

# CHAPTER 15: ENERGY

## KINETIC & POTENTIAL ENERGY

QOD: What is the difference between potential and kinetic energy?

- **energy – the ability to do work**

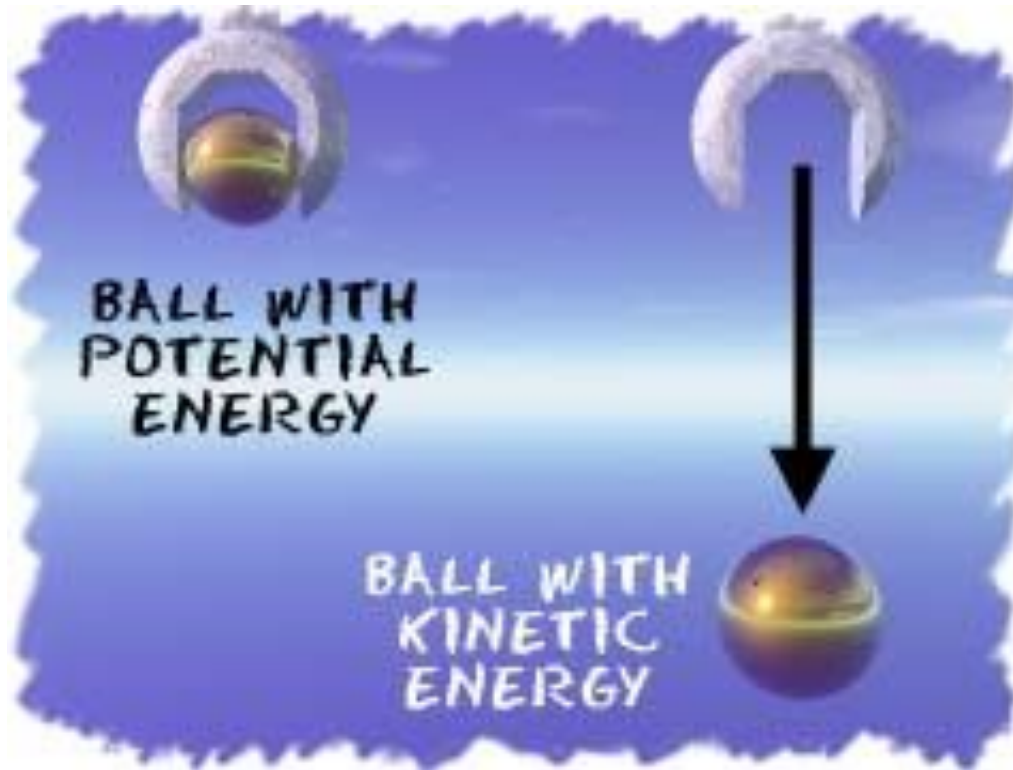
- energy is transferred by a force moving an object through a distance
- when work is done on an object, energy is transferred to that object

Example:

**Pushing a box across a table**

- kinetic energy –
- the energy of motion
- kinetic energy of any moving object
- depends upon its mass and speed

- kinetic energy – EXAMPLE
- **Ball falling from a table**



# Gravitational Potential Energy

- potential energy that depends on an object's height, mass, and acceleration due to gravity

# Gravitational Potential Energy

- Example:
  - Bike at the top of a hill

# Elastic Potential Energy

- the potential energy of an object that is stretched or compressed

Example: compressed spring

- Sound Potential Energy –
- ability for an object to produce sound after an object's motion

Example:

Vibration of a speaker



- Electromagnetic Potential Energy –
- ability for electromagnetic waves to radiate energy in space

Example:

Food warming up in a microwave

- Thermal Potential Energy –
- ability for an object to produce heat

Example:

Tires on a car

- Chemical Potential Energy –
- energy stored in the chemical bonds of a substance

Example:

Car engine

# Calculations of KE

- to calculate the kinetic energy of an object

$$\text{KE} = \frac{1}{2}mv^2$$

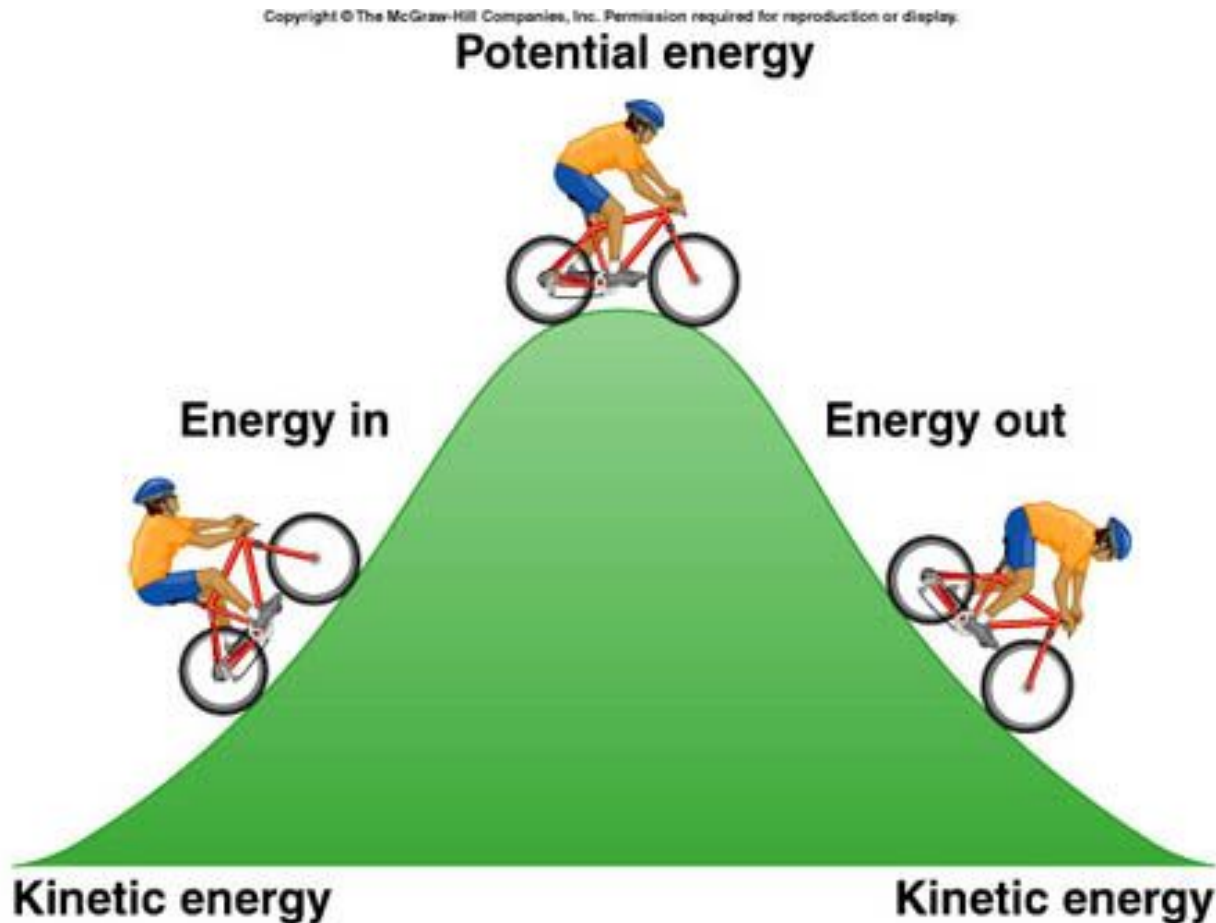
- Measured joules ( $\text{kg} \cdot \text{m}^2/\text{s}^2$ )

- What is the kinetic energy of a 0.1 kilogram toy truck moving at a speed of 1.1 meters per second?
- $KE = 1/2mv^2$

- Which runner has the greater kinetic energy: a 46 kilogram runner moving at a speed of 8 meters per second or a 92 kilogram runner moving at a speed of 4 meters per second?
- $KE = 1/2mv^2$

# Potential Energy

- energy stored as a result of position or shape



- A book on a shelf 2.0 meters above the floor has a mass of 1.5 kilograms. What is the gravitational potential energy of the book?
- $PE = mgh$



- Find the mass of a ball on a roof 30 meters high if the ball's gravitational potential energy is 58.8 joules.
- $PE = mgh$

