Essential Question:

How do the different forms of energy compare?

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

Forms of Energy

- Chemical energy
- Nuclear Energy
- Mechanical energy
- Electrical energy
- Electromagnetic (Radiant) energy
- Sound energy
- Thermal energy (Heat)

Mechanical Energy

- The total energy in any object
  It is combined potential energy + kinetic energy
- Mechanical energy can be all potential energy, all kinetic energy, or some of each.
- Ex: anything in motion

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

Electrical Energy

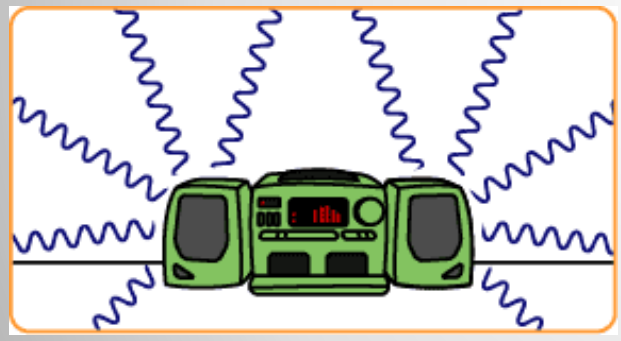
- Energy that is caused by movement of electrons. Carried by an electrical current
- A battery creates electrical energy by releasing it's stored chemical energy
- Ex: any object with a plug, wiring, or circuit board uses electrical energy

Electromagnetic Energy (Visible Light)

- Energy created by the movement of electrically charged particles.
- Light is a wave that can move through space.
- Examples: light bulb, computer screen

Sound Energy

- Sound energy is caused by vibrations of air.
- Sound cannot exist in space, it must have a medium to vibrate through.



Sound Energy

- Both potential and kinetic
- When you pull back a guitar string, you give the string the potential to make a sound.
- Examples: radio, vocal cords, guitar string

Thermal (Heat) Energy

- Energy that is created in the movement of particles (atoms) that produces heat.
- Heat moves from warmer to cooler objects
- The faster the particles (atoms) move, the greater the kinetic energy and the greater the object's thermal energy. The opposite is also true.
- Heat is a byproduct
- Ex: heater, stove, light bulb

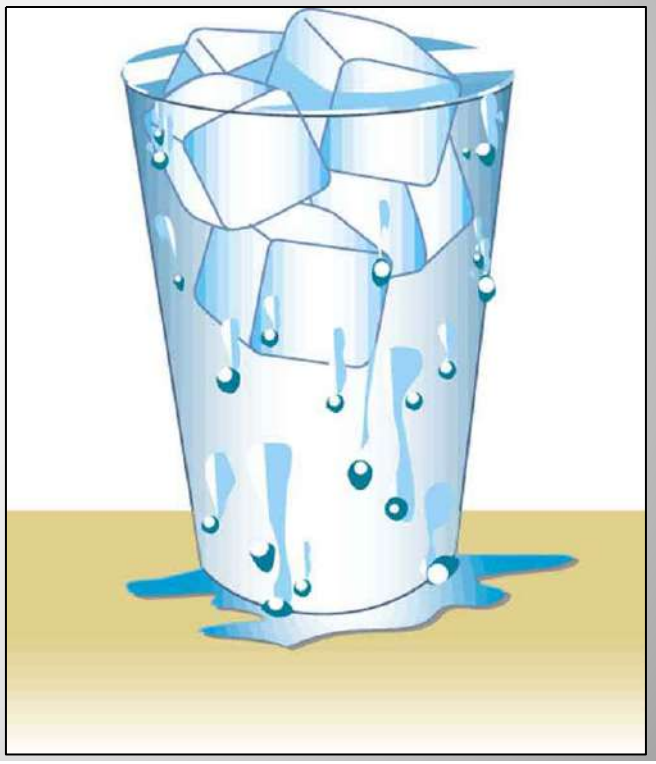
Heat (Thermal) Energy

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)

Which has more thermal energy? Why?

