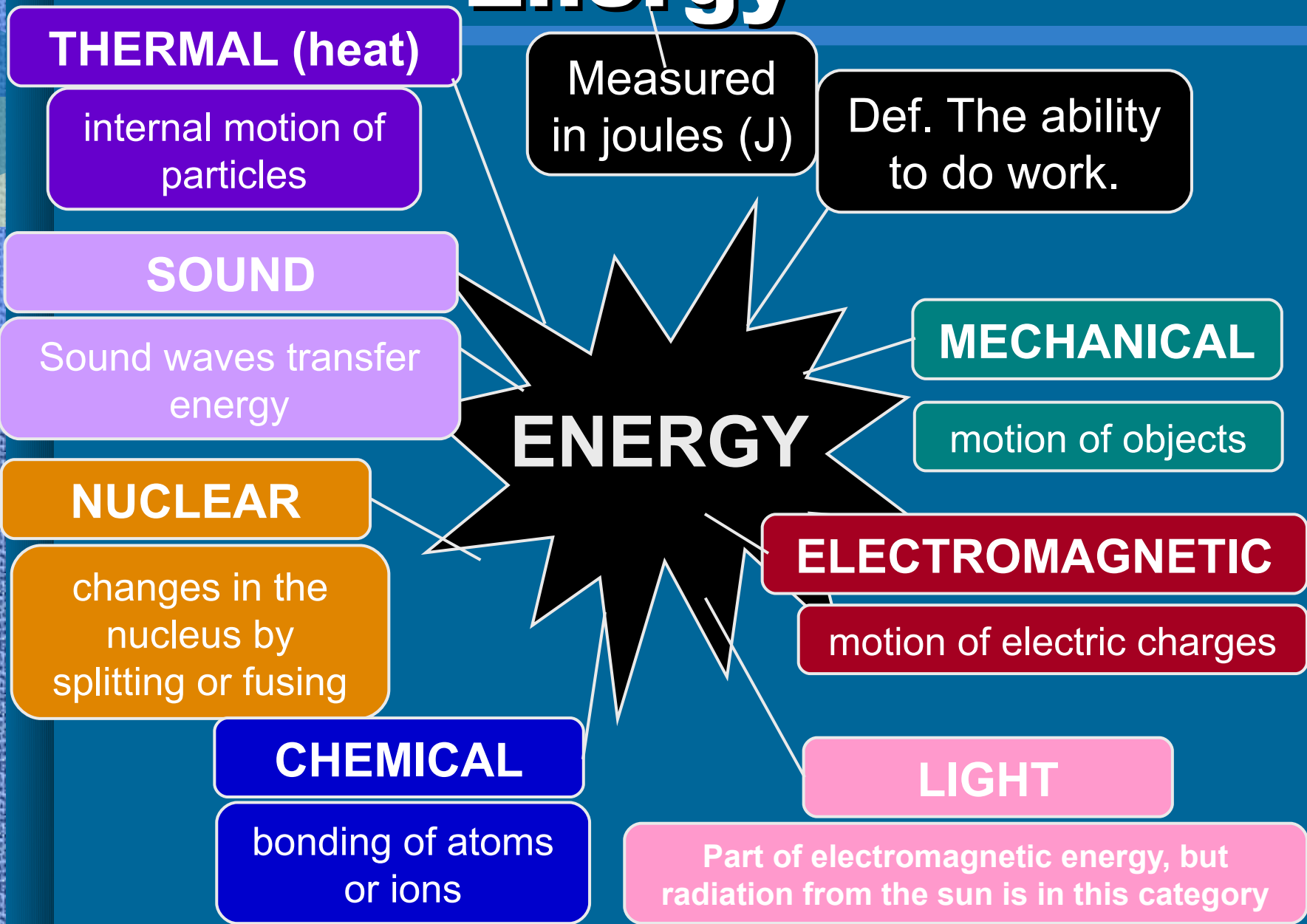
Ch. 16 - Energy

Essential Questions

- What is Energy?
- What are the 7 different forms of energy?
- What are Kinetic Energy & Potential Energy?
- How do KE and PE convert into one another?
- How do the forms of energy convert into one another?
- What is the law of the Conservation of Energy?
- How is energy related to the Physics subjects that we've studied already?

