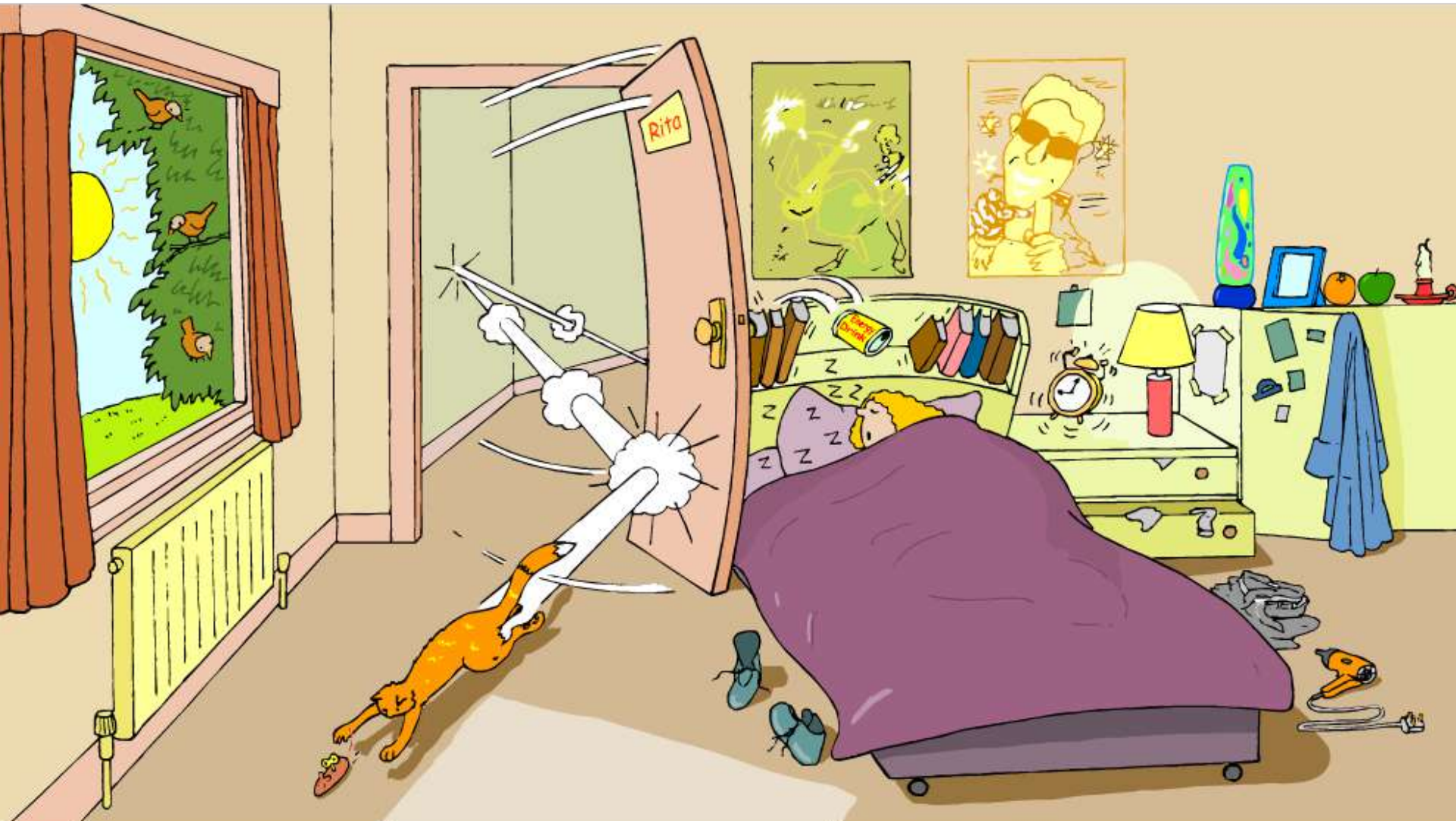


Identify all the forms of energy you see in the picture below.



Essential Question:

What are the various forms of energy? How does energy transform from one type to another?

Standard:

8P2c. Construct an argument to support a claim about the type of energy transformations within a system [e.g., lighting a match (light to heat), turning on a light (electrical to light)].

