

# Chapter 5

# Energy

## **Section 1 - The Nature of Energy**

# The Nature of Energy

- **Let's Review and Connect...**

- What are some changes that have happened in your world lately? What caused this change?
- How would you describe GRAVITY?
- What is the gravitational acceleration constant?
- What do you already know about energy?

# What is Energy?

- Every change that occurs involves energy.
- Energy is defined as the ability to do work or cause change. When work is done on an object, something moves and a change occurs.
- There are different forms of energy all around us. This energy is moving or transferring from one place to another.

# Different Forms of Energy

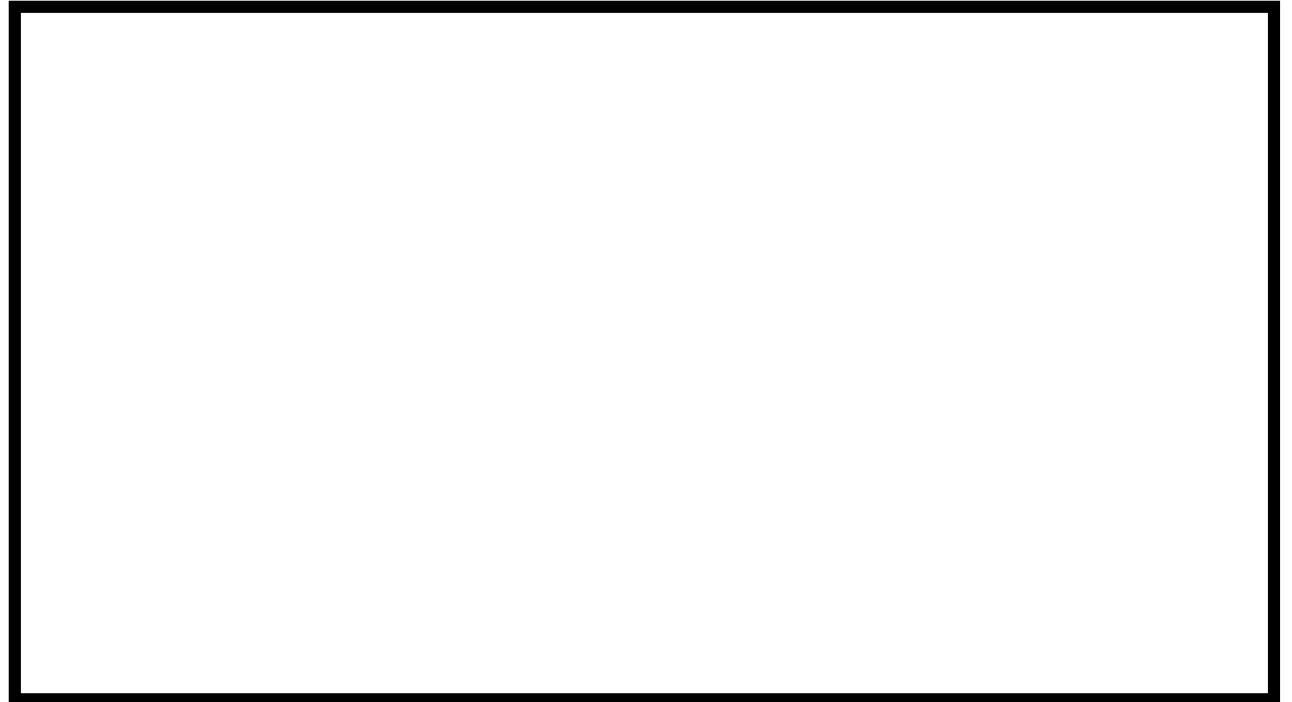
## Think of ENERGY like MONEY

- If you have \$50 you could have it in various forms- a paper check, all single dollar bills, a 50 dollar bill or a bag of change. You could take your bag of change to the bank and exchange the coins for two 20 and one 10 dollar bill. Regardless, you still have \$50, right?
- The energy that is all around us is found in different forms, but it is all essentially the same – ENERGY!
- There are two main forms of energy – Kinetic and Potential.

