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# Chapter 4.1: Forms of Energy



# Energy



- ▶ Energy **exists** in many forms.
- ▶ Energy **can** be changed from one form to another.
- ▶ Energy **cannot** be created or destroyed.



What is Always Present  
But Never Visible?

# ENERGY

Although energy isn't visible,  
you can detect evidence of energy.

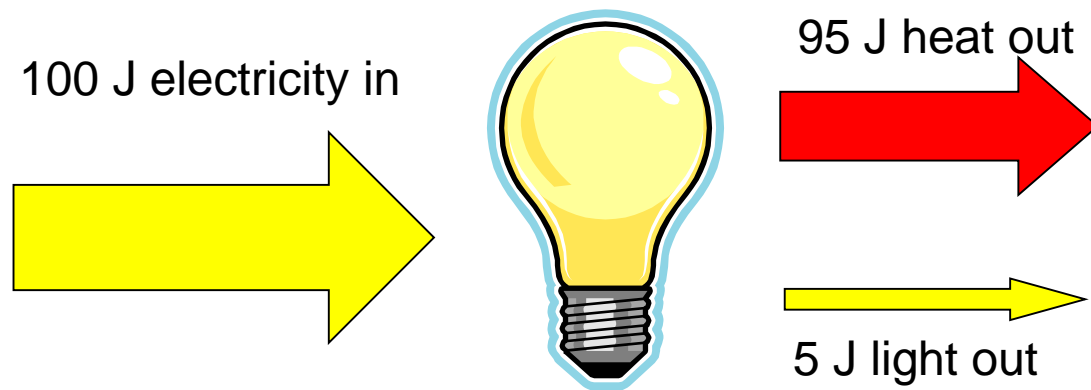


# Law of Conservation of Energy

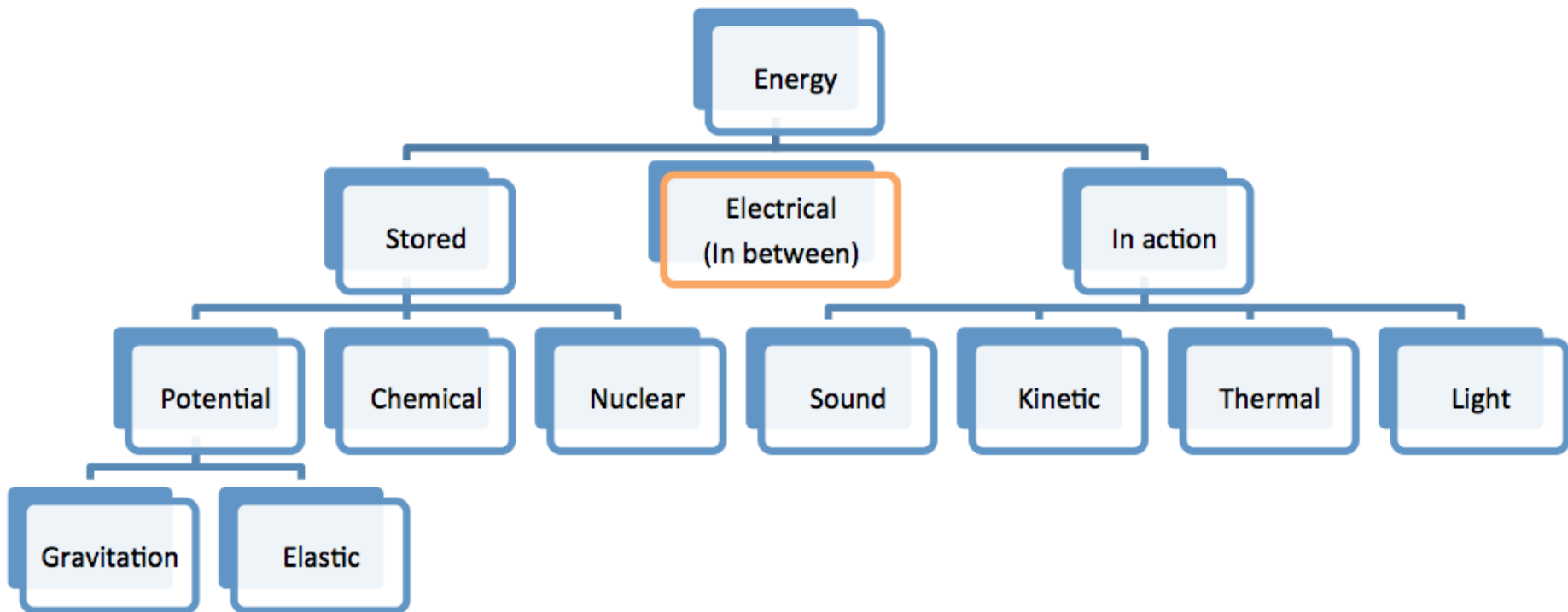
- ▶ **Energy can neither be created nor destroyed, but can be converted from one form to another.**