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**
- **Chemical Energy**
- **Nuclear 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)**



EXCITED
"HOT"
ATOM

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

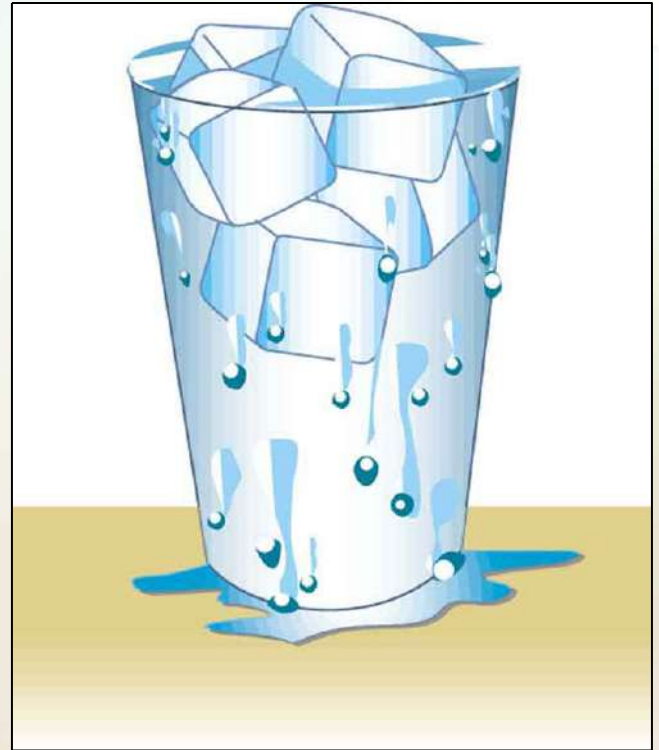


LAID BACK
"COOL"
ATOM

Which has more thermal energy? Why?



Hot Chocolate



Ice Water

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.**



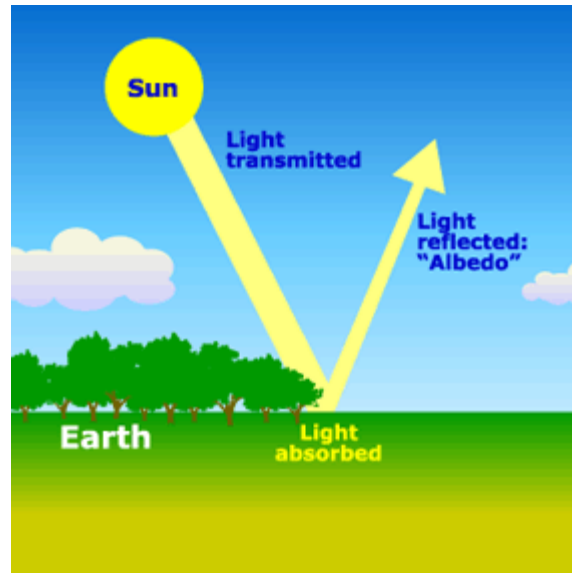
Examples of Mechanical Energy



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.**



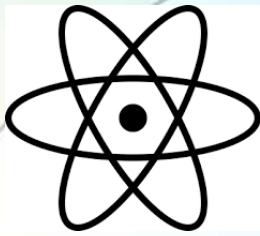
Chemical Energy

- **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





Nuclear Energy

Every atomic nucleus contains energy- nuclear energy- that can be transformed into other forms of energy.

Our sun produces nuclear energy.

Nuclear power plants use energy stored in the nucleus of an atom to generate electricity.

However, releasing the nuclear energy is a complicated process. It involves the construction of complex power plants.

(Nuclear Energy cont.)

Nuclear energy is energy in the nucleus (core) of an atom. Atoms are tiny particles that make up every object in the universe. Nuclear energy can be used to make electricity. But first the energy must be released.

It can be released from atoms in two ways: nuclear fusion and nuclear fission. In nuclear fusion, energy is released when atoms are combined or fused together to form a larger atom. This is how the sun produces energy.