# Different Forms of Energy

- What are some forms of energy that you are already familiar with?

**Jot them down here**



# Different Forms of Energy

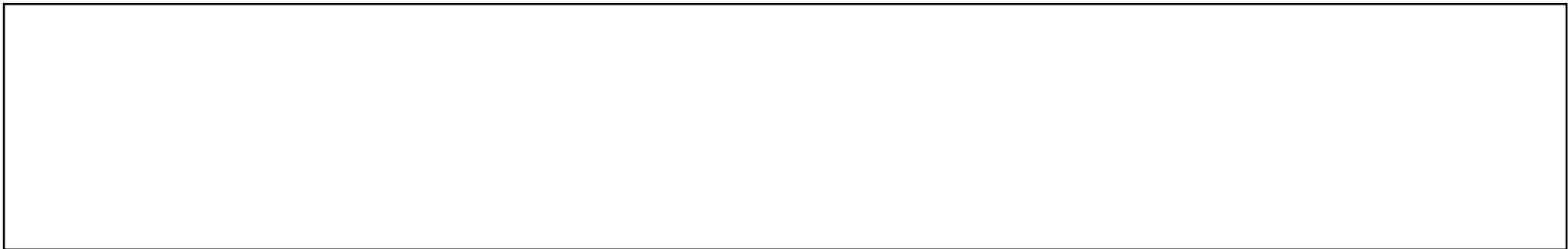
<b>KINETIC</b>	<b>POTENTIAL</b>
<p>The energy a moving object has because of its <u>motion</u>; <u>energy in motion/energy being used</u>.</p>	<p><u>Energy that is stored</u>; often due to the <u>position of an object</u>.</p>
<p><b>5 Types –</b></p> <ul style="list-style-type: none"><li>• <u>Mechanical</u></li><li>• <u>Electrical</u></li><li>• <u>Light</u></li><li>• <u>Thermal</u></li><li>• <u>Sound</u></li></ul>	<p><b>3 Types –</b></p> <ul style="list-style-type: none"><li>• <u>Gravitational</u></li><li>• <u>Elastic</u></li><li>• <u>Chemical</u></li></ul>

# Types of Potential Energy

- **Elastic Potential Energy** is energy that is stored in something that can stretch or compress.
  - Examples: \_\_\_\_\_
- **Chemical Potential Energy** is energy that is stored in chemical bonds.
  - Examples: \_\_\_\_\_
- **Gravitational Potential Energy** is energy that is stored by objects depending on the object's mass and height above the ground.
  - Examples: \_\_\_\_\_

# Check it out! Energy on a Rollercoaster...

- <http://d3tt741pwxqwm0.cloudfront.net/WGBH/conv16/conv16-int-rollercoaster/index.html>
- Where else in real life do we experience a combination of potential and kinetic energy transformations?

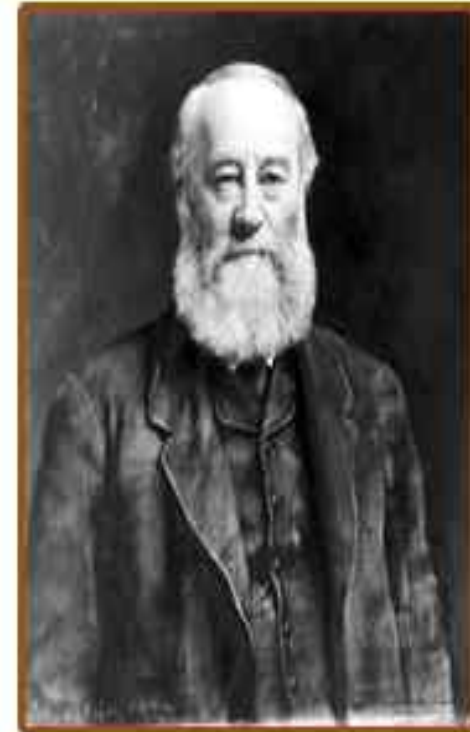




# Measuring Energy

- **James Prescott Joule**

- An English physicist who studied heat and mechanical work.
- The unit for energy and/or work, the Joule (J), is named after him.