Hot Chocolate



Ice Water

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

- Stored in the nucleus of atoms.
- Two ways to release nuclear energy
- Fission: split atom (nuclear power plant)
- Fusion: joining atoms (hydrogen in the sun)

- Examples: sun, nuclear bomb

What type of energy cooks food in a microwave oven?

Electromagnetic (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

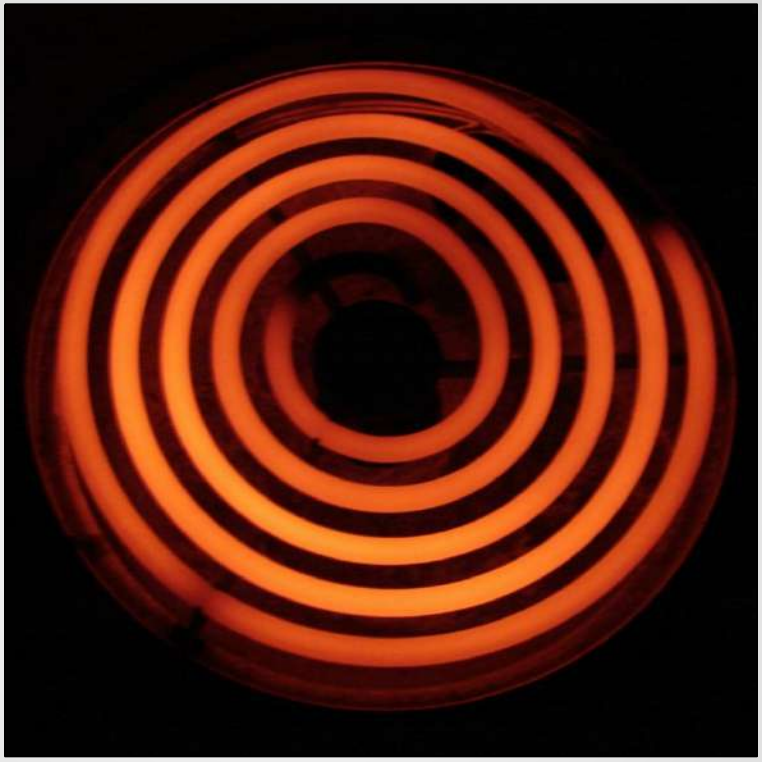
What type of energy is shown below?

Chemical Energy

What types of energy are shown below?