In nuclear fission, atoms are split apart to form smaller atoms, releasing energy. Nuclear power plants use nuclear fission to produce electricity



**What type of energy
cooks food in a
microwave oven?**

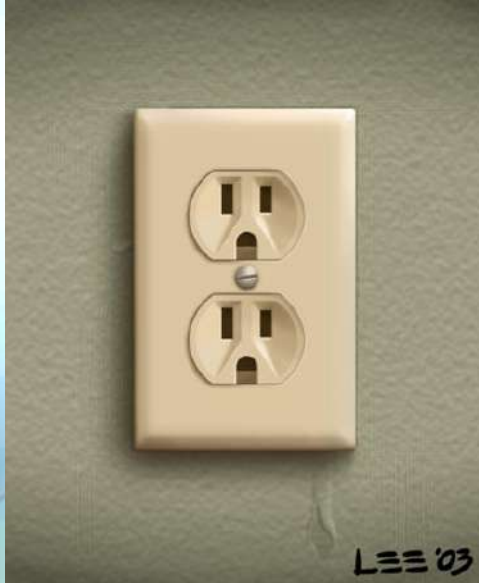
RADIANT ENERGY



**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?



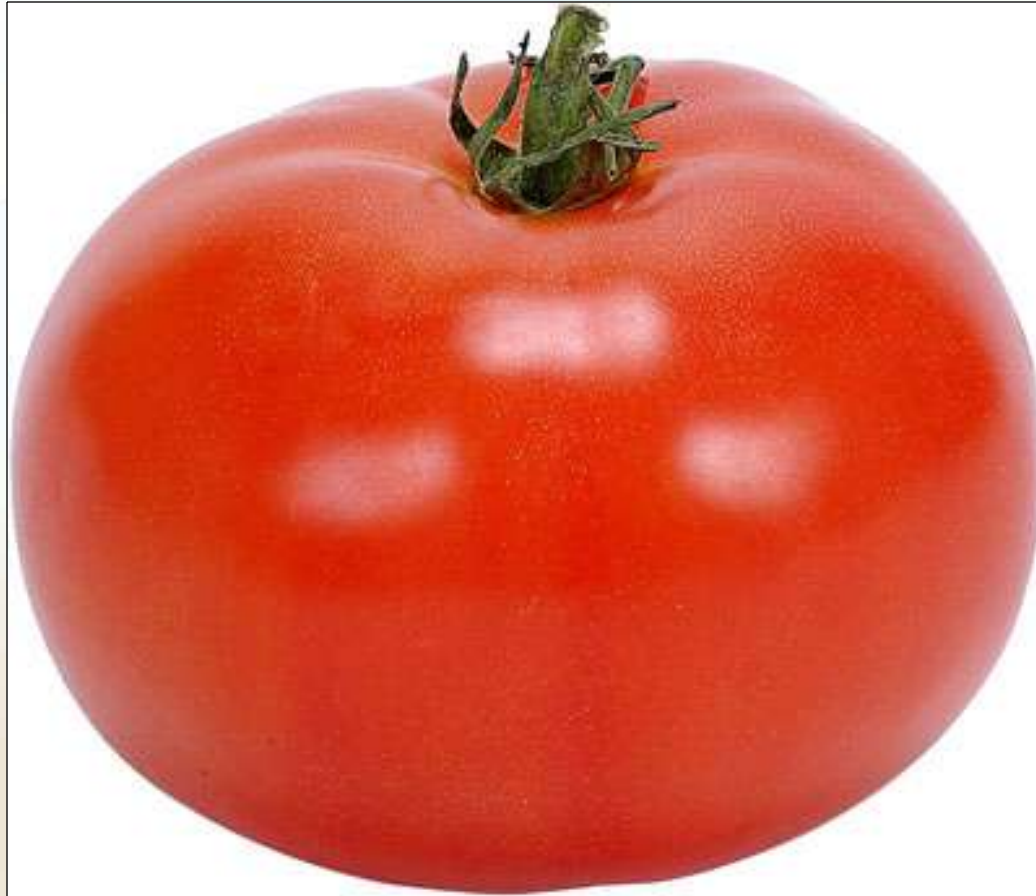
**Chemical, Mechanical and
Radiant Energy**

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.

According to the Law of Conservation of Energy, energy is never created or destroyed, it just changes its form.

Demonstration of the Law of Conservation of Energy: Exploratorium: Science of Baseball – “Baseketball a Physicist Party Trick”

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

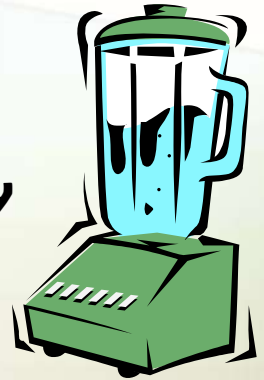


Hairdryer:

electrical energy $\Rightarrow$ mechanical energy, thermal energy, and sound energy



Alarm Clock: electrical energy $\Rightarrow$ light energy and sound energy



Blender:

electrical energy $\Rightarrow$ mechanical 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