**Jimmy Joule**  
1784 – 1858

# Measuring Energy

## • Kinetic Energy Formula

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

Use PEMDAS...starting at E (exponent)

- What do 'm' and 'v' represent? Mass and Velocity

**Example Problem – Copy the problem, start independently then we'll solve together.**

- A jogger with a mass of 60kg is moving at 3 m/s. Find the jogger's kinetic energy.



# Measuring Energy

## • Gravitational Potential Energy

$$\underline{\text{GPE} = \text{mass} \times \text{gravity constant} \times \text{height}} \quad \times$$

$$\underline{\text{GPE} = mgh}$$

- What do 'm' and h' represent? Mass and Height
- What is the gravity constant? 9.8 m/s<sup>2</sup>

**Example Problem – Copy the problem, start independently then we'll solve together.**

- A ceiling fan with a mass of 7 kg is hanging 4 meters from the floor. What is the fan's **potential energy?**



# Try a few more...

1. What is the **kinetic energy** of a baseball moving at a speed of 40 m/s if the baseball has a mass of 0.15 kg?

$$KE = \frac{1}{2} m v^2$$

2. If the height of a baseball thrown in the air is 50 m and that baseball has a mass of 0.15 kg, what is the baseball's **GPE**?

$$GPE = mgh$$

# How can energy change?

- **Kinetic Energy**

- How can the energy of an object increase or decrease?

- **Gravitational Potential Energy**

- How can the energy of an object increase or decrease?

# Chapter 5

# Energy

## **Section 2 – Conservation of Energy**



# Energy Transformations

- When energy is converted, the energy \_\_\_\_\_ is transferred or \_\_\_\_\_ into an energy \_\_\_\_\_





# Conversions between Kinetic and Potential Energy

- **Mechanical Energy** is the \_\_\_\_\_ OR the \_\_\_\_\_; the energy a system has \_\_\_\_\_.



The bowling ball has mechanical energy. When the ball strikes the pins, mechanical energy is transferred to the pins.

# Conversions between Kinetic and Potential Energy ... Visualize It!

- Create a drawing of an apple falling from a tree and label where:
  - kinetic energy is low and gravitational potential energy is high
  - kinetic energy is high and gravitational potential energy is low
  - kinetic energy is about equal to gravitational potential energy

**\* the GPE that the apple loses is gained back as kinetic energy**

# The Law of Conservation of Energy

- States that energy \_\_\_\_\_ from one form to another, but the total amount of \_\_\_\_\_; \_\_\_\_\_  
\_\_\_\_\_.

- Energy In = Energy Out

Electrical Energy =  
Thermal Energy  
Sound Energy  
Light Energy



# Is Energy Always Conserved?

- It may be confusing to think of some examples of energy NOT being conserved. These examples usually involve “losing” energy to \_\_\_\_\_ but the energy is still the same.
- Ex. Pumping your legs when swinging on a swing – stop pumping and your energy is “lost” due to friction of the chains and air resistance (your energy isn’t really lost!).



# Chapter Wrap-Up

*Write an A if you agree with the statement. Write a D if you disagree with the statement.*

- The total amount of energy in the universe never changes. \_\_\_\_\_
- Any two objects on the same shelf of a cupboard have the same potential energy. \_\_\_\_\_
- Energy is lost when an object is motionless. \_\_\_\_\_
- A lightbulb transforms electrical energy into light and thermal energy. \_\_\_\_\_

# Chapter Wrap-Up

- **After learning about energy in this chapter, summarize in your own words what energy is and what the law of conservation of energy means.**