# Law of Conservation of Energy

With every transformation, some energy is converted to less useful forms. Energy conversions are not 100% efficient. The energy output for the intended purpose is rarely the same as the energy we put in.



# Different Forms of Energy



# Eight Forms of Energy

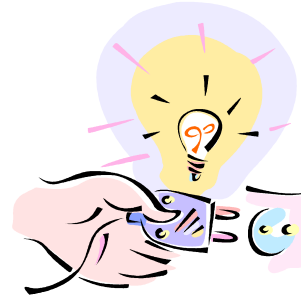
Kinetic



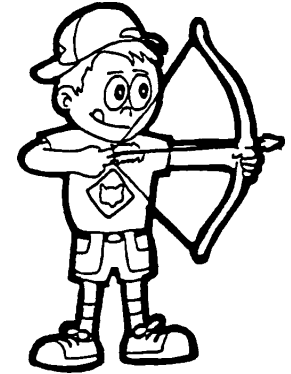
Chemical



Electrical



Potential



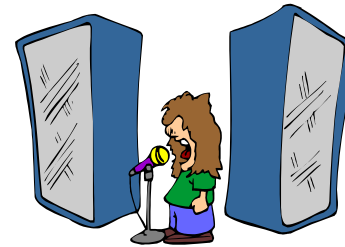
Heat/Thermal



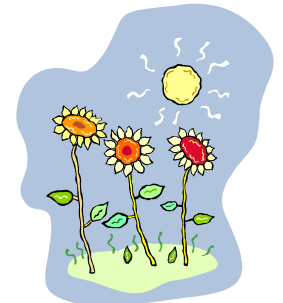
Nuclear



Sound

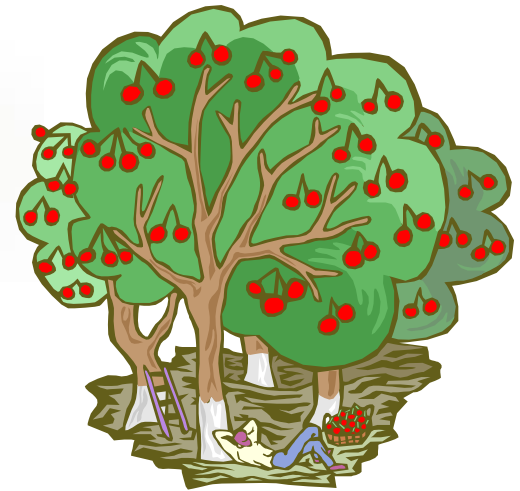


Light/Radiant



# Potential Energy

This is also known as stored energy.