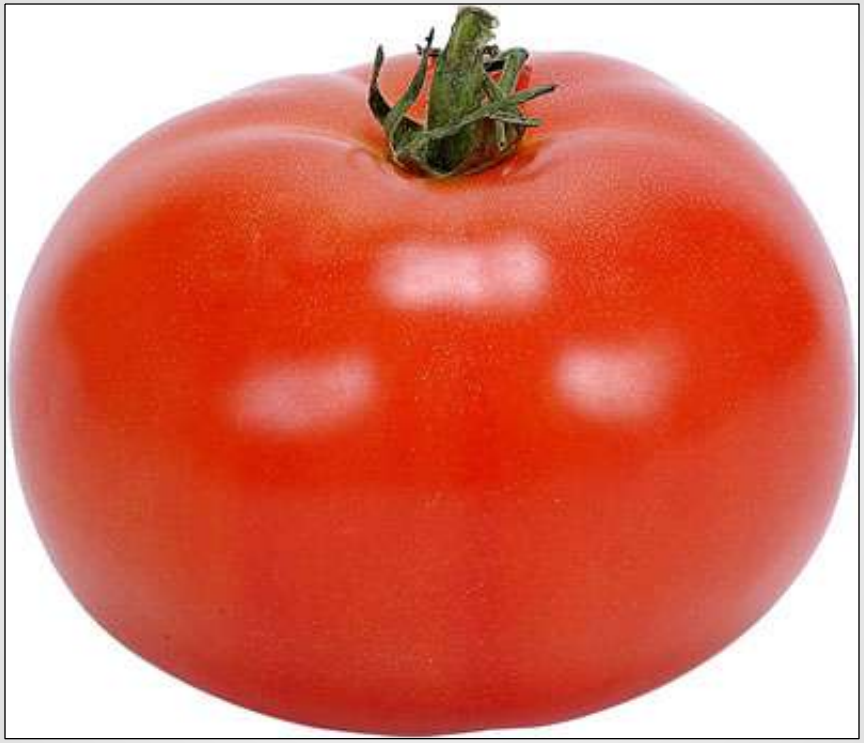
Chemical, Mechanical and Radiant Energy

What type of energy is shown below?



Thermal Energy

What type of energy is shown below?



Chemical Energy

What types of energy are shown below?

Mechanical and Thermal Energy
(Friction causes thermal energy)

Energy is transforming continually between one form and another.

According to the Law of Conservation of Energy, energy is never created or destroyed, it only 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

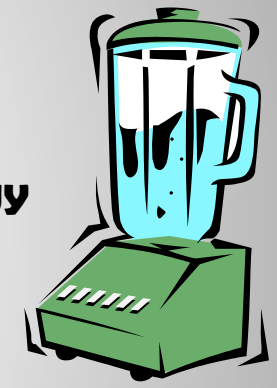
- **Plants use light (radiant) energy to make chemical energy. [remember Photosynthesis]**
- **The chemical energy in food is then changed into another kind of chemical energy that your body can use. [remember cellular respiration]**
- **Your body then uses that energy to give you mechanical energy [kinetic 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

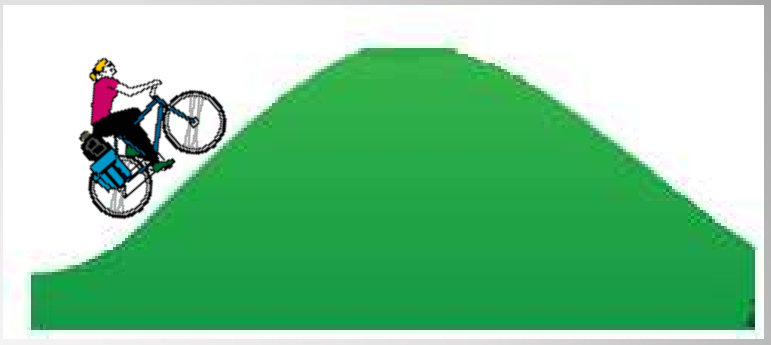
Hairdryer:
electrical energy ⇨ mechanical energy, thermal energy, and sound energy

