Day 4

Energy Transformation

In your notebook, identify all the forms of energy you see in the picture below.

Work

the amount of displacement due to force.

Force X Displacement = Work

1 Newton X 1 Meter = 1 Joule

1. A book weighing 1.0 newton is lifted 2 meters. How much work was done?

2. A force of 15 newtons is used to push a box along the floor a distance of 3 meters. How much work was done?

Essential Question: How are forms of energy alike and different?

Standard:

Understand forms of energy, energy transfer and transformation and conservation in mechanical systems.

In our previous lesson, we learned that there are two types of energy: Potential Energy & Kinetic Energy

There are also many forms of energy. This lesson will provide an overview of some forms of energy.

There are many forms of energy, but we are going to focus on just a few.

- Heat energy (Thermal)
- Mechanical energy
- Light (Radiant) energy
- Electrical energy
- Sound energy
- Chemical energy

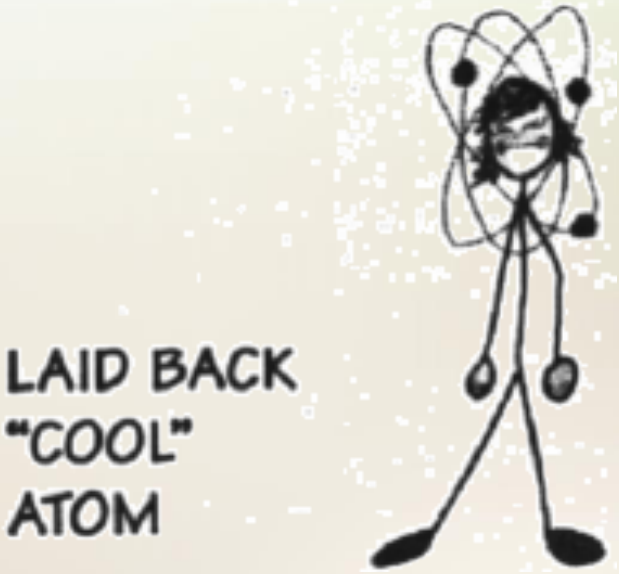
Heat (Thermal) Energy

- Energy that is created in the movement of particles (atoms) that produces heat.
- Heat (thermal) energy increases as temperature increases
- The faster the particles (atoms) move, the greater the kinetic energy and the greater the object's thermal energy. The opposite is also true.
- Thermal energy also depends on the number of particles. If there are more particles, there is more thermal energy.

Heat (Thermal) Energy

A hot object is one whose atoms and molecules are excited and show rapid movement.
(More heat energy)

A cooler object's molecules and atoms will show less movement.
(Less heat energy)



Mechanical Energy

- Energy of motion
- The total energy of motion and position of an object (potential energy + kinetic energy)
- Mechanical energy can be all potential energy, all kinetic energy, or some of each.

Mechanical Energy

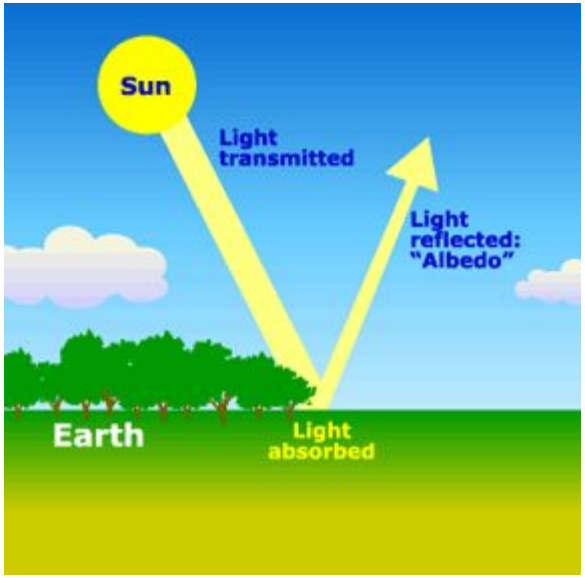
- The mechanical energy of an object stays the same, but the potential and kinetic energy of an object can increase or decrease.
- Think of juggling. The kinetic energy decreases until all of the pin's kinetic energy turns into potential energy, and it stops moving upward.
- As the pin falls back down again, its potential energy starts changing back into kinetic energy.

Examples of Mechanical Energy

Light (Radiant) Energy

- Energy created by vibrating particles that create waves that travel through space and time. [These waves are called electromagnetic waves.]
- Light (Radiant) energy can be absorbed, transmitted, or reflected.
- Includes energy from gamma rays, x-rays, ultraviolet rays, visible light, infrared rays, microwave and radio bands

Examples of Light (Radiant) Energy



Radio waves | Micro-waves | Infrared radiation | Visible light | Ultraviolet | X-rays | Gamma-rays



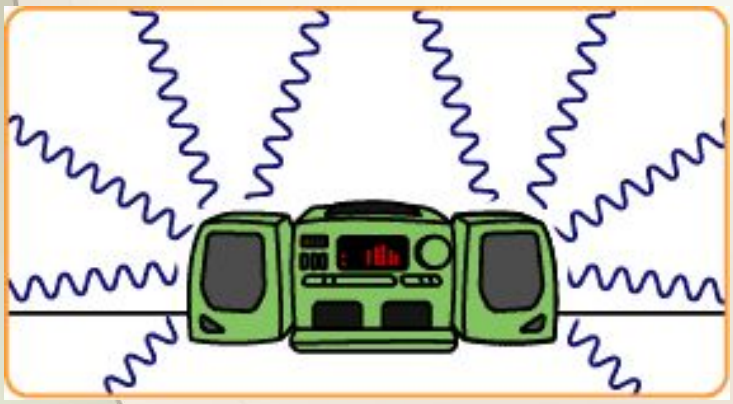



Electrical Energy

- Energy that is carried by an electrical current (the movement of electrons, the negatively charged particles of atoms)
- The electrical energy used in your home can be thought of as potential energy that is used when you plug in an electrical appliance and use it.