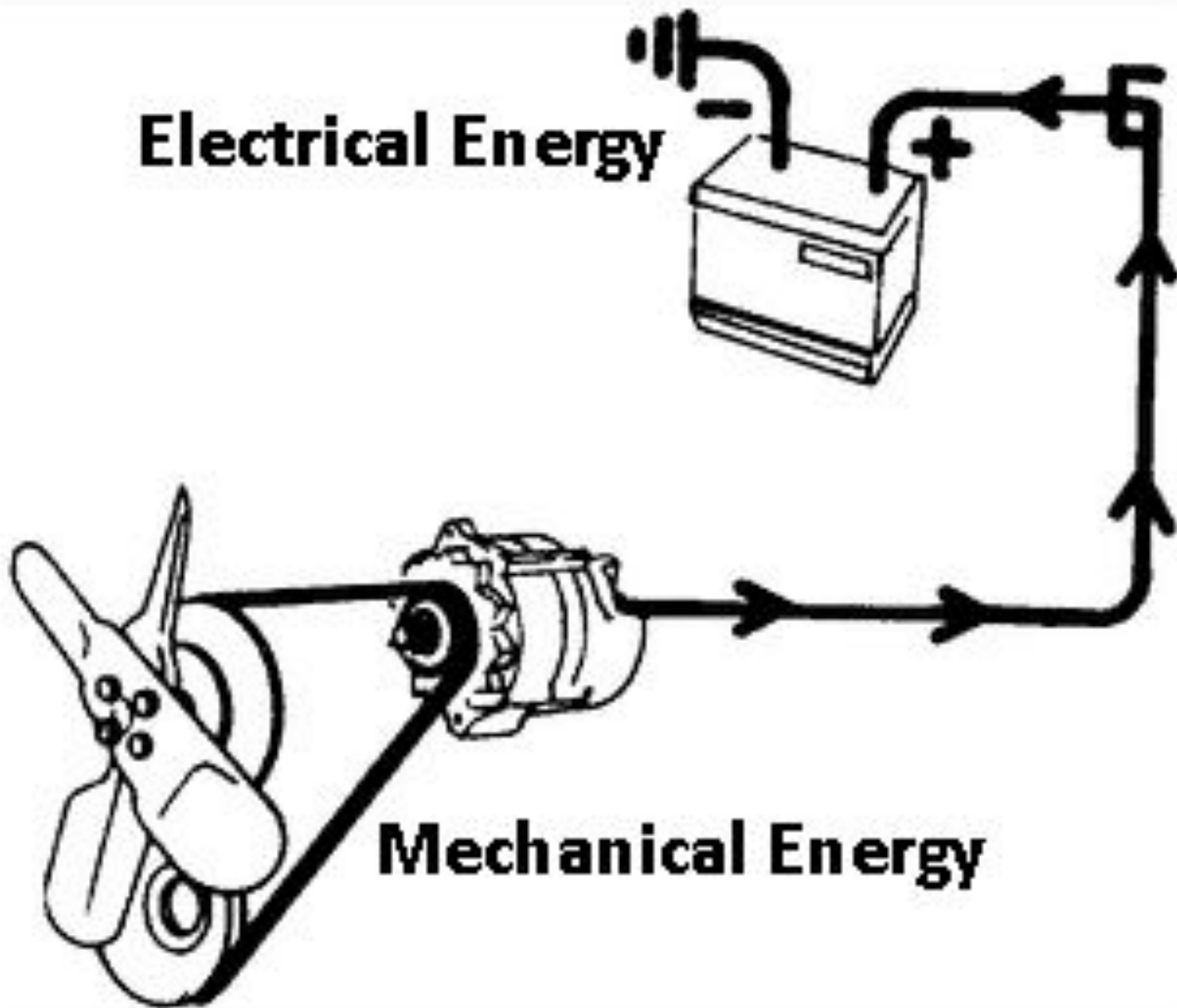
# SIX MAJOR FORMS OF ENERGY

QOD: What is an example of converting energy from one form to another that relates to you life?

- there are six major forms of energy:
  - mechanical
  - electrical
  - thermal
  - chemical
  - nuclear
  - electromagnetic
- each form can be converted into other forms of energy

- **mechanical energy** – the energy associated with the motion and position of everyday objects
- **electrical energy** – the energy associated with electrical charges
- electrical energy can exert forces that do work