Blender:
electrical energy ⇨ mechanical energy and sound energy



Alarm Clock: electrical energy ⇨ light energy and sound energy

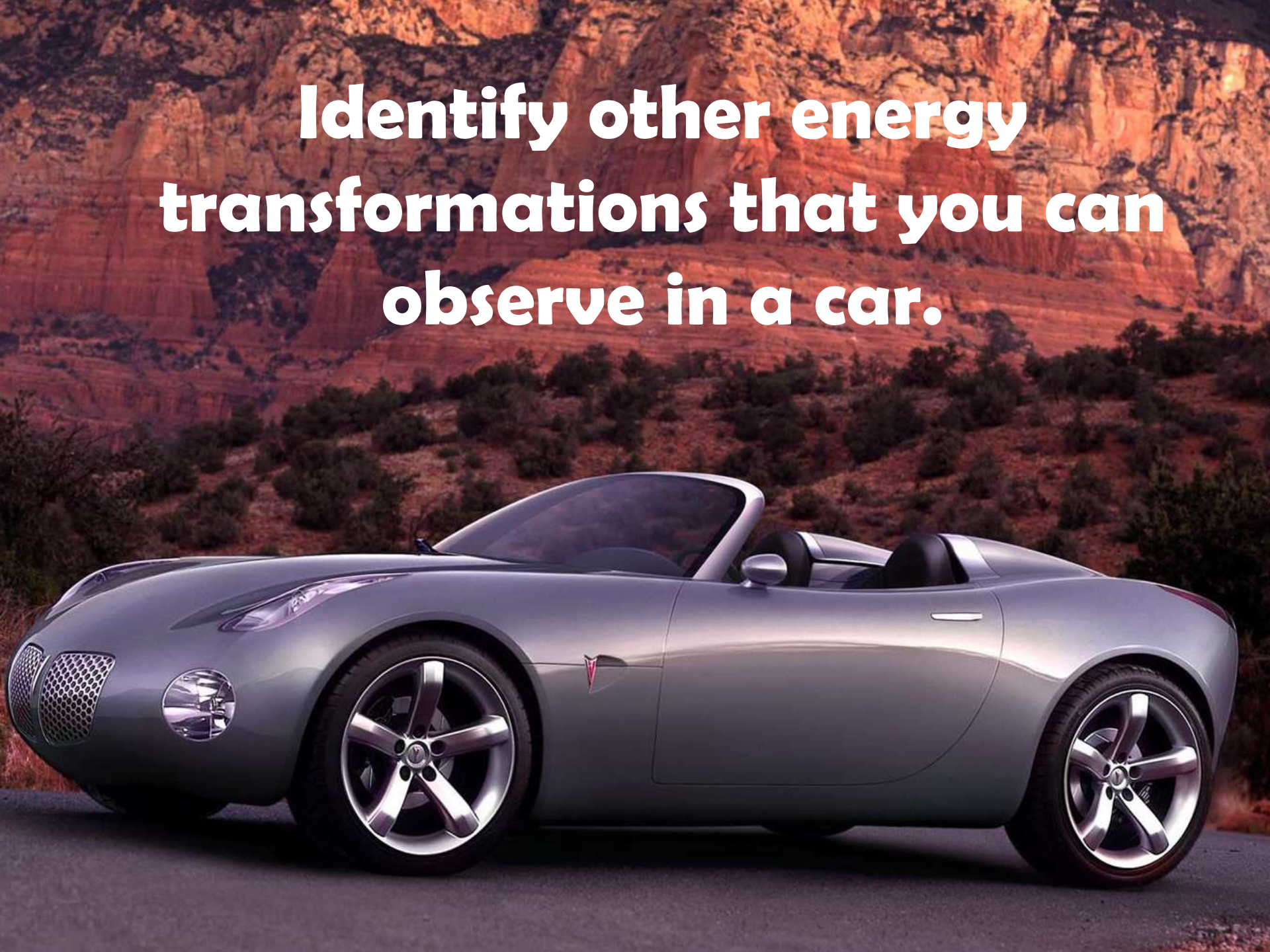
Let's examine the Energy Transformation in riding a bike.



- 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 Tr

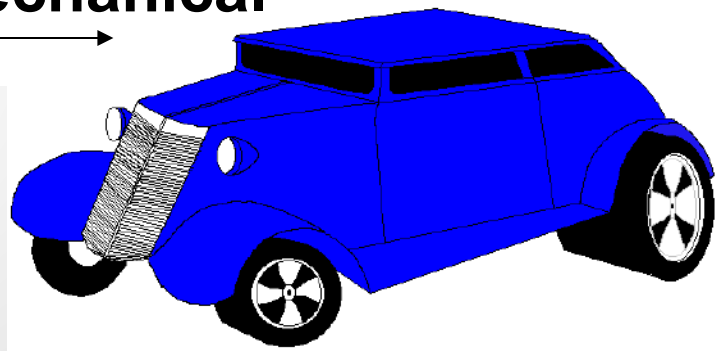
Electrical

Sound
(mechanical)