Sound Energy

- Sound energy is caused by an object's vibrations
- A vibrating object transmits energy through the air around it in waves (longitudinal waves)



Chemical Energy

- Energy stored in chemical bonds
- When chemical bonds are broken, new chemicals are formed and some of it is released energy
- Examples: Food, Battery, Burning candle or Wood, Fireworks, Fossil Fuels, Gasoline

Examples of Chemical Energy

What type of energy cooks food in a microwave oven?

RADIANT ENERGY

What type of energy is the spinning plate inside of a microwave oven?

MECHANICAL ENERGY

Electrical energy is transported to your house through power lines.

When you plug an electric fan to a power outlet, electrical energy is transformed into what type of energy?

MECHANICAL ENERGY

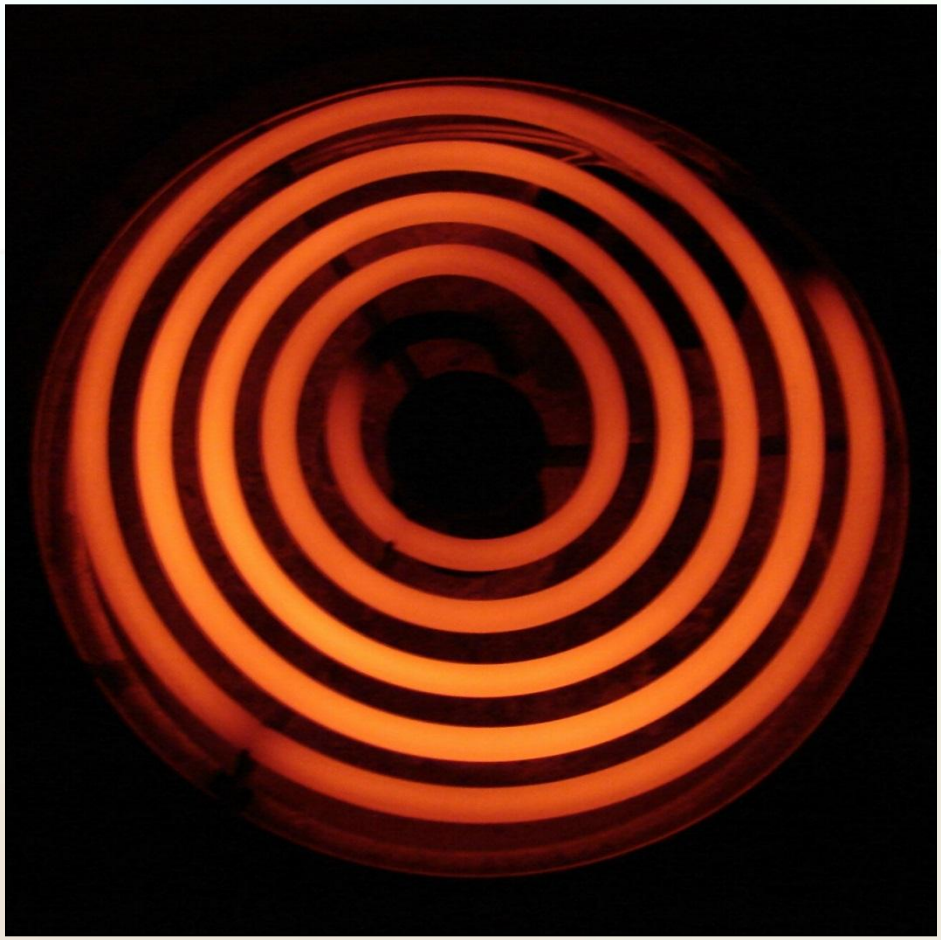
What type of energy is shown below?

Chemical Energy

What types of energy are shown below?