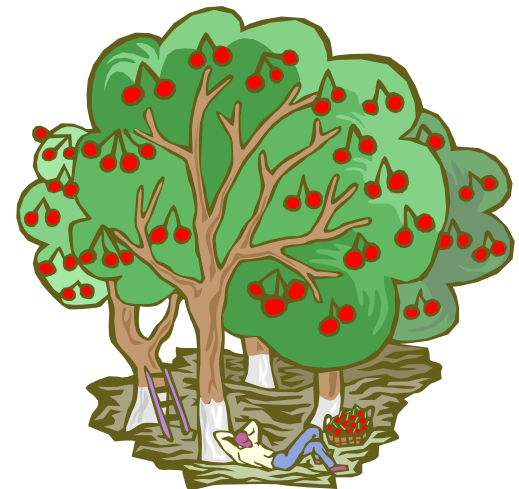
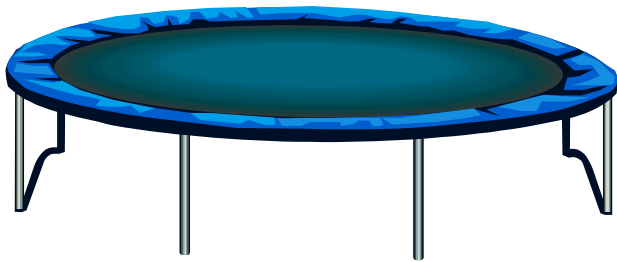




# Potential Energy

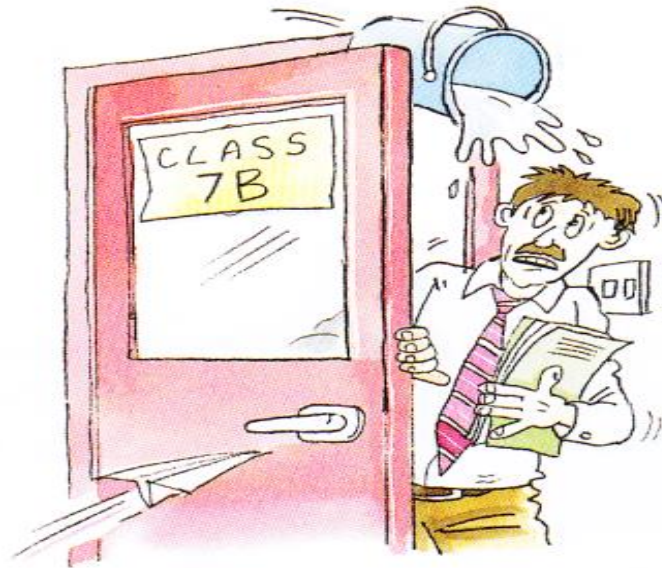
There are 2 types of potential energy:


- 1) Gravitational Potential Energy
- 2) Elastic Potential Energy



# 1) Gravitational Potential Energy

- ▶ Look at the picture below. What will happen to the professor

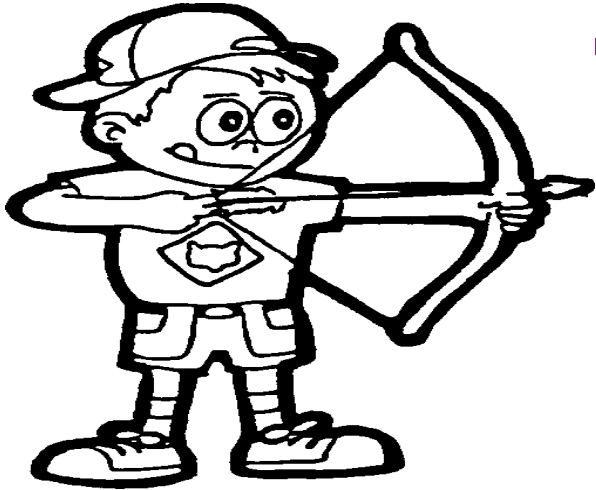


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- ▶ The bucket will fall on the professor. This is called **Gravitational Potential Energy**.

Where did the energy come from?

- ▶ There was energy in the bucket of water because it was **lifted high up**. The bucket of water falls because **GRAVITY** pulls it down

## 2) Elastic Potential Energy



- ▶ The energy for the arrow to move came from the stretched bowstring. When the bowstring above was pulled and stretched, tension was created. Energy was present in the stretched bowstring.