Thermal

Electrical

Mechanical

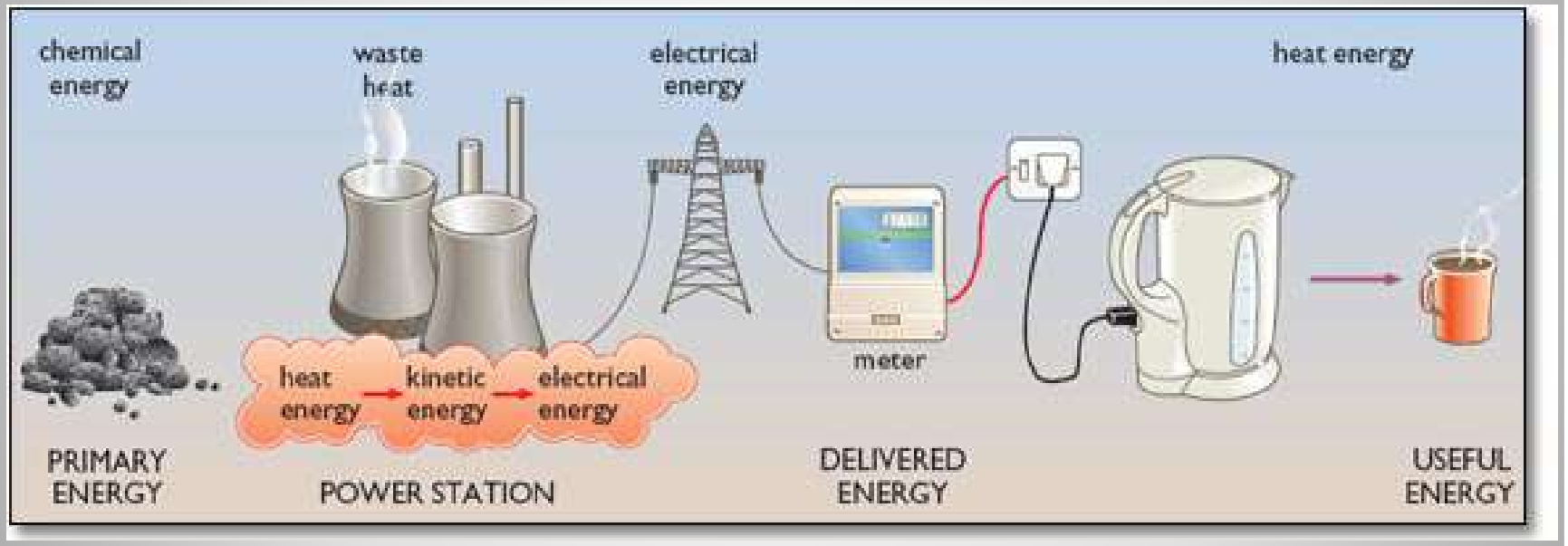


Chemical

Electrical

Light
(Electromagnetic)