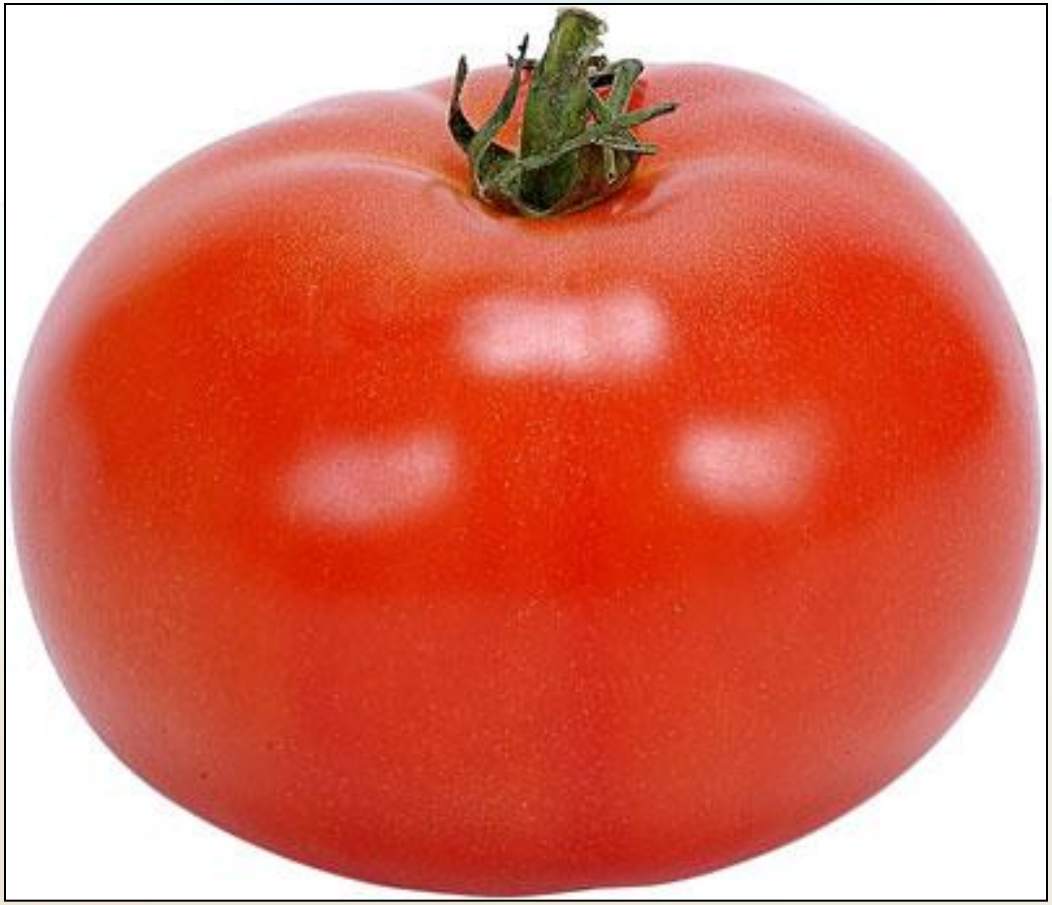
Chemical, Mechanical and Radiant Energy

What type of energy is shown below?