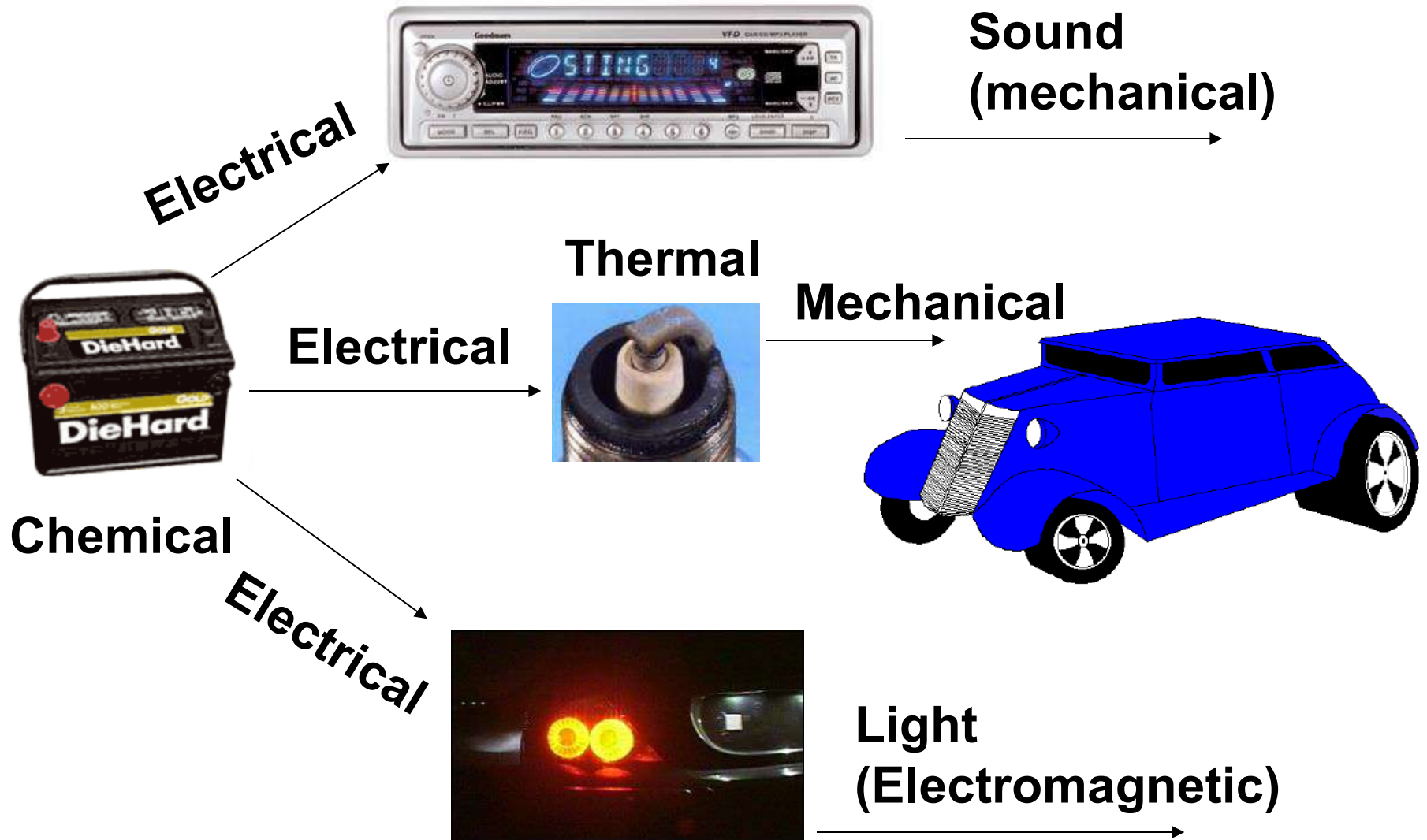


- **A car engine transforms the chemical energy in gasoline into mechanical energy (kinetic and potential energy)**
- **Not all of the chemical energy is converted into mechanical energy. Some is converted into thermal energy, and the engine becomes hot.**
- **The chemical energy in the car battery is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