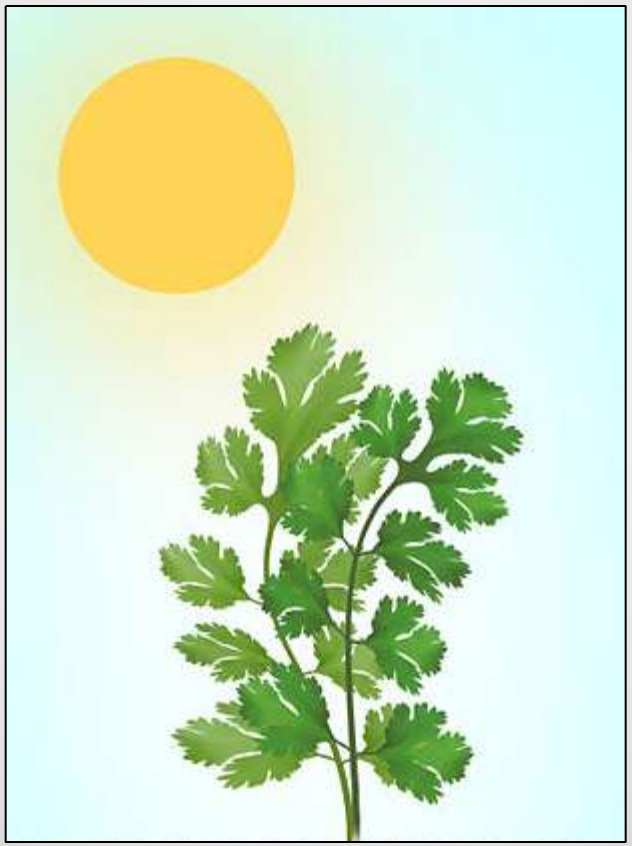
Energy Transformations



Identify the Energy Transformation

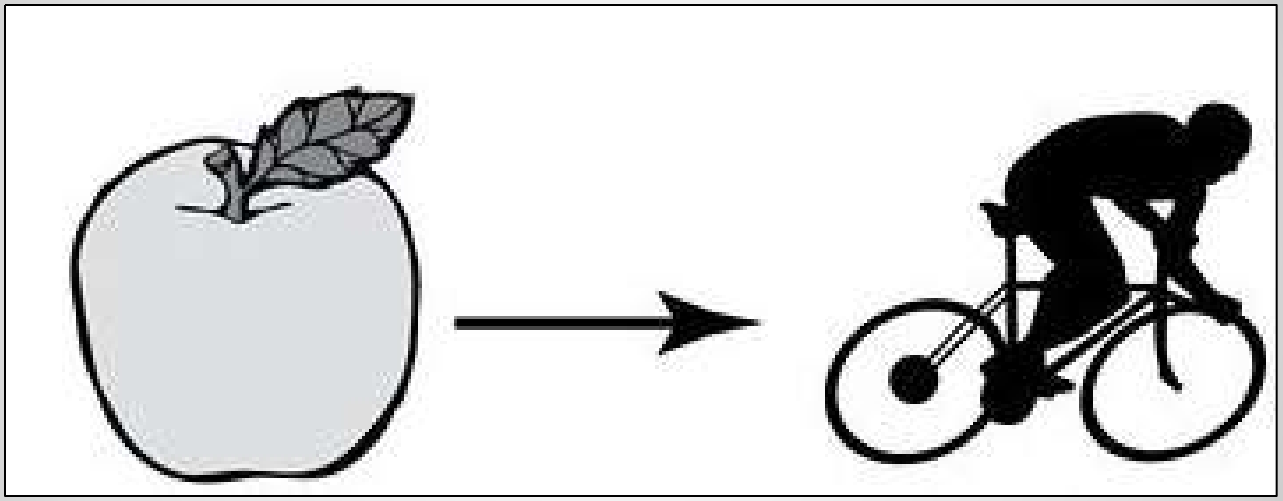
Electrical ⇨ Sound

Identify the Energy Transformation



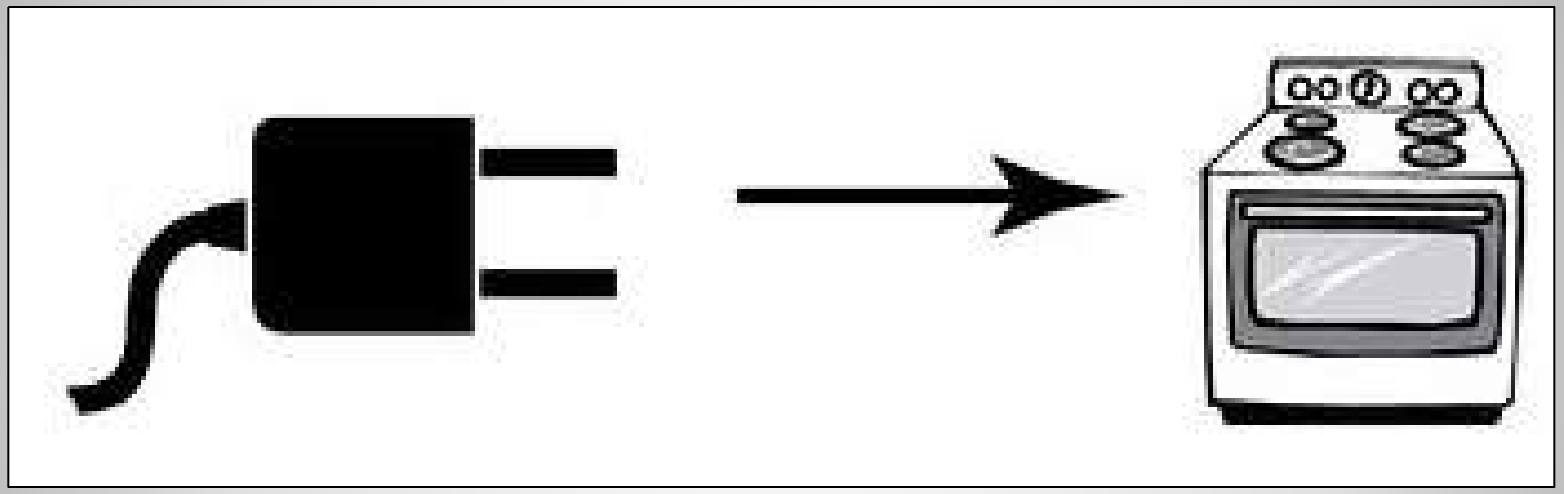
