

# Law of Conservation of Energy



**Remember Newton's Cradle**

## Five (5) Forms of Energy

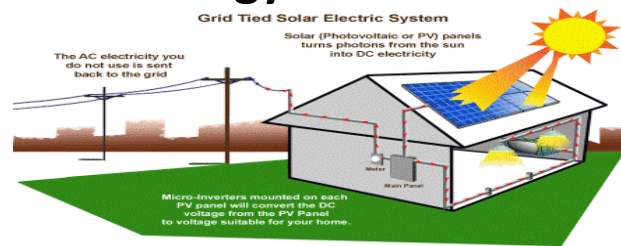
\*Mnemonic Device:  
**HCSME!**

*\*Light, sound & nuclear (like the atom bomb) are forms of energy also, but more emphasis is placed on the main 5 forms.*

- Chant: "Energy can neither be created, nor destroyed, WHAT? Energy can neither be created, nor destroyed, WHAT? Energy can neither be created, nor destroyed, It just changes form."
- Energy **NOT** created or destroyed
- Total amount stays the **SAME**
- Can only **change form** of energy

1. **Heat/Thermal**
2. **Chemical**
3. **Solar** (a type of **Radiant** Energy)
4. **Mechanical** (includes potential/kinetic)
5. **Electrical**-sound and light energy can be transformed with electrical energy in a circuit.

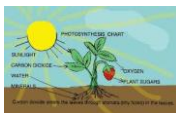
## Solar Energy



- Original source of all energy is from the **sun**
- Solar cell- changes solar energy → electrical energy

## Chemical Energy

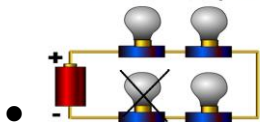
Chemical Energy is **POTENTIAL** Energy



- Energy **stored (potential)** in particles & released (batteries & food)
- Photosynthesis (sugar)  
solar → chemical

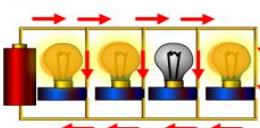
## Electrical Energy

If one bulb fails, they all fail.



- Series circuit-if one burns out they all go out.

If one bulb fails, the rest continue to burn.



- Parallel circuit-(2 or more paths for electricity) if one burns out they can stay on.

- Energy that **flows** through an electric circuit
- Produced by **batteries**, by burning fuels in **generators**
- **4 parts circuit** (copper wire, switch, voltage source, resistor)
- Sources of electrical energy include: stored chemical energy in batteries; solar energy in solar cells; fuels or hydroelectric energy in generators  
**\*\*\*\*IF IT HAS A WIRE, IT HAS TO BE ELECTRICAL ENERGY!**

## Mechanical Energy-

all energy that is in a moving object;  
may be potential (stored) or kinetic (moving).

**potential** → stored energy due to **position of object** can move but isn't (stretching a rubber band stores mechanical potential energy, rock at the top of a hill, water behind a dam).

**kinetic** → motion/moving \***verb showing action** (releasing a rubber band uses mechanical kinetic energy, rock falling from the top of a hill, water going over a dam).

The total energy of the particles in a substance (**associated with motion**)

- faster object (more kinetic) → hotter
- slower object (less kinetic) → colder

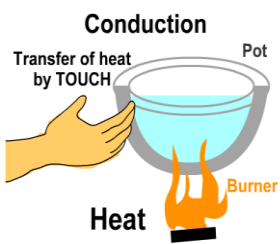
3 types of heat energy?

Conduction, convection, radiation

## Heat Energy



## ConDuction (heat transfer)

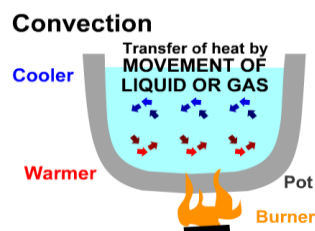


heat transfer (objects heating up) by **D**irect contact/2 objects touching

- **H**eat flows from **H**otter to colder objects

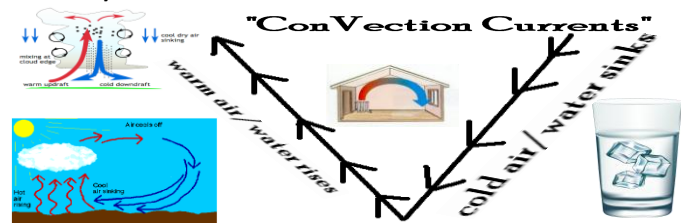
## ConVection

(heat transfer)



gases and liquids heat up by:

warm rising (weighs less), cold sinking (weighs more)



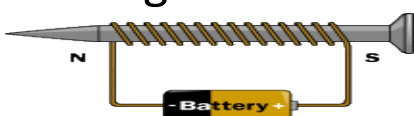
## Radiation-like sun "rays"

(heat transfer)



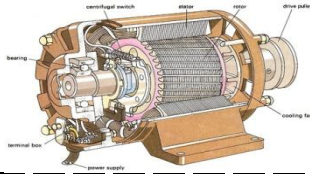
- heat moving through **space**
- heat does not need to travel through air or other particles

## Electromagnet



- Uses electrical energy to make magnetic field (makes a temporary magnet), device doesn't spin.

