed so that it resides in a different state.
 - Energy in many states may be used to do many varieties of physical work.
 - Energy may be used in natural processes or machines, or else to provide some service to society (such as heat, light, or motion).
 - > A machine that transforms energy from one form to another is called a *transducer*.



Click picture for website -->

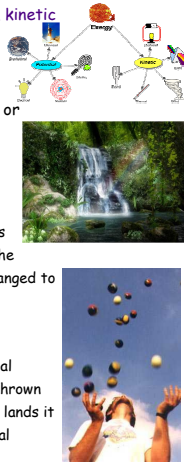
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- 2 main transformation types
 - > Single energy transformations
 - Energy is transformed from one energy type directly into a second energy type.
 - Ex.) cell phone: electrical → electromagnetic
 - Ex.) muscles/food: chemical → mechanical
 - > Multiple energy transformation Demo -->
 - Energy is transformed through a series of different energy types before ending in the desired energy type.
 - Ex.) match: mechanical → thermal → chemical → electromagnetic
 - Ex.) car engine: electrical → thermal → chemical → thermal mechanical



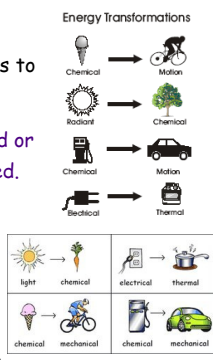
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- One of the most common energy transformations is the transformation between potential & kinetic energy.
- Kinetic energy: energy of motion
- Potential energy: energy due to position or shape (no motion)
- Examples
 - Waterfall
 - Water at the top of the waterfall has gravitational potential energy, once the water begins to fall this energy is changed to kinetic energy.
 - Juggling
 - In the hand an object has gravitational potential energy, once the object is thrown is changed to kinetic energy. Once it lands it changes back to gravitational potential energy.




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- Law of Conservation of Energy
- Remember conserve in Science means to begin & end with the same amount.
- Therefore, energy cannot be created or destroyed, it can only be transformed.
- Ex: Energy & Friction
 - Friction transforms mechanical energy into thermal energy.
 - Whenever a moving object experiences friction, some of its kinetic energy is transformed into thermal energy.



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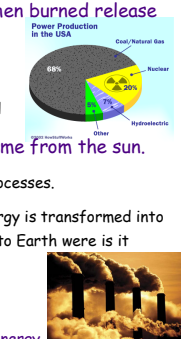
- Energy & Matter
- Matter is defined as anything that has mass and takes up space.
- Einstein discovered that there is an exception to the law of conservation of energy.
- Energy can be created through the absolute destruction of matter however to destroy matter requires a substantial amount of energy & a substantial amount of energy is released (i.e., the atomic bomb).
- Revised Law of Conservation of Energy
 - Matter and energy together cannot be created or destroyed just transformed.



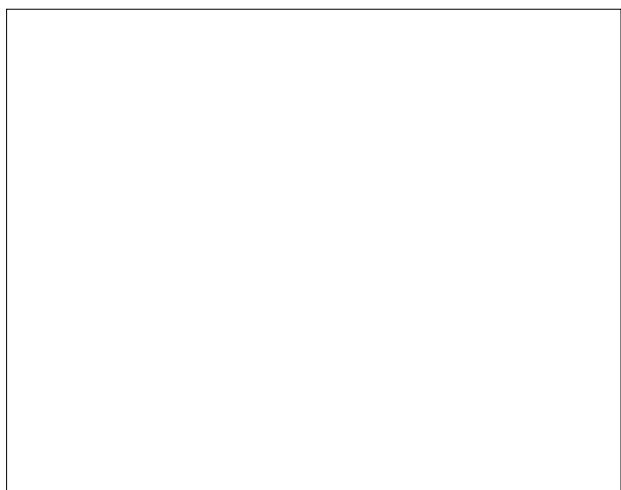
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Renewable and Nonrenewable Resources

- Fossil Fuel
 - A non-renewable resource that forms over millions of years from the remains of ancient plants and animals when burned release chemical energy.
 - Ex.) Coal ➔ Plant material
 - Ex.) Oil, Petroleum , Natural Gas ➔ Animal material
- Fossil fuels contain energy that originally came from the sun.
 - The sun is source of energy for most of Earth's processes.
 - Nuclear fusion is the process by which nuclear energy is transformed into electromagnetic energy. This energy then travels to Earth were is it absorbed & stored inside of plants & animals.
- Combustion
 - The process of burning a fuel to produce thermal energy.



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