

ENERGY

- THE ABILITY TO DO WORK OR TRANSFER HEAT.

WORK

- THE ENERGY TRANSFERRED BY A FORCE TO MOVE AN OBJECT
- Measured in joules (J)

Formula for Work:

$$\text{WORK} = \text{FORCE} \times \text{DISTANCE}$$

WORK

■ WORK IS
DONE ON AN OBJECT
WHEN AN OBJECT
IS FORCED TO MOVE



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FIRST LAW OF THERMODYNAMICS

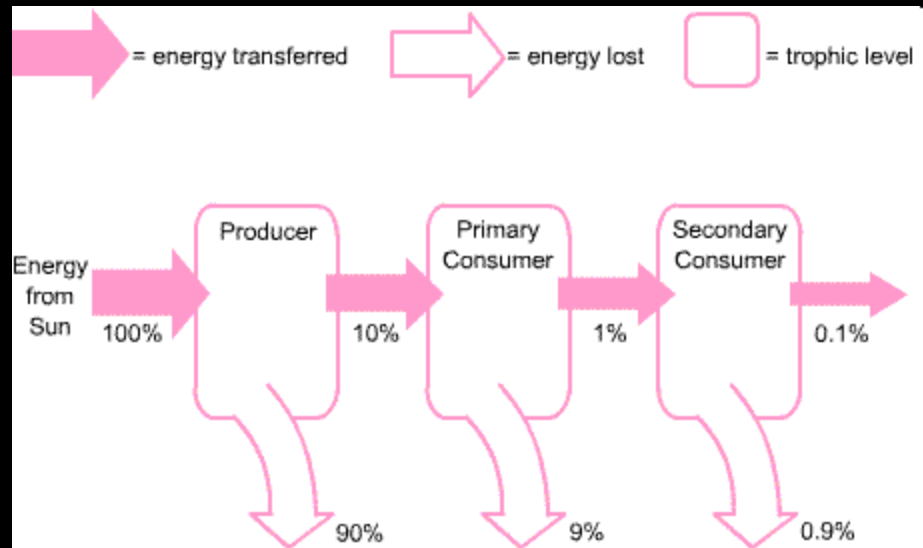
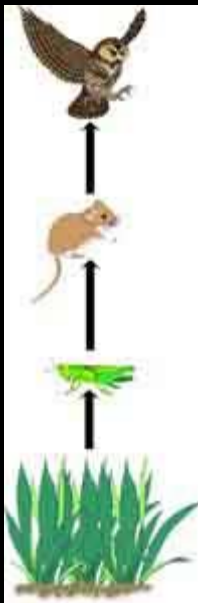
- Energy cannot be created nor destroyed, it can only change form.
- Burn wood
Chemical energy changes into light and heat
- Eat cheeseburger
Chemical energy changes into mechanical and heat

SECOND LAW OF THERMODYNAMICS

- When energy is changed from one form to another, some energy is always lost as heat. 100% of energy cannot be converted into useful work
- ENERGY CONVERSIONS ARE NOT 100% EFFICIENT.