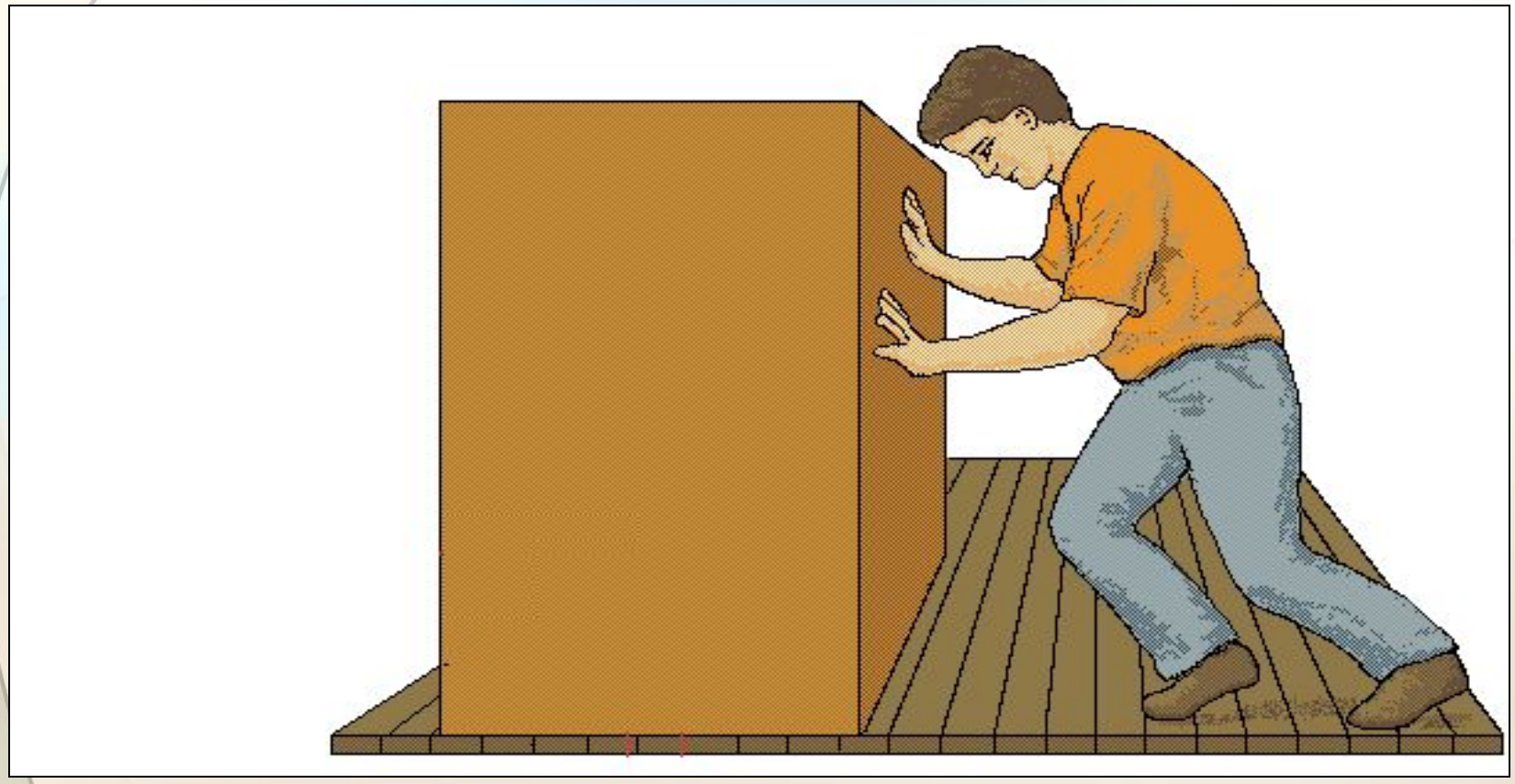
Thermal Energy

What type of energy is shown below?



Chemical Energy (yummy)

What types of energy are shown below?



Mechanical and Thermal Energy
(Friction causes thermal energy)

In the world around you, energy is transforming continually between one form and another.

Often, one form of energy changes into more than one form.

Examples of Transforming Heat (Thermal) Energy

- When an object is heated to a high temperature, it glows and gives off heat. Therefore, some thermal energy is converted to light (radiant) energy
- A fire or a flame converts heat (thermal) energy to light (radiant) energy
- Energy in the form of heat is almost always one of the products of an energy transformation.
- For example, when people exercise, when cars run, when a light is turned on, heat is produced.

Examples of Transforming Chemical Energy

- Inside your body, chemical energy is transformed into mechanical energy (kinetic energy)
- Batteries, wood, matches, fireworks, fossil fuels, etc. are forms of chemical energy that are converted into other forms once used or burned
- The matter contained in living organisms has chemical energy. When organisms die, this chemical energy is broken down and converted to other chemical compounds. In this process, thermal energy is released.

Examples of Transforming Light (Radiant) Energy

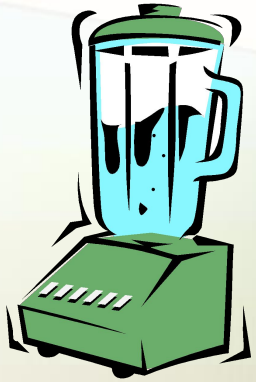
- Plants use light (radiant) energy to make chemical energy. [remember Photosynthesis]
- The chemical energy in food is then changed into another kind of chemical energy that your body can use. [remember cellular respiration]
- Your body then uses that energy to give you mechanical energy [kinetic and potential energy]
- Also, the light (radiant) energy converted into chemical energy in say a tree can then be changed into thermal energy when you burn the tree's wood.

Examples of Transforming Electrical Energy

Every time you plug something into a wall outlet, you are using electrical energy and that electrical energy is transformed into other forms of energy

Hairdryer:
electrical energy ⇨ mechanical energy, thermal energy, and sound energy

Blender:
electrical energy ⇨ mechanical energy and sound energy



Alarm Clock: electrical energy ⇨ light energy and sound energy

Let's examine the Energy Transformation in riding a bike.

- As the rider pedals, her leg muscles transform chemical energy (potential energy stored from the food she ate) into mechanical (kinetic) energy
- The mechanical (kinetic) energy of her leg muscles transforms into mechanical (kinetic energy) of the bicycle as she pedals
- Some of this energy transforms into potential energy as she moves up the hill
- Some energy is transformed into thermal energy (her body is warmer because chemical energy is released and because of friction, the mechanical parts of the bicycle are warmer too)

Energy Transformations in a Car

- A car engine transforms the chemical energy in gasoline into mechanical energy (kinetic and potential energy)
- Not all of the chemical energy is converted into mechanical energy. Some is converted into thermal energy, and the engine becomes hot.
- The chemical energy in the car battery is also transformed into other forms of energy


Identify other energy transformations
that you can observe in a car.

Energy Transfer

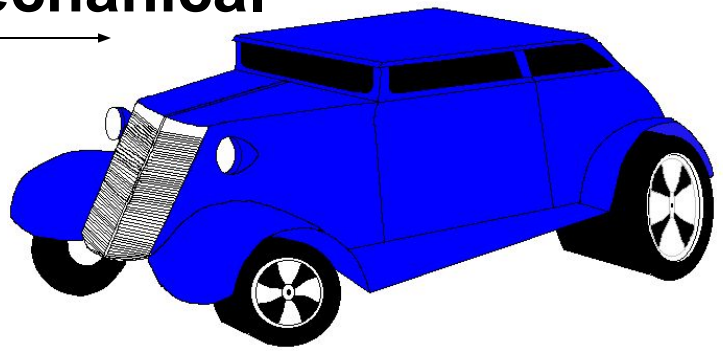
Electrical

Sound
(mechanical)