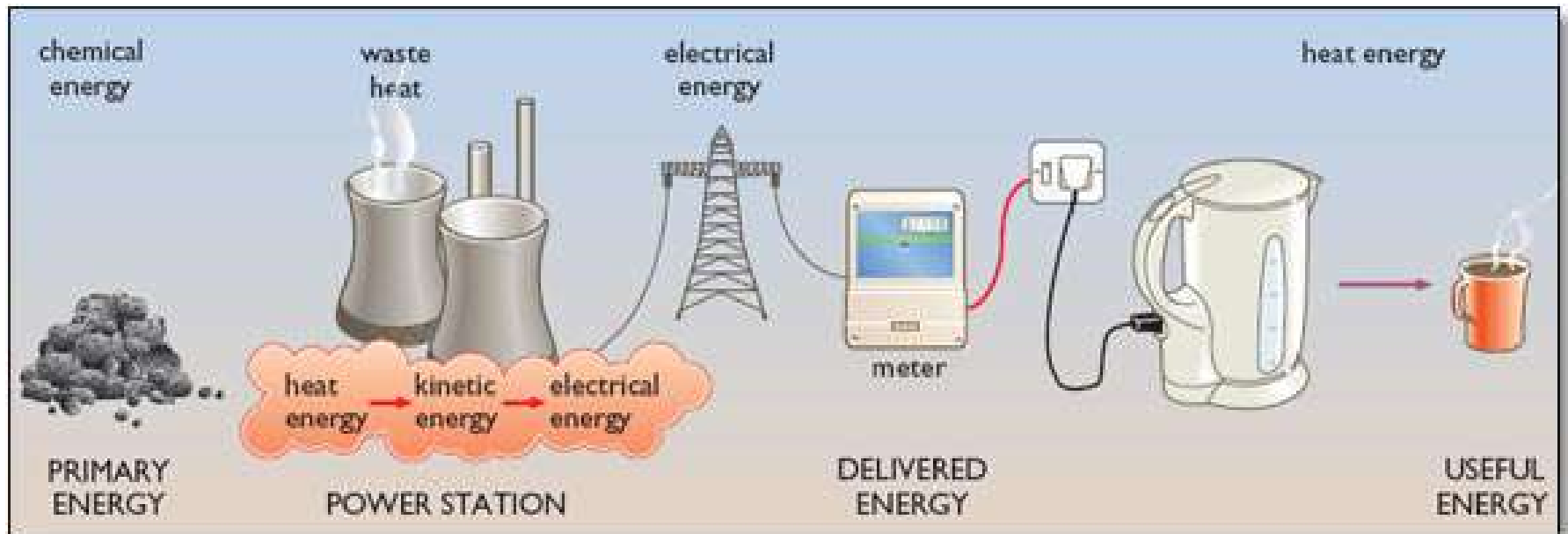
Identify other energy transformations that you can observe in a car.



Energy Transfer



Energy Transformations



BLAM

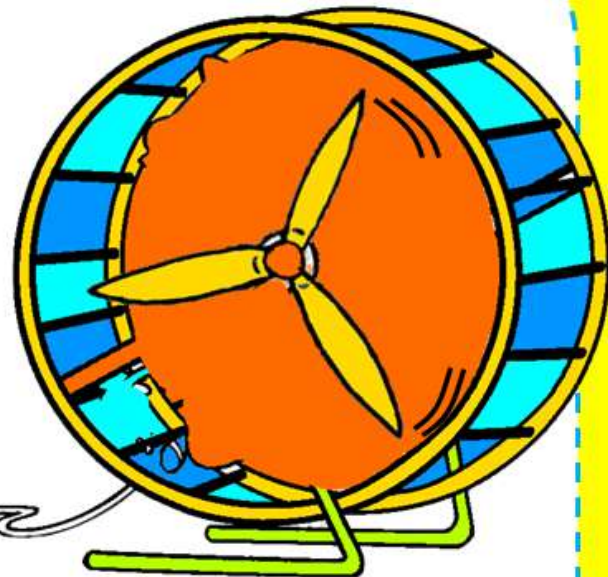
BLAHH

grrrrr
grrrrr

HAAGH!



White House



Isn't it cool.. It
converts sound
waves to
electricity!