Section 1 – Forms of Energy

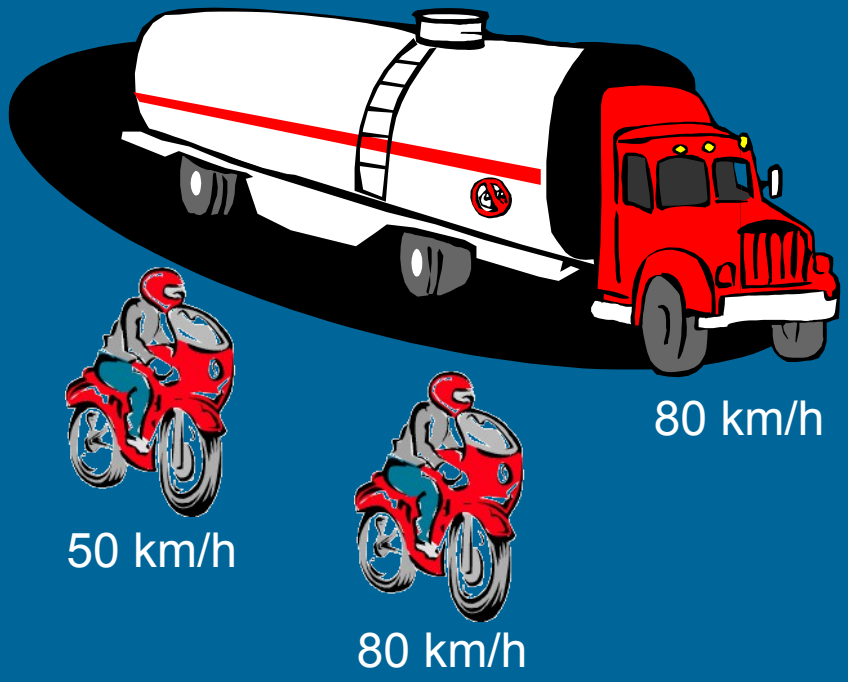


Section 2 – Kinetic & Potential Energy

- **Kinetic Energy (KE)**
  - energy in the form of motion
  - depends on mass and velocity

- Which has the most KE?
  80 km/h truck

- Which has the least KE?
  50 km/h motorcycle



Formula for Kinetic Energy

- Kinetic Energy

$$KE = \frac{mass \times velocity^{2}}{2}$$

Kinetic Energy Problem

- An object has 2 kg of mass and a velocity of 2.5 m/s. How much kinetic energy does it contain?

GIVEN:	WORK:
m = 2 kg V = 2.5 m/s KE = ?	$KE = \frac{m \times v^2}{2}$ $KE = \frac{2\ kg \times (2.5\ m/s)^2}{2}$ KE = 6.25 J

Kinetic Energy Analysis

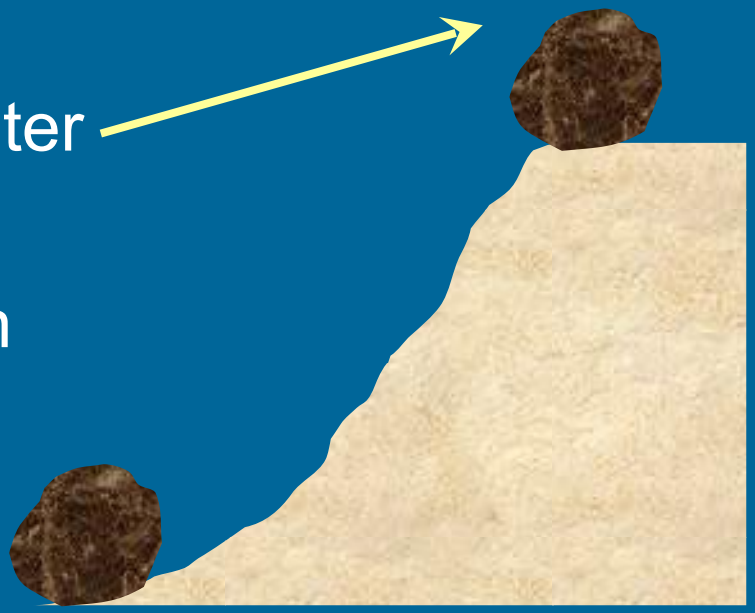
- Complete the following table.
- Which has the greater effect on the KE of an object – mass or velocity? WHY?????