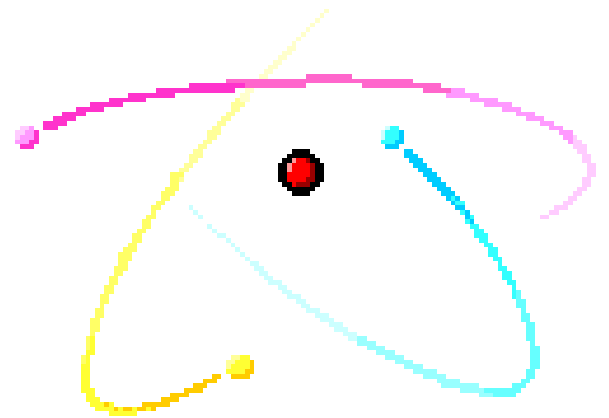
# Chemical Energy

- ▶ Energy released by a chemical reaction
- ▶ The food you eat contains chemical energy that is released when you digest your meal
- ▶ Wood, coal, gasoline, and natural gas are fuels that contain chemical energy



# Nuclear Energy

- ▶ Energy contained in the nucleus of an atom
- ▶ Nuclear energy is released when nuclei are split apart into several pieces, or when they are combined to form a single, larger nucleus



# Electrical Energy



► Energy can be carried by electricity. When a lamp is switched on it gives off light energy. The **electricity** is **transferring** energy to the lamp.

- The same thing happens with all the electric appliances. We call energy transferred by electricity **ELECTRICAL ENERGY**.
- Lightning and static electricity are also forms of electrical energy

# Heat (Thermal) Energy

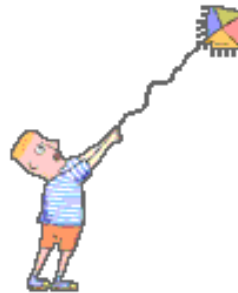
- ▶ Energy created by the motion of atoms and molecules that occurs within an object
- ▶ Thermal energy exists when you heat a pot of water on a stove





# Kinetic Energy

Energy of a moving object



# Light (Radiant) Energy



- ▶ Energy that can move through empty space
- ▶ The sun and stars are powerful sources of radiant energy
- ▶ The light given off by light bulbs and campfires are also forms of radiant energy

What type of energy is being represented?