FOOD CHAIN

- **90% OF THE ENERGY IS LOST AS HEAT AT EACH STEP OF A FOOD CHAIN**



http://lgfl.skool.co.uk/uploadedImages/12.2_energy_food_chains.gif

ENTROPY

- THE THERMODYNAMIC MEASURE OF DISORDER
- A SYSTEM TENDS TO BECOME DISORDERLY
- TO MAINTAIN ORDER ENERGY MUST BE USED

ENTROPY



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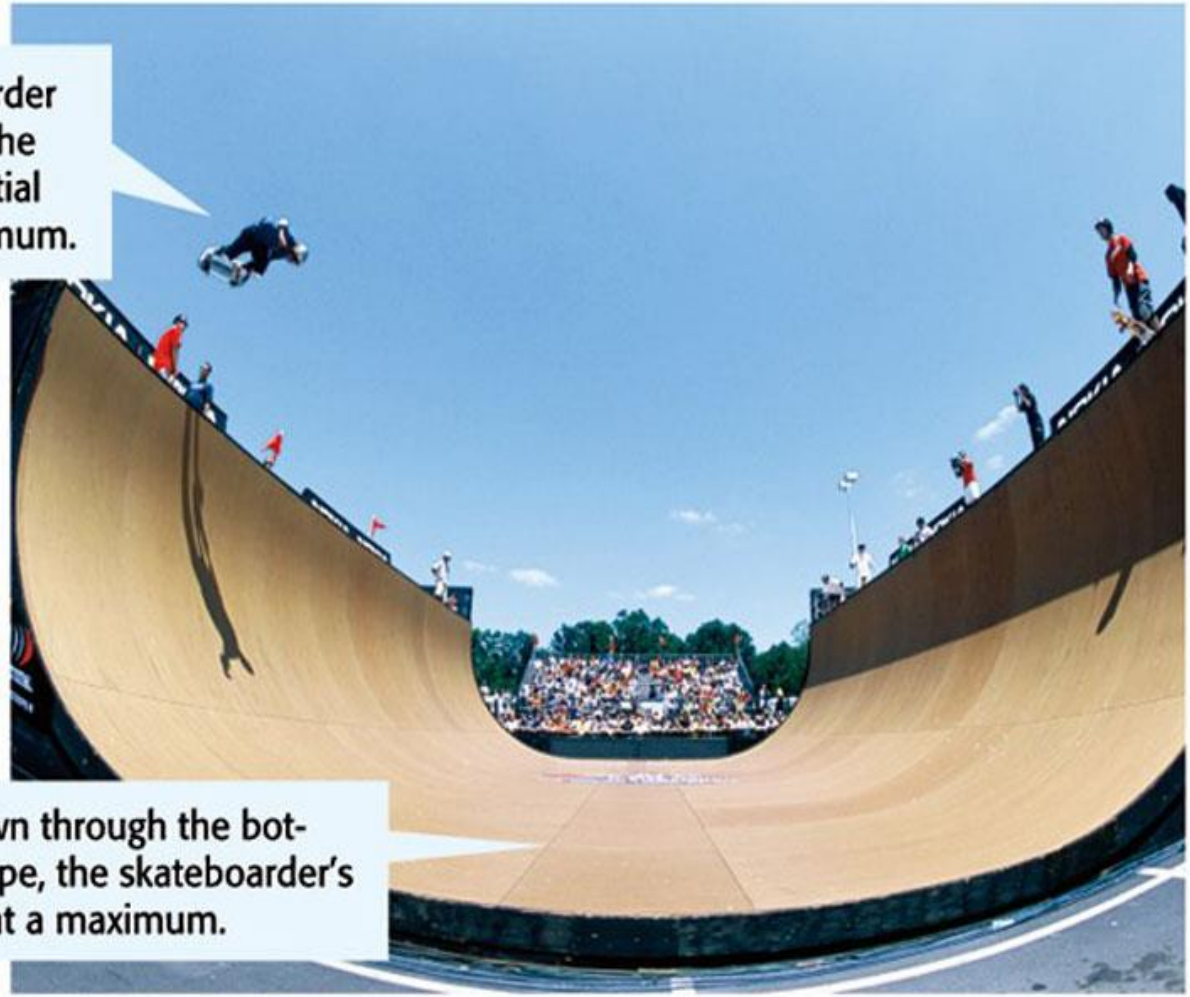
- TO KEEP YOUR ROOM CLEAN YOU MUST USE ENERGY TO PICK UP AND ORGANIZE
- TO MAINTAIN A CAR THE OIL MUST BE CHANGED, TUNE UPS, SPARK PLUGS REPLACED, FLUIDS TOPPED OFF OR REPLACED, ETC.

Energy Conversions

- An **energy conversion** is a change from one form of energy to another.
- In the picture on the next slide we see potential mechanical energy transforming into kinetic mechanical energy and heat and then vice versa

Potential Energy and Kinetic Energy

When the skateboarder reaches the top of the half-pipe, his potential energy is at a maximum.



As he speeds down through the bottom of the half-pipe, the skateboarder's kinetic energy is at a maximum.

Conversions Involving Chemical Energy

- The chemical energy in the food you eat is converted into another kind of chemical energy your body can use (ATP).
- Your body then converts that chemical energy into kinetic mechanical energy when you move.

Conversions Involving Electricity

- You encounter many electrical energy conversions in your day to day life.
- What energy form is missing during each conversion?

| | |
|--------------------|---|
| Alarm clock | electrical energy → light and sound energy |
| Battery | chemical energy → electrical energy |
| Light bulb | electrical energy → light and thermal energy |
| Blender | electrical energy → mechanical and sound energy |

What energy form is missing during each conversion?