Electrical

Thermal

Mechanical

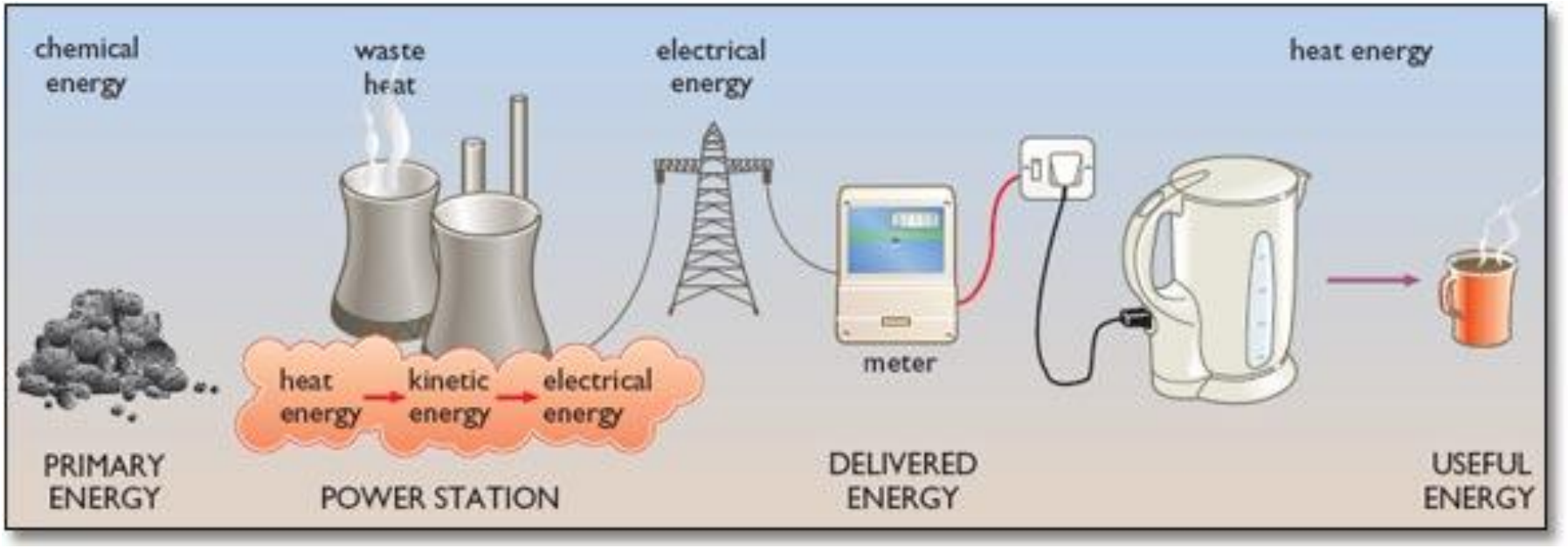


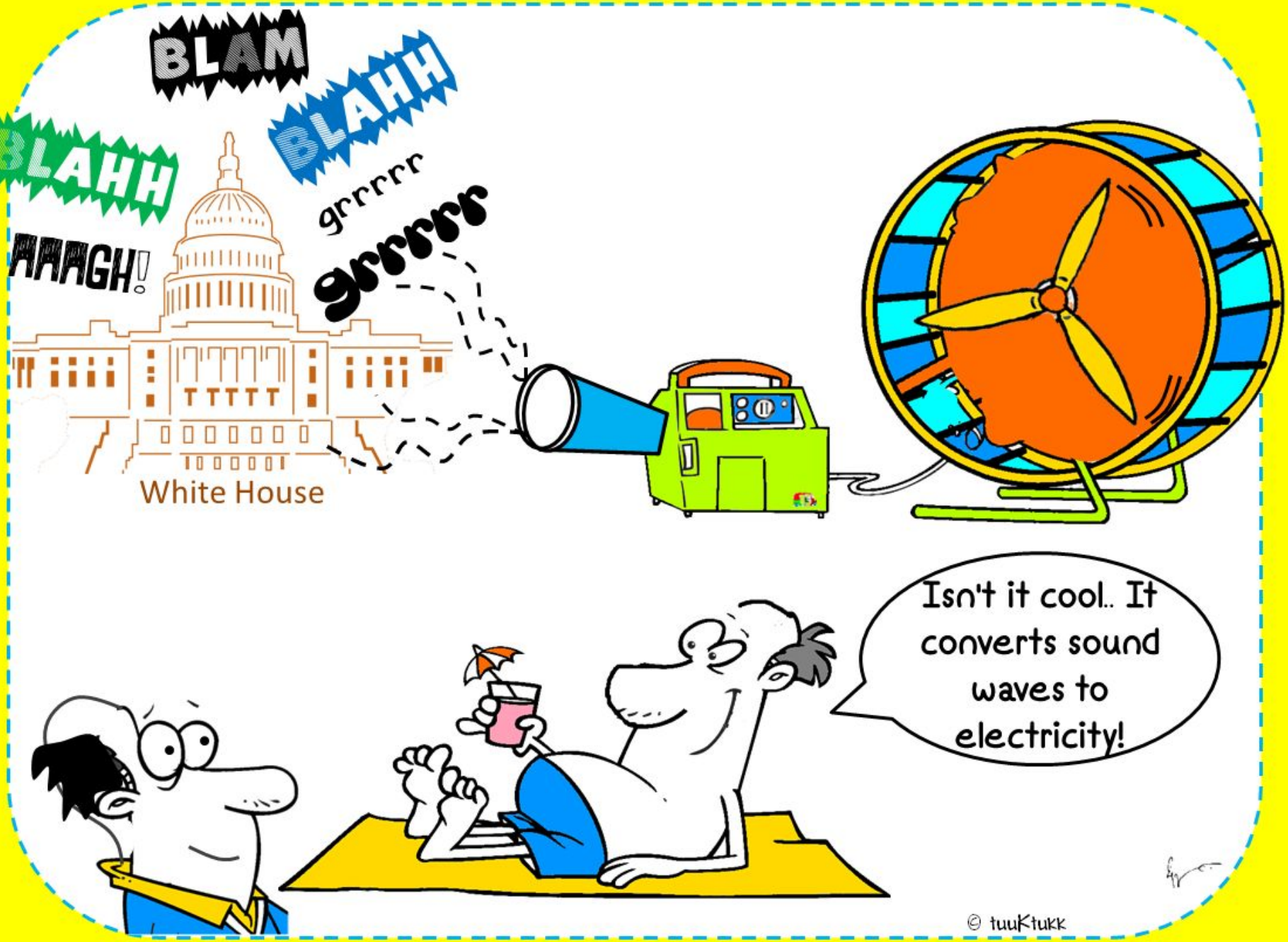
Chemical

Electrical

Light
(Electromagnetic)

Energy Transformations




BLAM
BLAHH
BLAHH
grrrrr
grrrrr
AAAGH!
White House
Isn't it cool.. It converts sound waves to electricity!
© tuuKtukk

Watch the short video clip. Identify the energy transformations that occur.

http://www.discovery.com/tv-shows/other-shows/videos/time-warp-lighting-a-match.htm

In the video, chemical energy in the match changes to heat (thermal) energy and light (radiant) energy.

While the match is burning, is the amount of chemical energy in the match the same? Why or Why not?