Object	Mass (kg)	Velocity (m/sec)	KE (J)
A	1	1	
B	2	1	
C	1	2	
D	2	2	

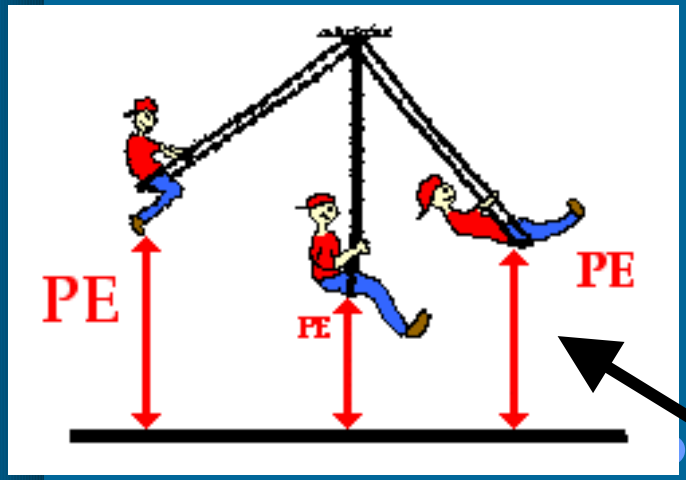
Section 2 – Kinetic & Potential Energy

- **Potential Energy (PE)**
  - stored energy
  - depends on position (gravitational) or configuration (shape) of an object

- Which boulder has greater gravitational PE?
- What other ways can an object store energy?

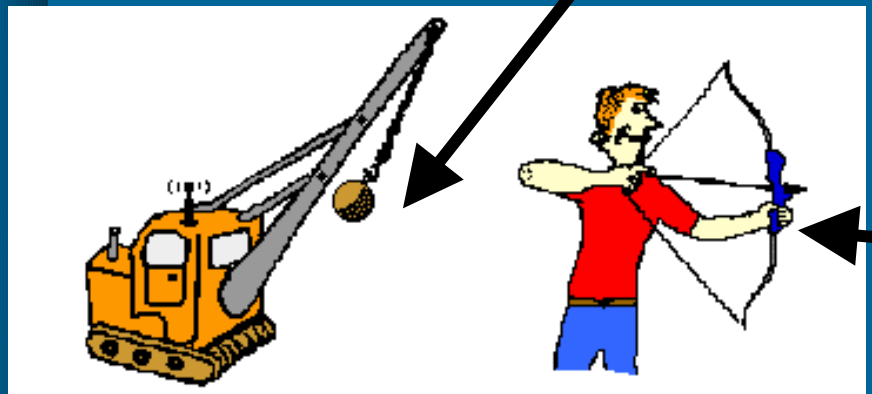


Examples of Potential Energy



The compressed springs of a dart gun store elastic potential energy. When the trigger is pulled, the springs apply a force to do work on the dart.

Gravitational Potential Energy Examples



The massive ball of a demolition machine and the stretched bow possesses stored energy of position - potential energy.

- **Potential Energy due to shape/configuration examples**

Formula for Gravitational Potential Energy

- Gravitational Potential Energy (GPE)

$$GPE = weight \times height$$

Potential Energy Problem

- A person with a mass of 60 kg climbs up a 3 meter diving board. How much potential energy do they have?

GIVEN:	WORK:
m = 60 kg	W = m x g
h = 3 m	W = 60 kg x 9.8 m/s^2
GPE = ?	W = 588 N
What do we need to do FIRST???????	GPE = W x h
	GPE = 588 N x 3 m
	GPE = 1,764 J