Light ⇨ Chemical

Identify the Energy Transformation



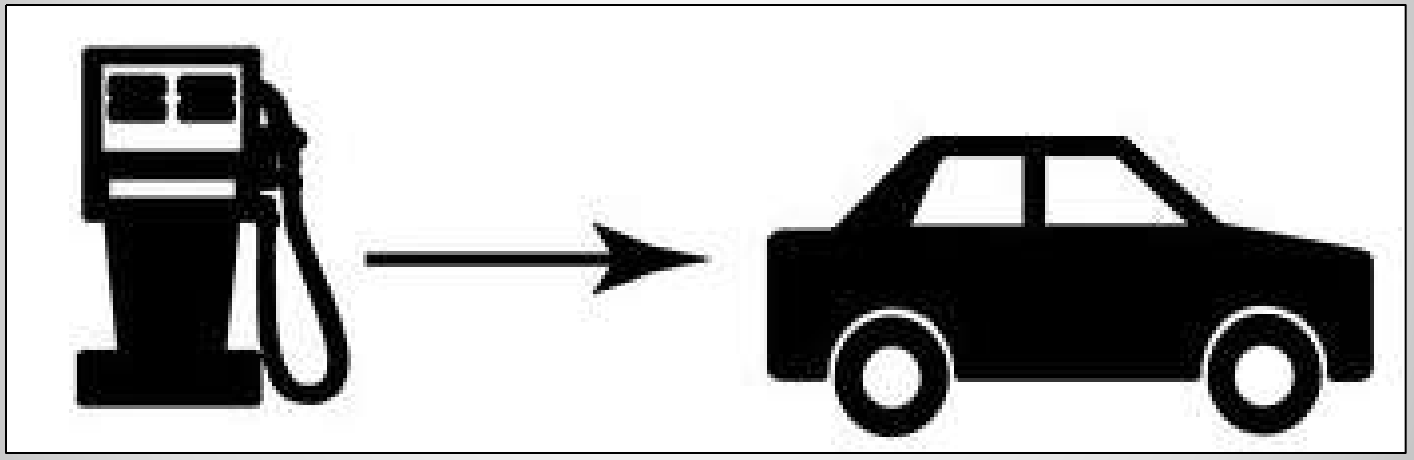
Chemical ⇨ Mechanical

Identify the Energy Transformation



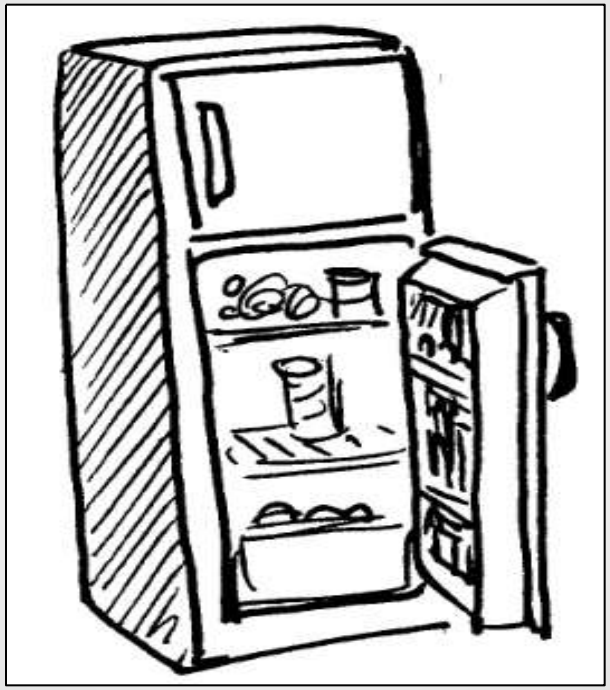
Electrical ⇨ Heat (Thermal)

Identify the Energy Transformation