As the match is burning, the chemical energy is decreasing while the thermal energy and the radiant energy are increasing.

How is Energy Like Money? Handout

As you discovered in the handout, energy is like money in that it doesn't go away, it just changes form.

Additionally, the starting twenty dollars was reduced, but all of it was still there just in different places. The same is true for energy.

Study Jams Video: Energy and Matter

http://studyjams.scholastic.com/studyjams/jams/science/matter/energy-and-matter.htm

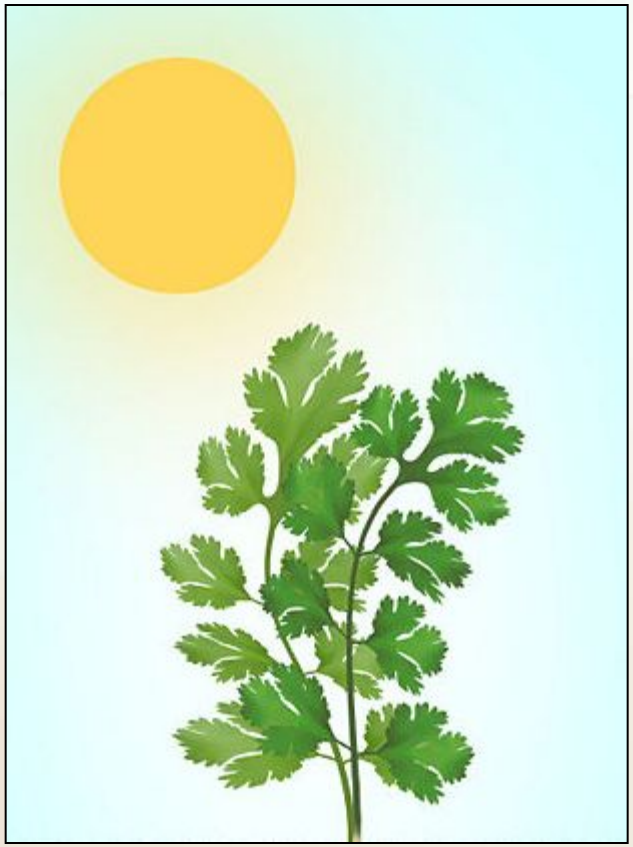
Let's see what you know about energy transformations.

The following slides will show an image. Guess the type of energy transformation that occurs in the image.