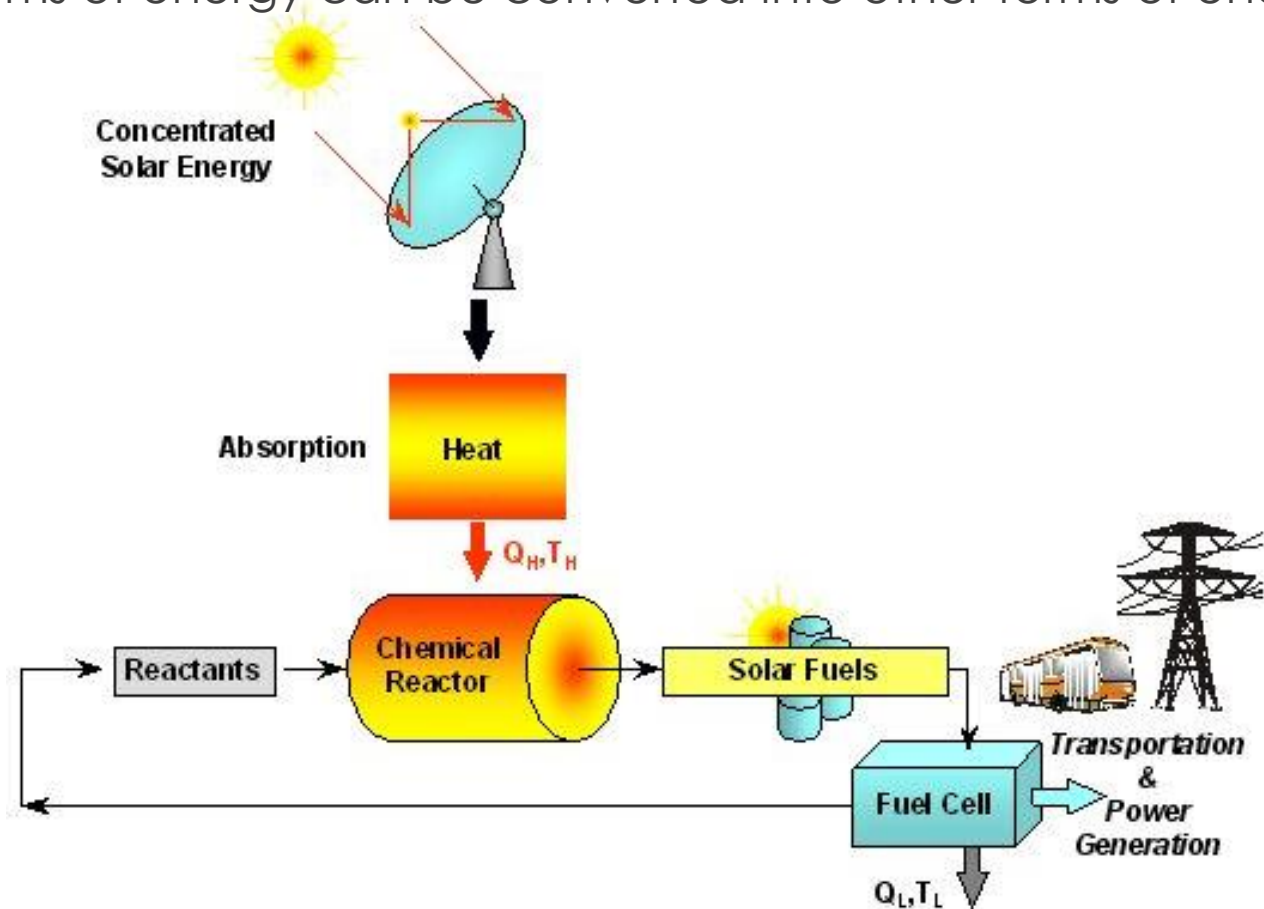


# Who would need more energy? Why?

- ▶ Manual worker vs. Office worker
- ▶ Boy vs. Girl
- ▶ Man vs. Woman
- ▶ Boy vs. Man
- ▶ Girl vs. Woman
- ▶ Footballer vs. Accountant
- ▶ Baby vs. Girl/Boy
- ▶ Woman/Man vs. Old woman/man

# Energy Conversion

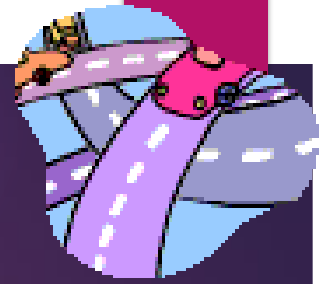
All forms of energy can be converted into other forms of energy







# Energy Forms



- ▶ These forms of energy do work that end up as motion, light, or heat.
- ▶ Energy is used to power manufacturing, light buildings, propel vehicles, and communicate messages.

What else do we use energy for?

# Transferring Energy

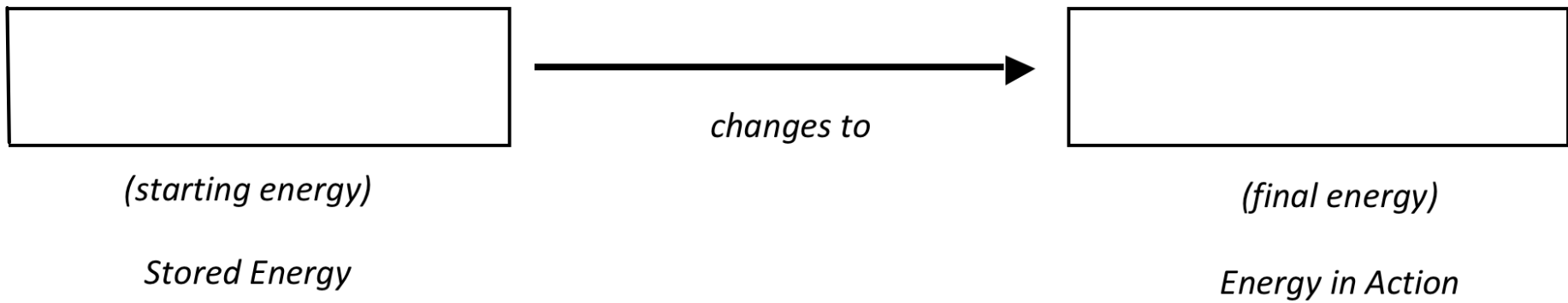


- ▶ Look at the picture on the left. The picture shows a burning fire.
- ▶ What two types of energy is the fire giving off?
- ▶ Where did the energy come from?