## Simple Electric Motor



device changes:

**E**lectrical → **M**echanical/kinetic

“Oh my word, electric motors haven’t ya heard? E to the M, E to the M, E to the M . . .

## Generator



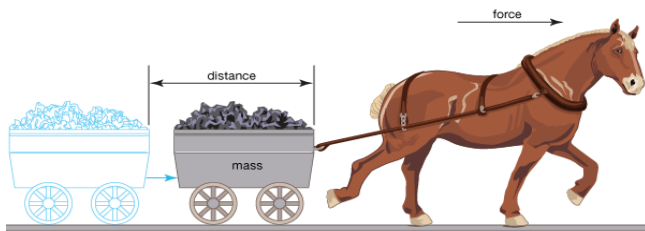
Generators generate elec-tri-city! For who, who, who? For ME, ME, ME!

**M**echanical/Kinetic → **E**lectrical

## Energy

- The ability to do work. If there is no energy, then there is no work done.

## Work



- Since energy is needed to do work (no energy, no work).

- Formula:  $\text{Work} = \text{force} \times \text{distance}$

- Units : Joules = Newtons x meters

## Simple Machines- Chant

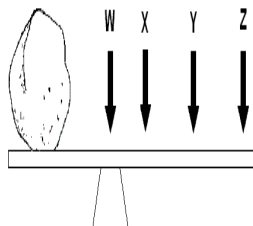
*A simple machine of course, of course, always reduces the force of course. A simple machine of course, of course, always reduces force!*

- **reduce force** by increasing **distance** traveled; Amount of work stays the same **only effort force changes!**

## Compound/Complex Machines

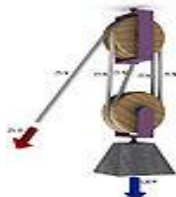
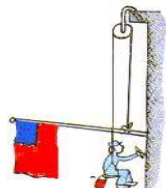
- compound- more than 1 simple machine

## Levers



- fulcrum- pivot (turning point), fulcrum closer to load requires less force to move; moves up/down, side/side
- don't forget your arm is a lever (elbow-fulcrum, muscle-effort force, pen in hand-load)

## Pulleys



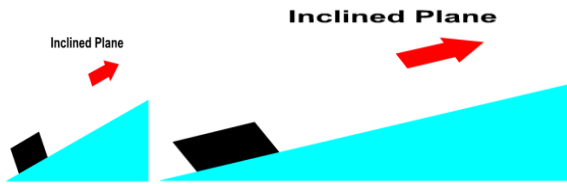
single, fixed

movable

**single, fixed**- only changes direction of load, doesn't reduce force (flag pole, clothesline)

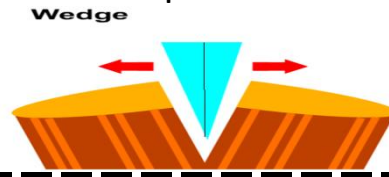
\***moveable**- does **reduce force** needed to move load (block and tackle-lifts engine)

## Inclined Plane



ramp- **reduces force** needed by increasing distance object moves/

**wedge**- 2 inclined planes back to back



- modified inclined plane wrapped around a cylinder
- **reduces force** needed by increasing distance

## Screw



## Wheel & Axle



wheel rotates, axle passes through center of wheel

**WIPPL SWAG**  
**WEDGE**  
**INCLINED PLANE**  
**PULLEY**  
**LEVER**  
**SCREW**  
**WHEEL & AXLE**  
**GEAR**

Mnemonic device to remember the six simple machines plus the gear.

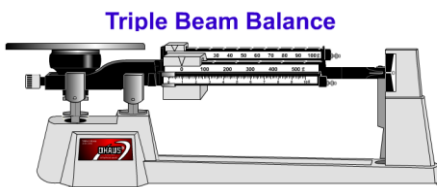
## Engineering Design

GOAL: Construct devices or design solutions using scientific knowledge to solve specific problems or needs:



1. Ask questions to identify problems or needs.
2. Ask questions about the criteria and constraints of the device or solutions (size, cost, time).
3. Generate and communicate ideas for possible devices or solutions.
4. Build and test devices or solutions,
5. Determine if the devices or solutions solved the problem and refine the design if needed.
6. Communicate the results.

## Triple Beam Balance



**Mass** means matter and that's a fact with the triple beam balance add front to back, add 1, add 2, add the 3rd beam . . . ya that's right you get the scene! Keep it up and you use your hand and don't forget to label **grams**!

Tool used to measure mass in grams (g).

## Spring Scale



Tool used to measure weight or **force** in **Newtons (N)**.