- Heat always released with energy transformations.

Energy Conversions in a Bicycle

For your bike to start and keep moving, energy must be transferred and converted.



1 Chemical energy in your body is converted into kinetic energy when your muscle fibers contract and relax.

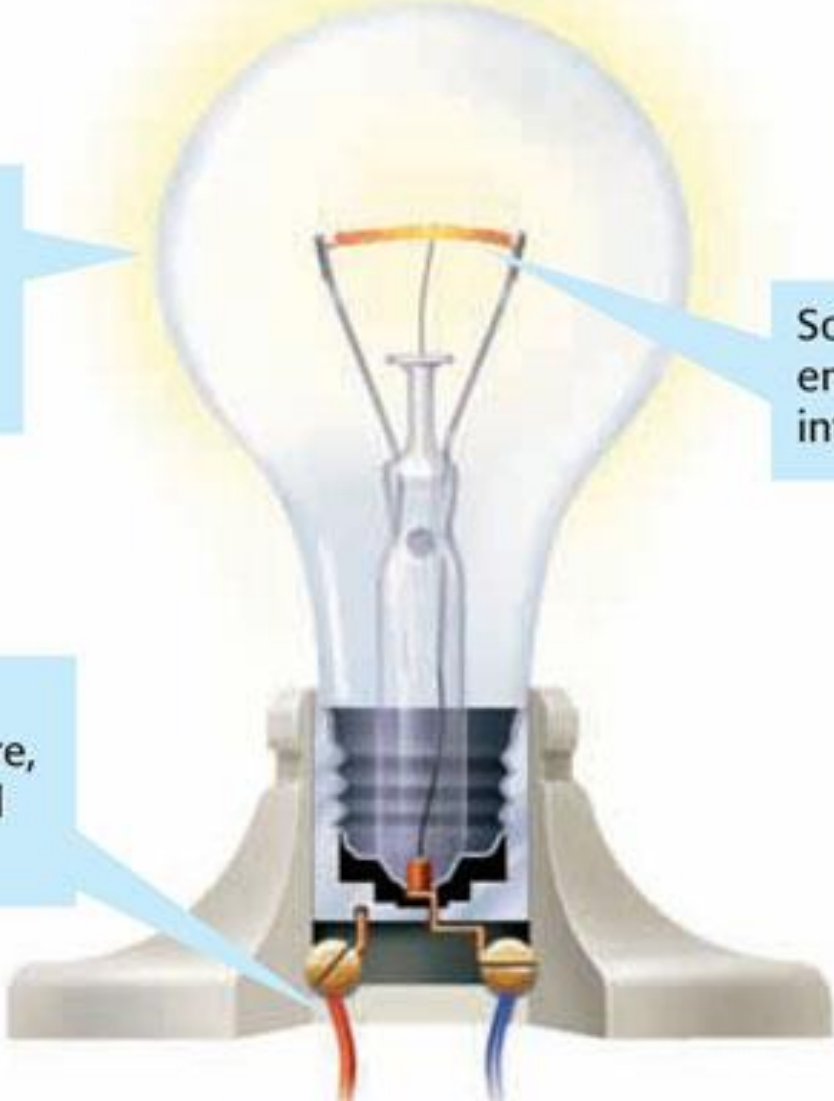
2 Your legs transfer this kinetic energy to the pedals by pushing them around in a circle.

4 The chain moves and transfers energy to the back wheel, which gets you moving!

3 The pedals transfer this kinetic energy to the gear wheel, which transfers kinetic energy to the chain.

Where Does the Energy Go?

- The 1st Law of Thermodynamics states that energy cannot be created or destroyed.
- Energy can be converted from one form of energy to another, but all the different forms of energy in a closed system will always add up to the same amount of total energy.



Some energy is converted into thermal energy, which makes the bulb feel warm.

Some electrical energy is converted into light energy.

As electrical energy is carried through the wire, some of it is converted into thermal energy.

No Conversion Without Thermal Energy

- Any time one form of energy is converted into another, some of the original energy always gets converted into thermal energy.
- The thermal energy due to friction that results from energy conversions is usually not useful energy.