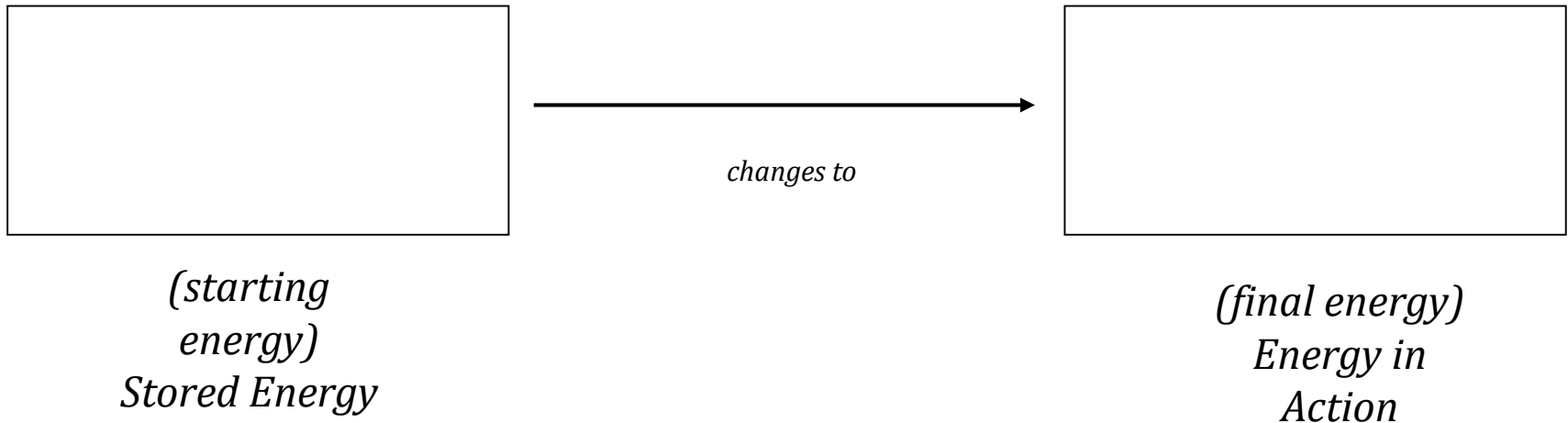


- ▶ In this case, we say that the energy was changed from chemical energy to thermal and light energy. We say that energy was **TRANSFERRED**. This can be shown as an energy transfer diagram



# Think of a light bulb

The electrical energy changes to light energy. This can be written as follows:



Match each of these to the type of energy that it contains

A mug of coffee

A piece of coal

A squashed spring

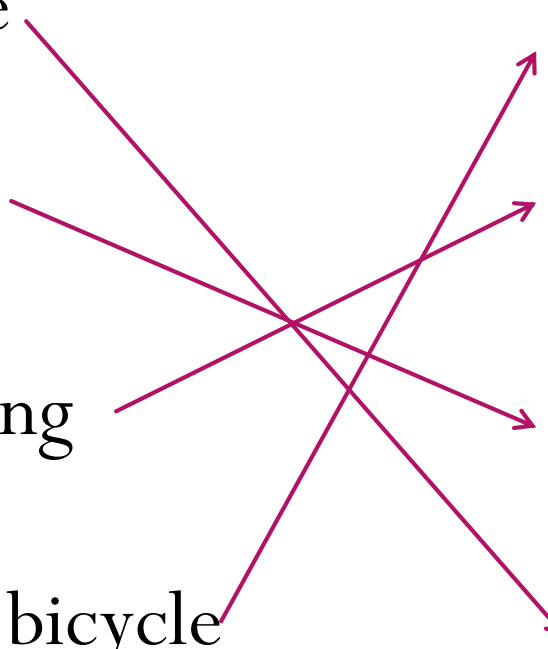
A freewheeling bicycle

Kinetic energy

Elastic energy

Chemical energy

Heat energy



# Heat as waste

- ▶ Whenever energy is transferred from ONE FORM to another, only part of the INPUT energy is usefully transferred as OUTPUT energy in the form that is wanted.
- ▶ The remainder is transferred in some non-useful way and is therefore WASTED ENERGY.
- ▶ In most cases the wasted energy is usually heat and so most energy chains end with heat.