Section 3 – Energy Conversions

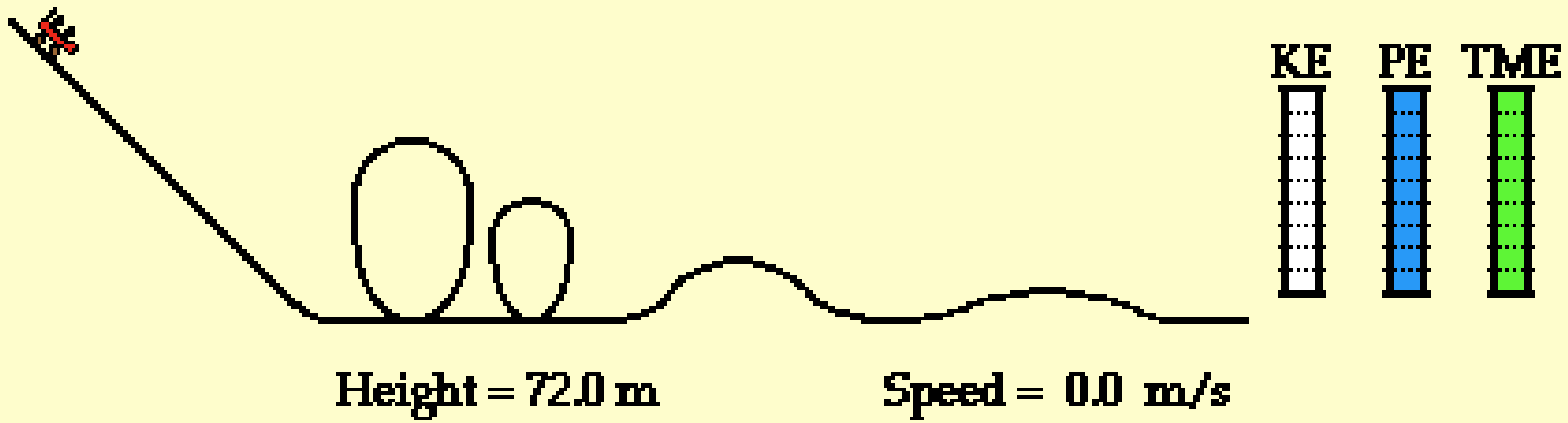
- **Energy Conversions**
  - Changes in the forms of energy from one to another
  - **All forms of energy can be converted to other forms.**
  - One of the most common changes is PE to KE and KE to PE.
  - Other examples include:
    - mechanical thermal
    - chemical thermal

Section 3 – PE/KE Energy Conversions

PE KE can continuously convert back and forth into one another.