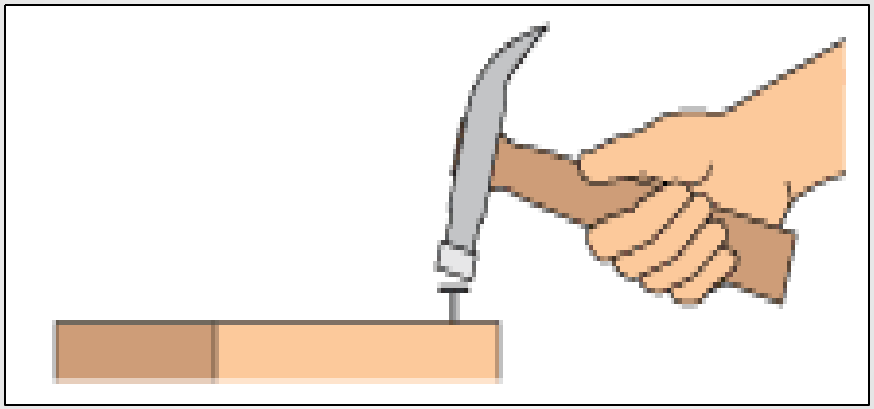
Chemical ⇨ Mechanical

Identify the Energy Transformation



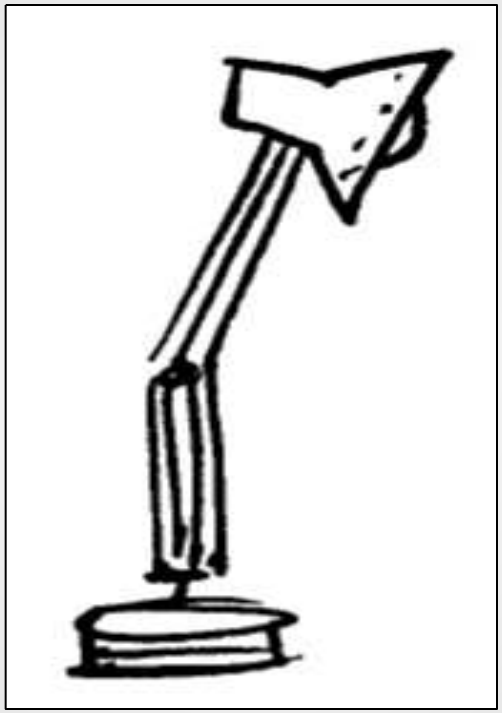
Electrical ⇨Mechanical and Heat (Thermal)

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