What are the main energy transfers for a television?

electrical



light

sound

heat

What are the main energy transfers for a car engine?

chemical



kinetic

sound

heat

What are the main energy transfers for a radio?

electrical



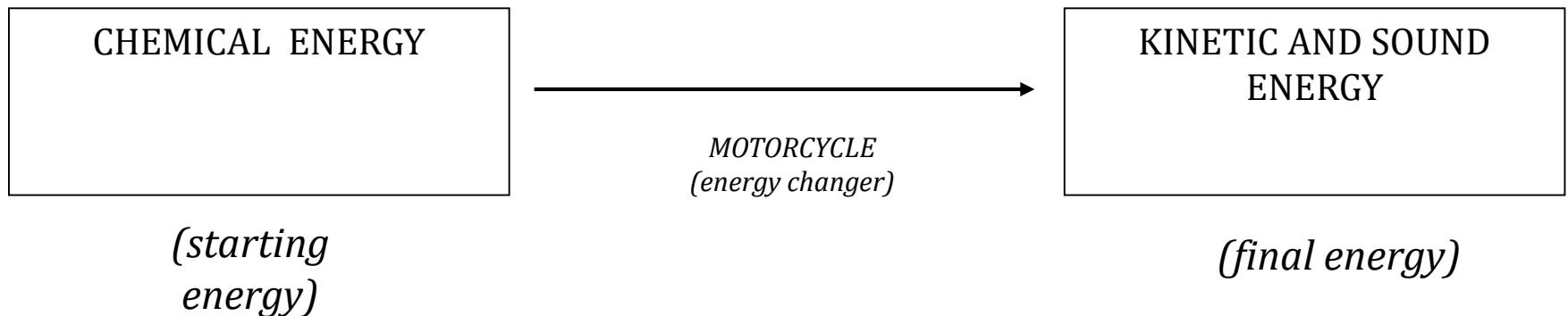
sound

heat

# Energy Changers



- ▶ For example: A **motor cycle** is an energy changer because it changes **chemical energy** (stored energy) to **kinetic and sound energy** (energy in action). This can be written down as follows:





# Energy Transfer Values

Electrical energy  
100%



Kinetic energy  
58%  
(Useful

spinning of  
the drill bit)

Kinetic energy  
22%

(Wasted  
vibration of  
the drill)

Heat energy  
20%



A microphone changes \_\_\_\_\_ energy  
to \_\_\_\_\_ energy.



A photosynthesizing plant changes \_\_\_\_\_  
energy to \_\_\_\_\_ energy.



A climber climbing changes \_\_\_\_\_  
energy to \_\_\_\_\_  
energy and \_\_\_\_\_ energy.



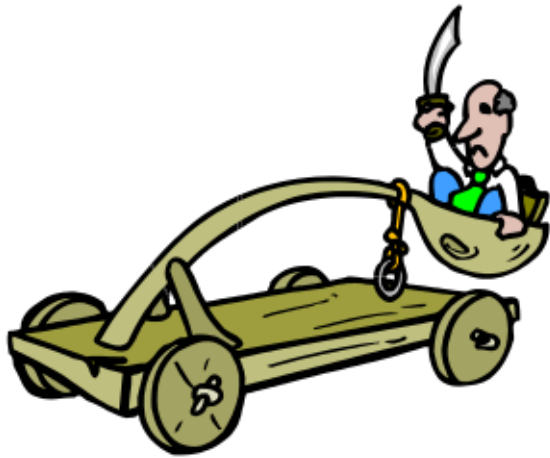
A skydiver falling changes \_\_\_\_\_  
\_\_\_\_\_ to \_\_\_\_\_ energy



A hair dryer changes \_\_\_\_\_ energy  
to \_\_\_\_\_ energy, \_\_\_\_\_ energy  
and \_\_\_\_\_ energy



A burning candle changes \_\_\_\_\_  
energy to \_\_\_\_\_ energy and \_\_\_\_\_  
energy.