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.**

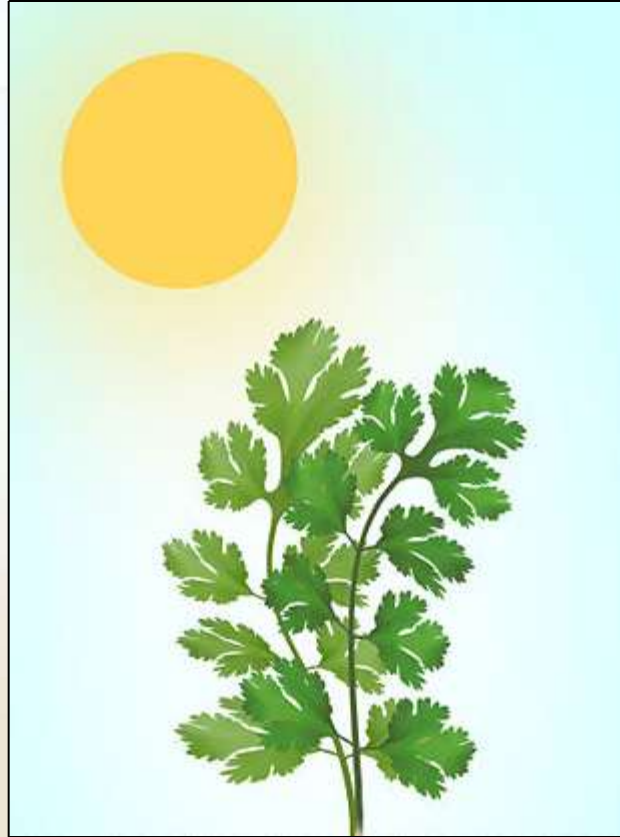
**The following slides will show
an image. Guess the type of
energy transformation that
occurs in the image.**