Ex: at top of hill – max GPE, no KE

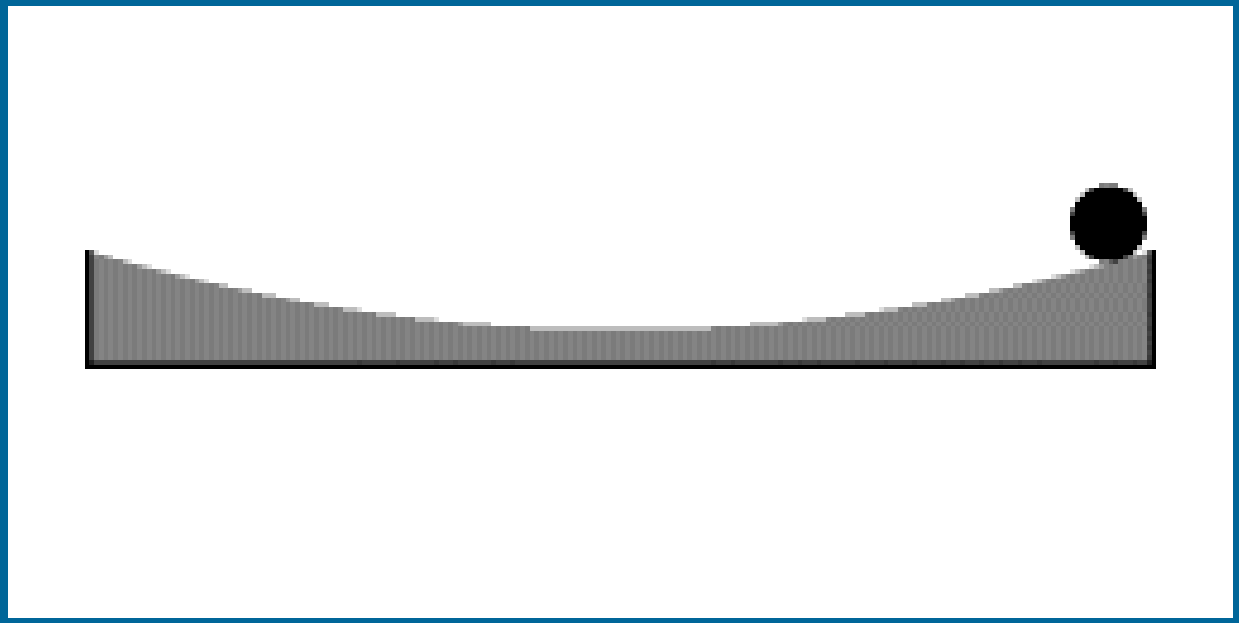
At bottom of hill – max KE, no GPE



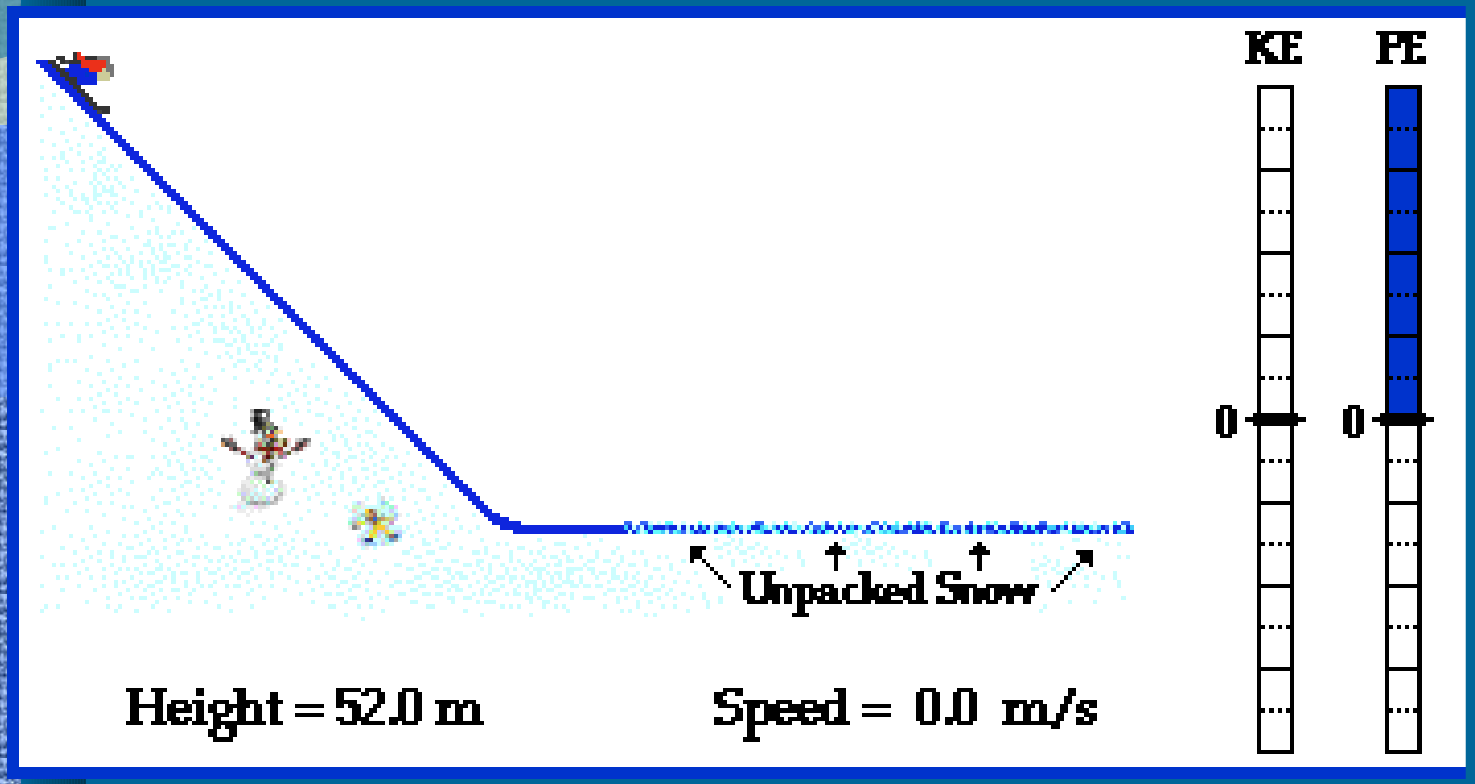
Section 3 – PE/KE Energy Conversions

Label where KE of the marble is greatest and Zero.

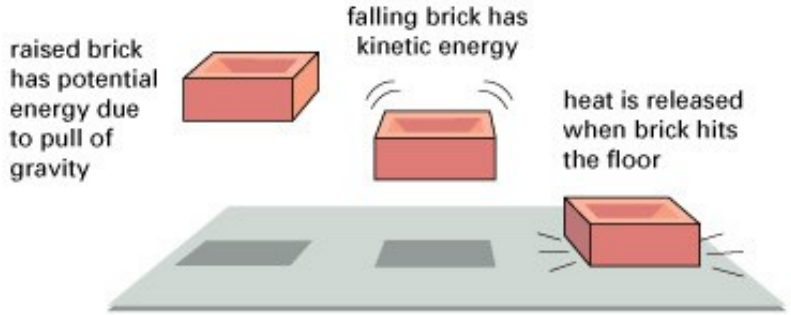
Label where PE of the marble is greatest and Zero.