When a catapult is released it changes \_\_\_\_\_ energy to \_\_\_\_\_ energy and \_\_\_\_\_ energy.



The Sun changes \_\_\_\_\_ energy to \_\_\_\_\_ energy and \_\_\_\_\_ energy.






A quacking duck changes \_\_\_\_\_ to  
\_\_\_\_\_ energy and \_\_\_\_\_  
energy.

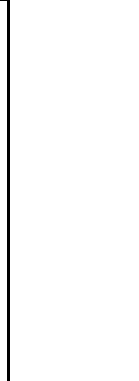
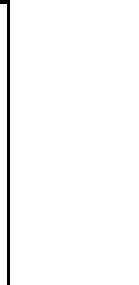
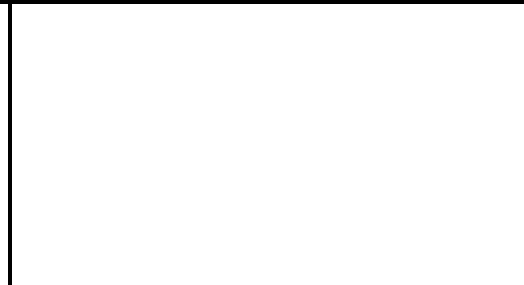
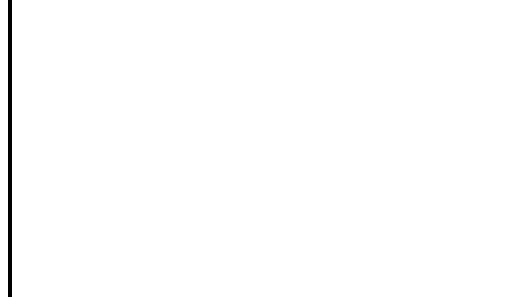
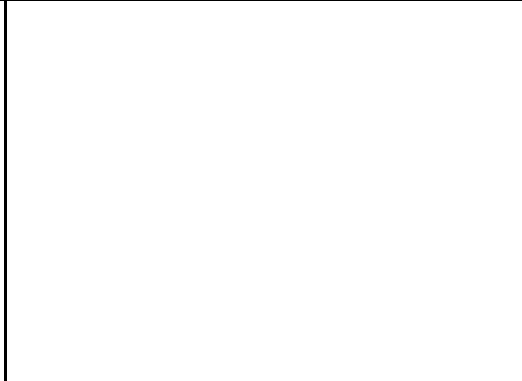
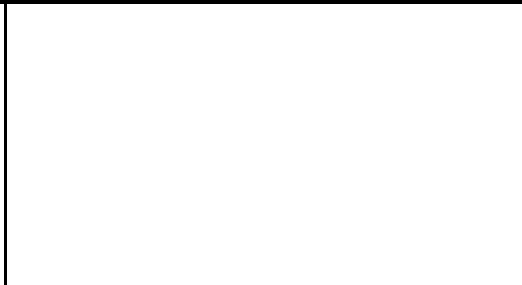
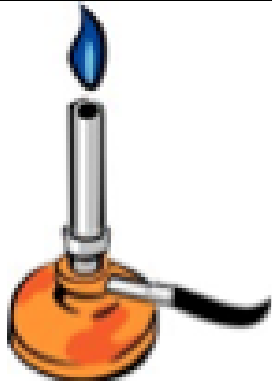


A springboard changes \_\_\_\_\_  
energy to \_\_\_\_\_  
energy and \_\_\_\_\_ energy.

## What is the energy transfer for each?



What is happening	Starting Energy	Finishing Energy
		
		
		





## How is electricity produced?

Electricity is **generated** in power stations. Power stations need an energy resource, such as fossil fuels, nuclear fuels, or a **renewable resource**.