Identify the Energy Transformation



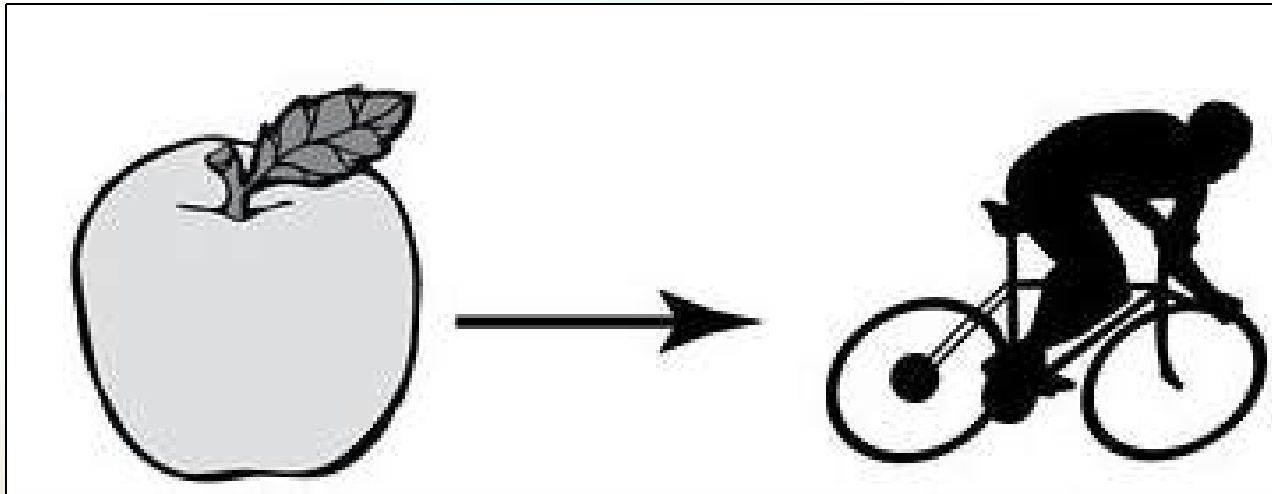
Electrical $\Rightarrow$ Sound

Identify the Energy Transformation



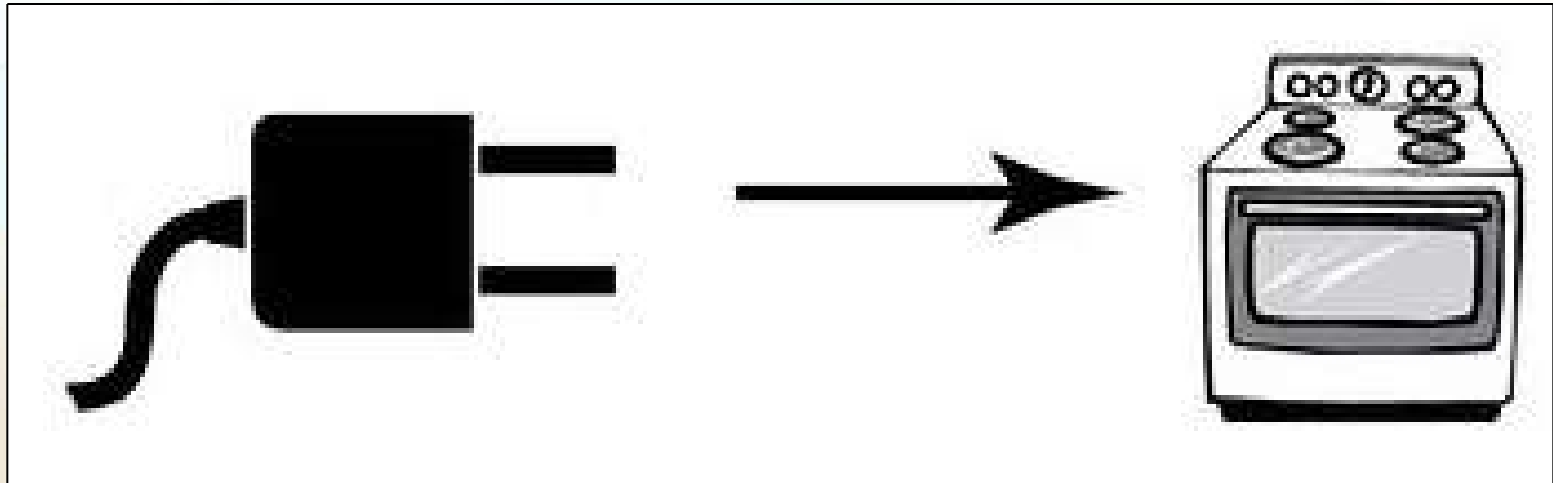
Light $\Rightarrow$ Chemical

Identify the Energy Transformation



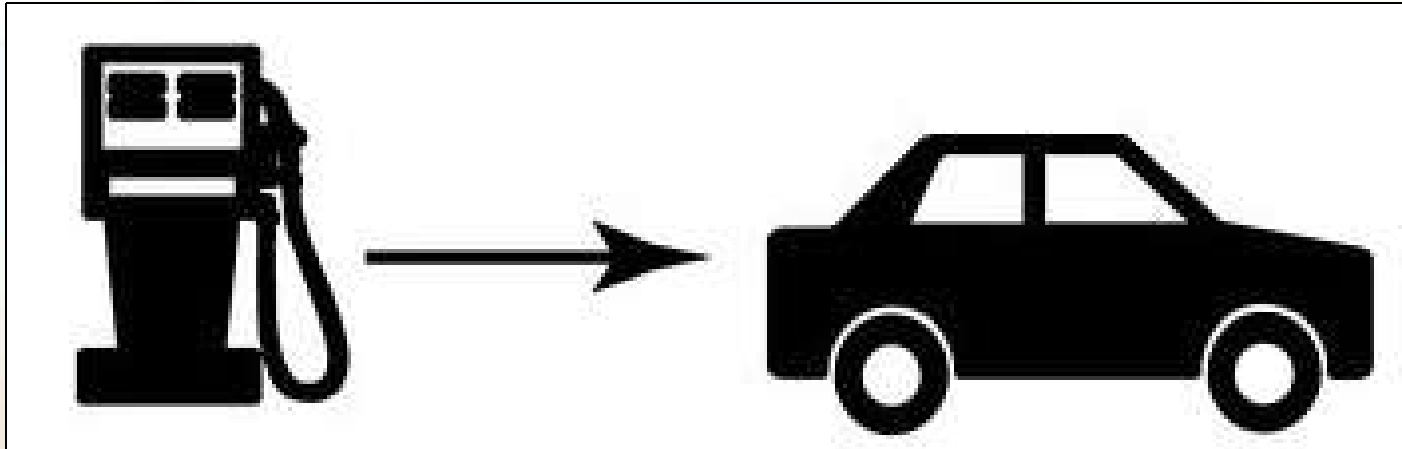
Chemical $\Rightarrow$ Mechanical

Identify the Energy Transformation



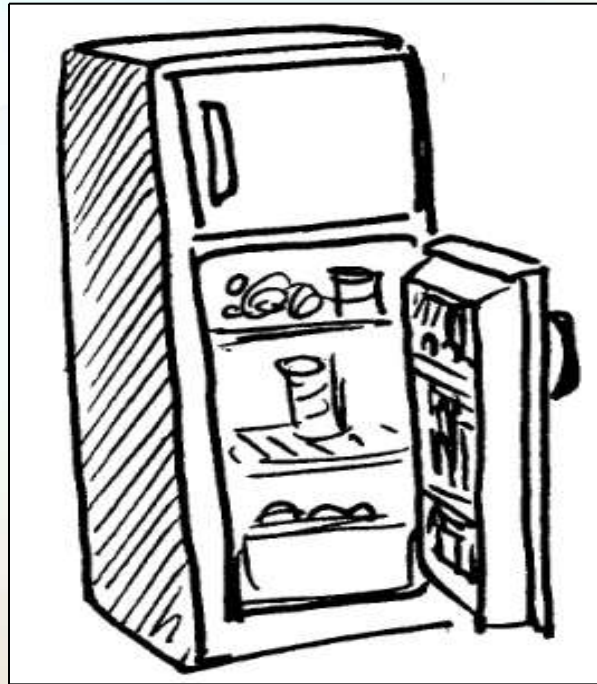
**Electrical $\Rightarrow$ Heat
(Thermal)**

Identify the Energy Transformation



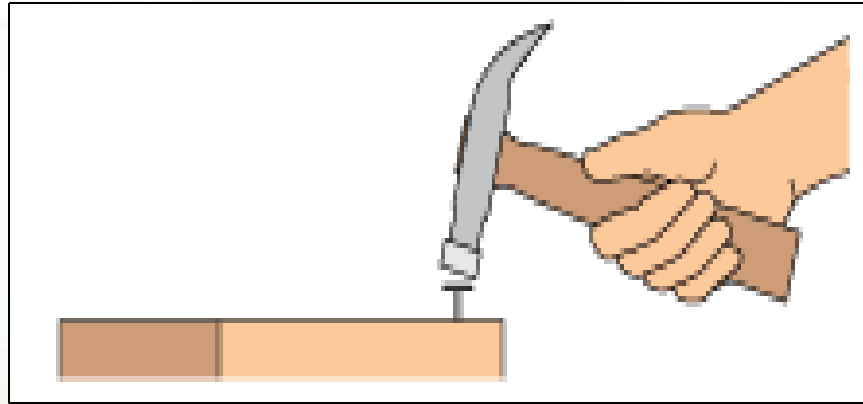
Chemical $\Rightarrow$ Mechanical

Identify the Energy Transformation



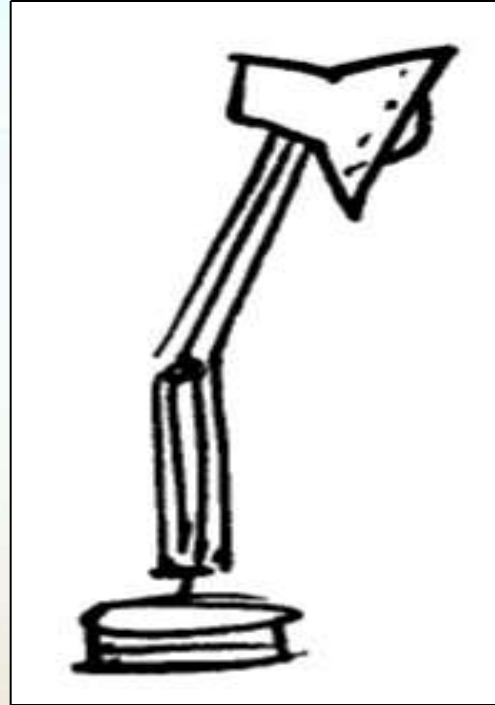
**Electrical $\Rightarrow$ Mechanical
and Heat (Thermal)**

Identify the Energy Transformation



**Mechanical $\Rightarrow$ Heat
(Thermal)**

Identify the Energy Transformation



Electrical $\Rightarrow$ Light and Heat (Thermal)

Identify the Energy Transformation



Chemical $\Rightarrow$ Light and Heat (Thermal)

Identify the Energy Transformation



Light $\Rightarrow$ Electrical and Heat (Thermal)

Identify the Energy Transformation



**Sound $\Rightarrow$ Electrical $\Rightarrow$
Sound**

Activities to Reinforce Energy Transformation

- **Energy Forms and Conversion Worksheet**
- **Energy Transformations [2] Worksheet – see resources for notes**
- **Energy Transformations [3] Worksheet – see resources for notes**
- **Energy Cube Review**
- **How is Energy like Money? Handout**
- **Energy Transformations in a Car constructed response**
- **Station Activities to demonstrate energy transformation**

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