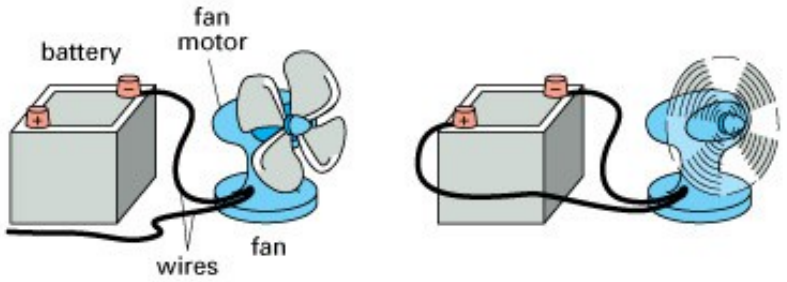


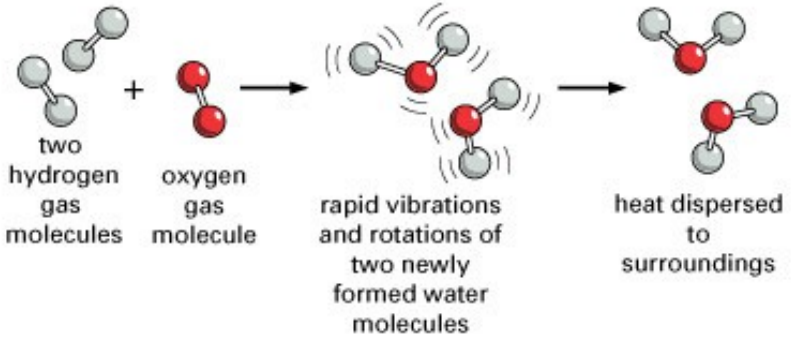
Section 3 – PE/KE Energy Conversions

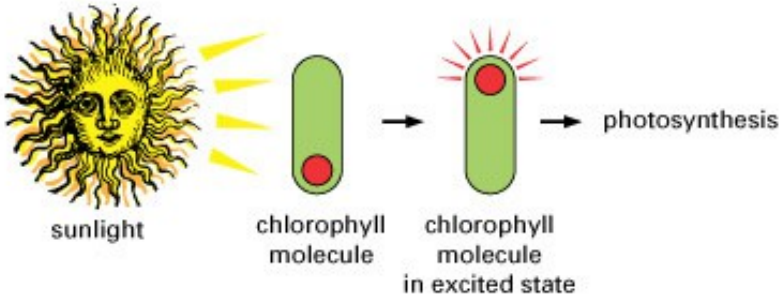


Section 3 – 7 Forms of Energy Conversions









Section 3 – 7 Forms of Energy Conversions

- Let's trace the path of energy conversions on Page 406 of the text.

Section 4 - Conservation of Energy

- **Law of Conservation of Energy**
  - Energy may change forms, but it can neither be created nor destroyed by ordinary means (ways).
  - Energy just changes form from one to another.
  - Einstein discovered that mass can be converted into pure energy and vice-versa.

Section 4 - Conservation of Energy

- Formula for calculating energy

$$E = mass \times speed\ of\ light^2$$

$$E = mc^2$$

- Because the speed of light is such a huge number, theoretically, even a small mass may yield a tremendous amount of energy

Section 4 - Conservation of Energy

- How do we work with a number in scientific notation that is being squared?

The formula is $E = mc^2$

This means $E = \text{mass} \times (3 \times 10^8)^2$

The ^{2} on the outside of the parentheses is distributed to everything within the parentheses!

This becomes $E = \text{mass} \times (9 \times 10^{16}\ m^2/s^2)$

Every time you use this formula!!!!!

Conservation of Energy Problem

- How much energy is found in a 5 kg pile of doggie poo poo?

GIVEN:	WORK:
$c = 3 \times 10^8$ m/s $m = 5$ kg $E = ?$	$E = mc^2$ $E = (5 \text{ kg}) \times (3 \times 10^8 \text{ m/s})^2$ $E = (5 \text{ kg}) \times (9 \times 10^{16} \text{ m}^2/\text{s}^2)$ $E = 45 \times 10^{16}$ J or 4.5×10^{17} J