**Electrical Energy**

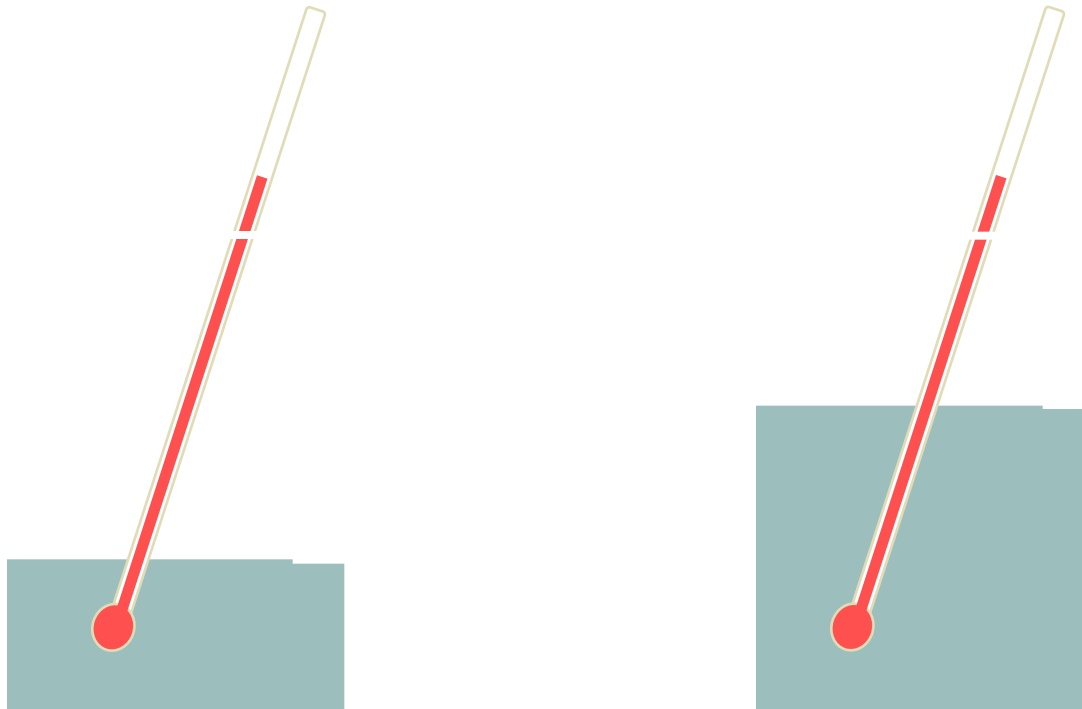


**Mechanical Energy**

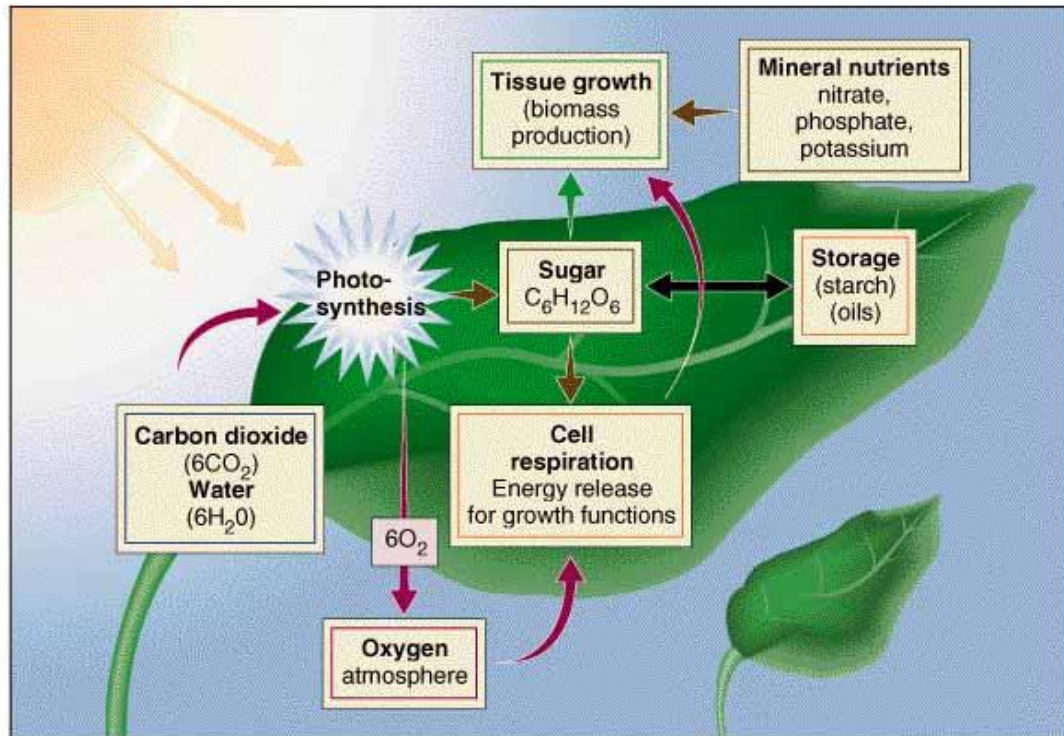
- **thermal energy** – the total potential and kinetic energy of all the microscopic particles in an object
- as an object's atoms move faster, its thermal energy increases and the object becomes warmer
- objects that are hot enough can emit light



- which beaker of water has more thermal energy?
- B does, same temperature, but more mass