Identify the Energy Transformation

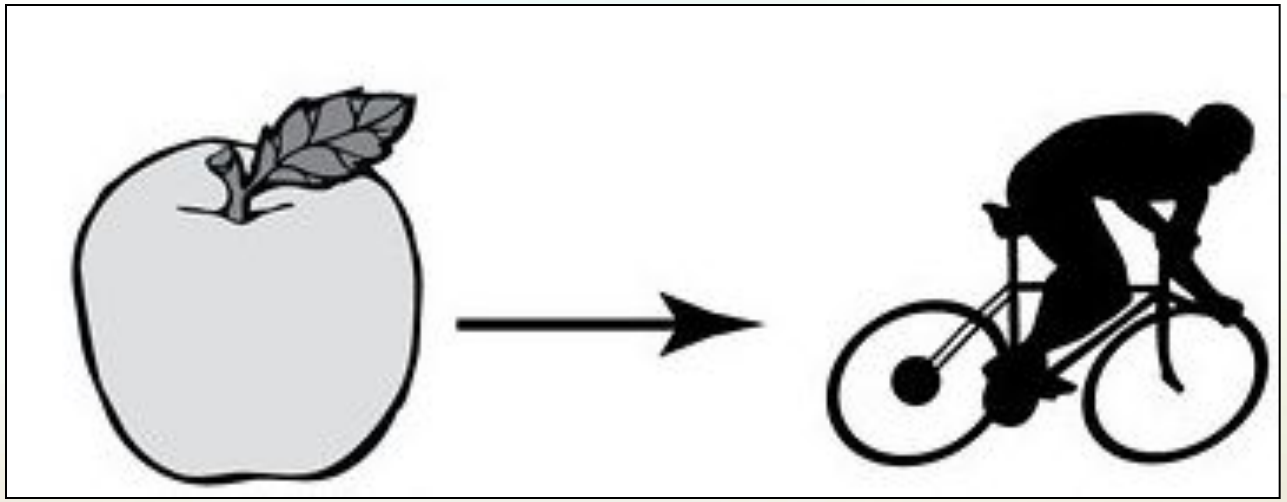
Electrical ⇨Sound

Identify the Energy Transformation



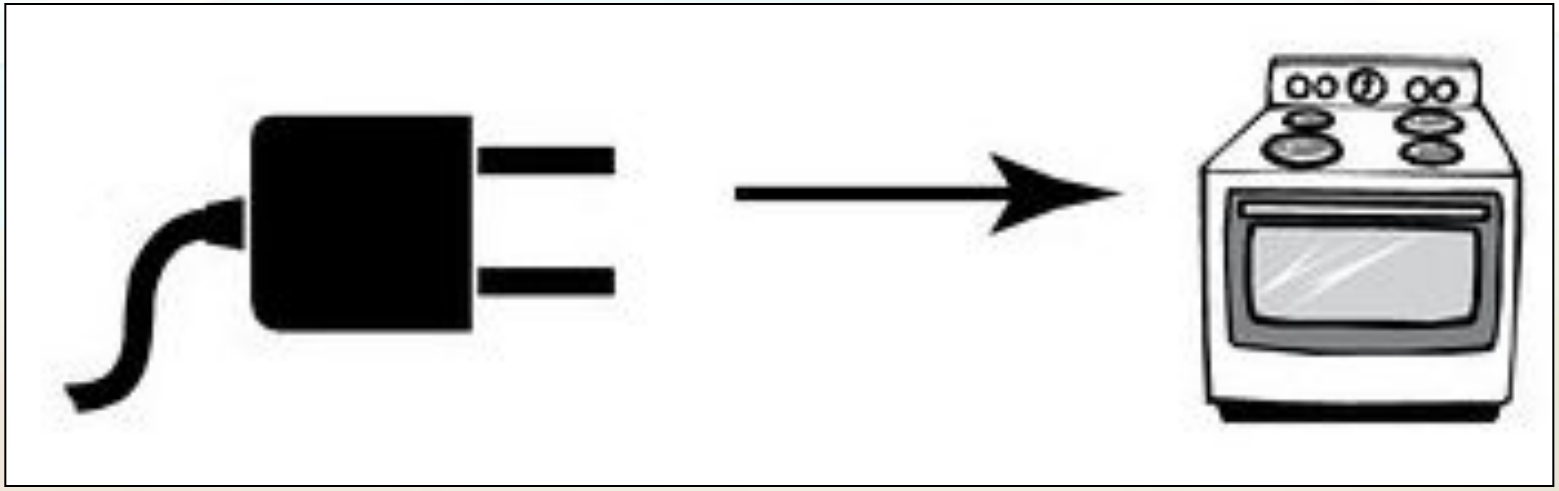
Light ⇨Chemical

Identify the Energy Transformation



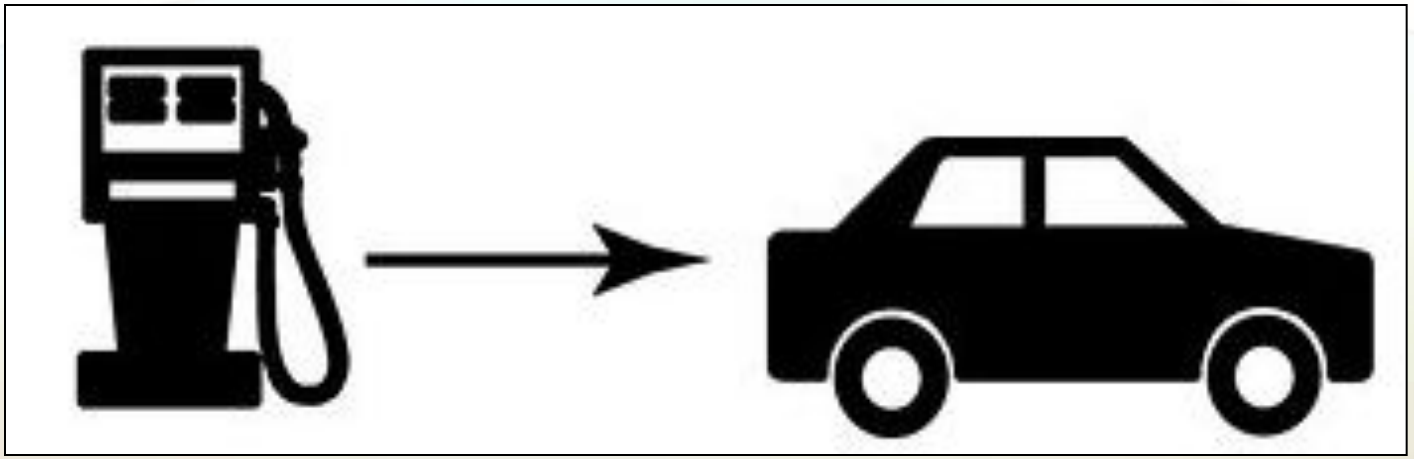
Chemical ⇨Mechanical

Identify the Energy Transformation



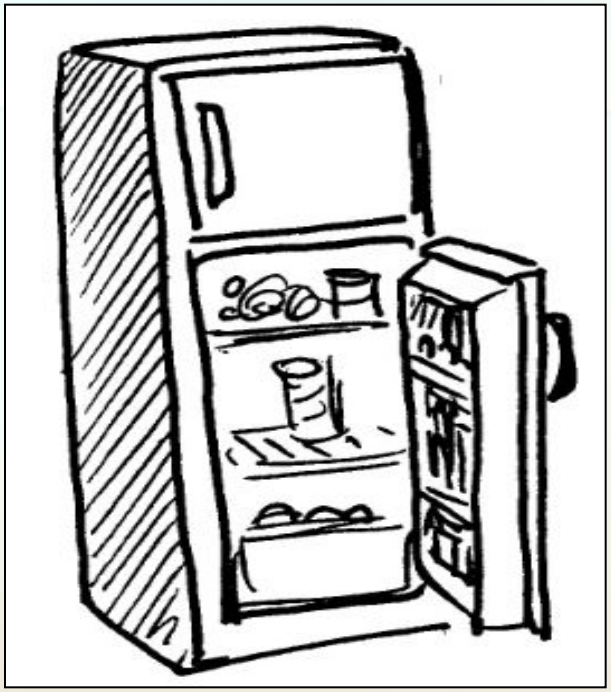
Electrical ⇨ Heat (Thermal)

Identify the Energy Transformation



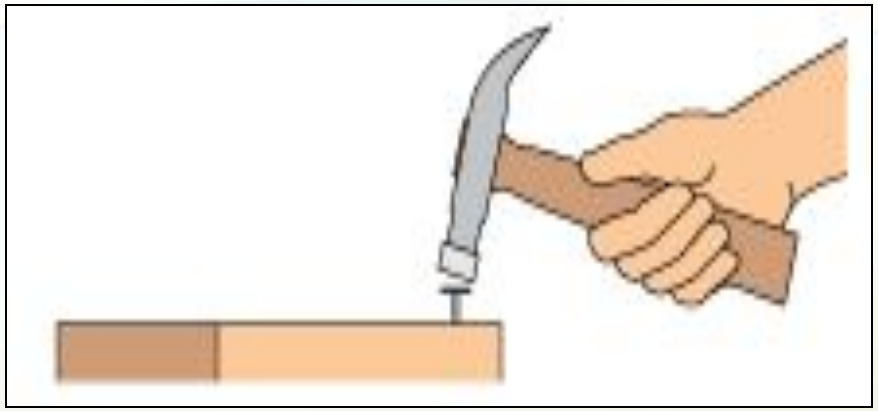
Chemical ⇨Mechanical

Identify the Energy Transformation



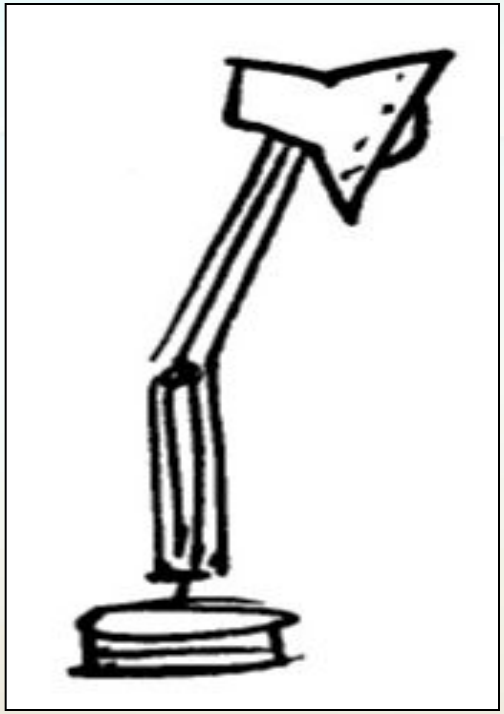
Electrical ⇨Mechanical and Heat (Thermal)

Identify the Energy Transformation



Mechanical ⇨Heat (Thermal)

Identify the Energy Transformation



Electrical ⇨Light and Heat (Thermal)

Identify the Energy Transformation

Chemical ⇨Light and Heat (Thermal)

Identify the Energy Transformation

Light ⇨Electrical and Heat (Thermal)

Identify the Energy Transformation

Sound ⇨Electrical ⇨ Sound

Activitiy to Reinforce Energy Transformation

- **Access the Energy Transformation worksheet, complete and submit.**

Identify energy transformations in the illustration below. Include the following: Heat, Light, Mechanical, Electrical, Sound, & Chemical