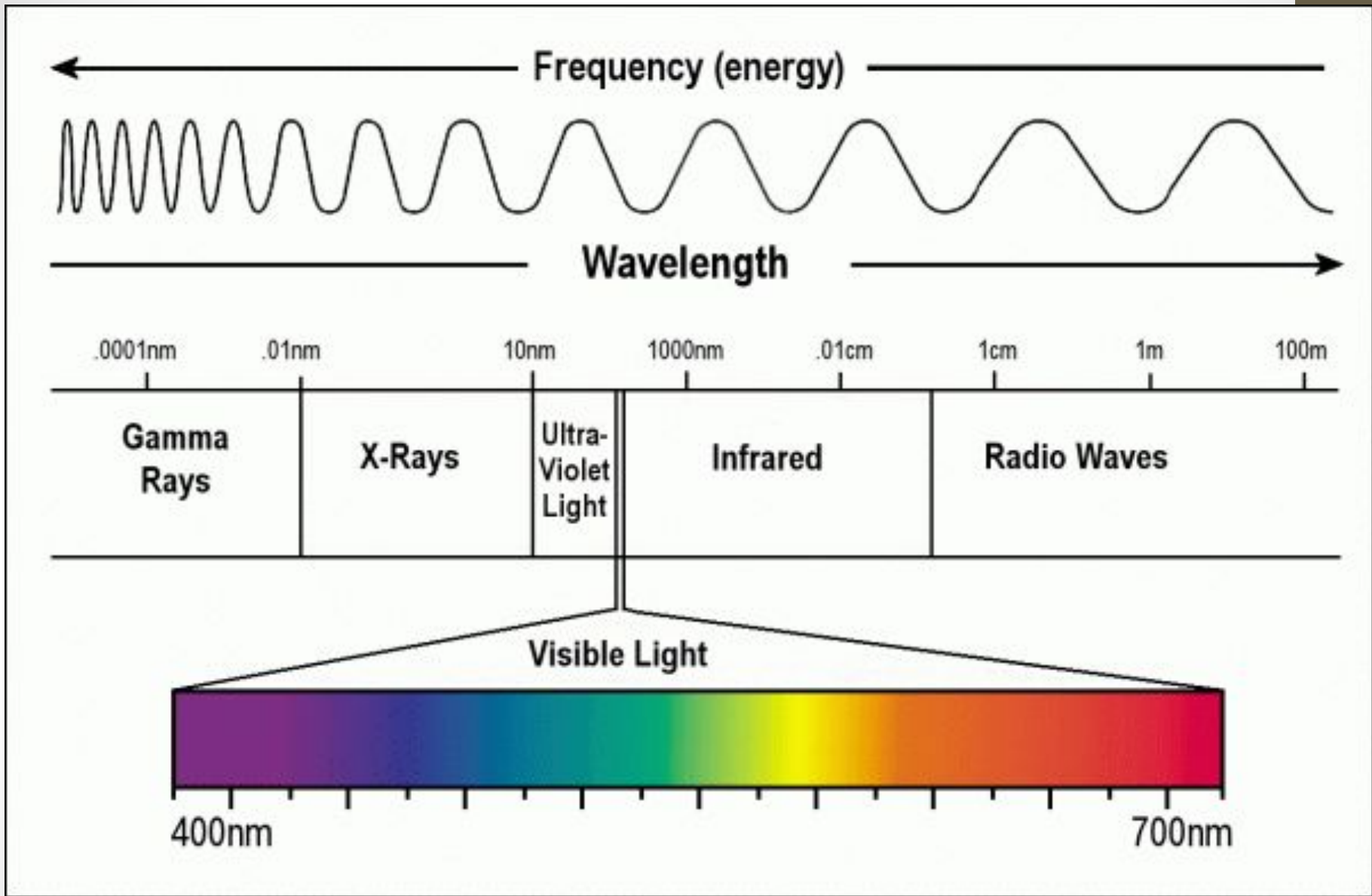
- **chemical energy** – the energy stored in chemical bonds
- when bonds are broken, the released energy can do work
- all chemical compounds store energy (including fuels)





- **nuclear energy** – the energy stored in atomic nuclei
- nuclear fission releases energy by splitting nuclei apart
- nuclear fusion releases energy when smaller nuclei combine to form a more massive nucleus
- the heat and light from the sun are produced by the fusion of hydrogen nuclei into helium nuclei

- **electromagnetic energy** – a form of energy that travels through space in the form of waves
  - visible light, x-rays, ultraviolet light, radio waves, infrared and gamma rays
- the sun radiates electromagnetic energy
- electromagnetic energy can travel long distances through space and air



electromagnetic energy

