ENERGY AND WORK

UNIT 6

WHAT IS ENERGY????

- Energy can have many different meanings and forms…
- The ability of an object to do work
- Measured in joules (J)
  - $N \cdot m = J$
- So what is are the different types of energy…?

DIFFERENT KINDS OF ENERGY

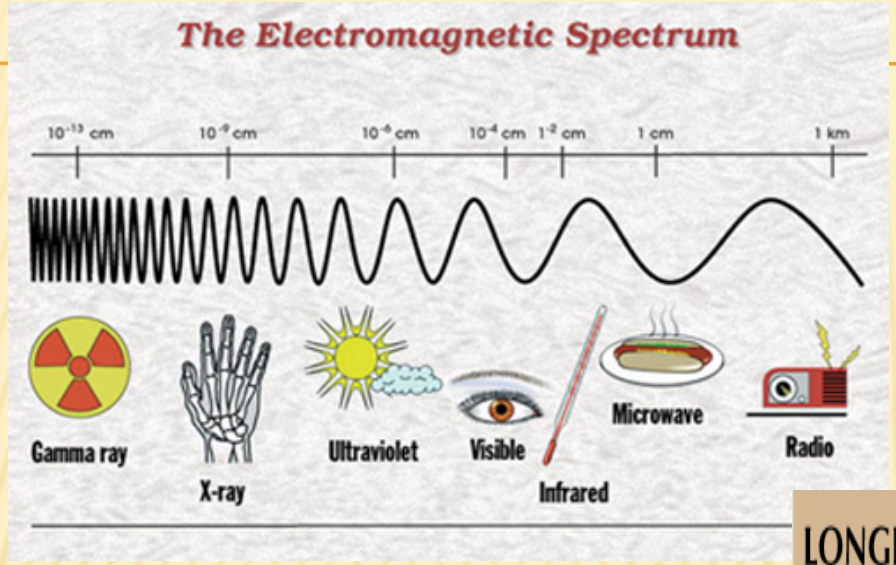
1. Mechanical: associated with motion or position of everyday objects
    1. it is the sum of an object's potential and kinetic energy

2. Chemical: stored in chemical bonds, compounds, and molecules
    + bonds holding the compounds in wood together hold energy and if burned, release this energy

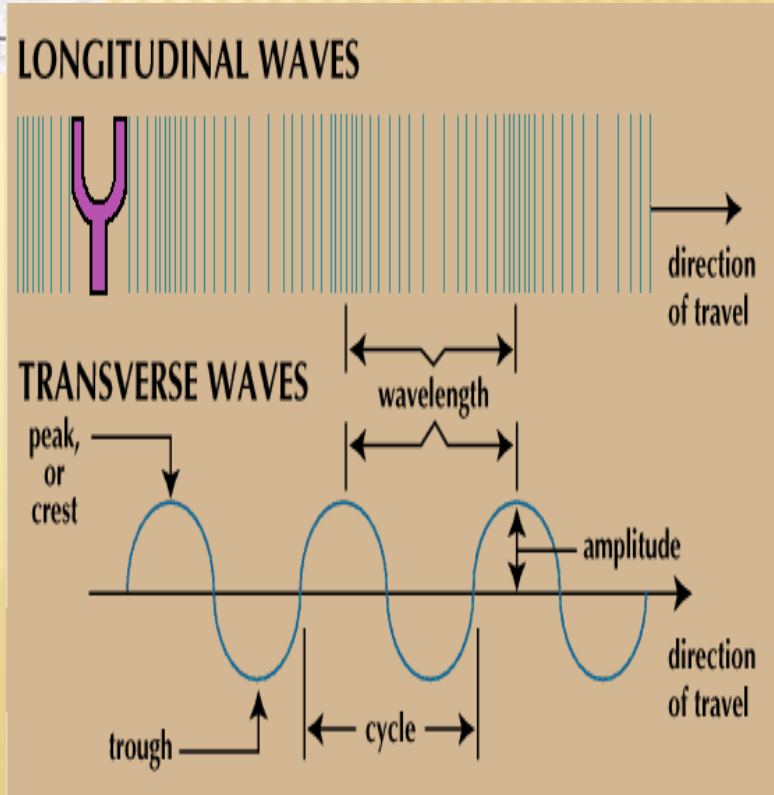
3. Electrical: (electricity) associated with a flow of electrons

4. Thermal: heat associated with molecule movement

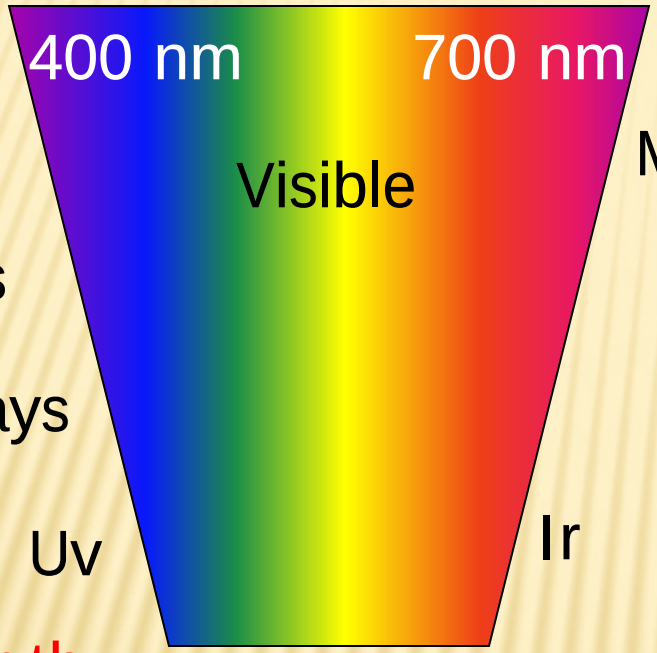
5. Light: energy associated with electromagnetic waves



6. Sound: energy from longitudinal mechanical waves



THE ELECTROMAGNETIC SPECTRUM



γ rays

x-rays

Uv

Ir

Microwaves

Radio waves

Radar

TV

FM

Short wave

Long wave

wavelength

frequency

High Frequency Short Wavelength

Low Frequency Long Wavelength

WHERE DOES THIS ENERGY COME FROM?

LAW OF CONSERVATION OF ENERGY

- States that “Energy is not created or destroyed, but transformed from one form to another. “
- What does that mean???

When you stop applying gas to a car, the car eventually stops… Why????

The kinetic energy is converted into thermal energy due to friction!

APPLYING THIS KNOWLEDGE:

- Describe the changes in energy that are necessary to power the lights in this room…

  - Light bulbs transform electrical energy into light energy we can see, some electrical energy is turned into thermal (Get gets hot)

1. **What is energy, in scientific terms?**

2. **What is the unit for energy?**

3. **Name three different types of energy.**

4. **What part of the electromagnetic spectrum can we visibly see?**

5. **What is so important about the Law of Conservation of Energy?**

WE DEFINED ENERGY AS THE ABILITY TO DO….WORK

- Work: the force multiplied by the distance in the force's direction
- Work can only occur if a force is applied to an object AND the object must move in that direction of the force
- When work occurs, energy is transferred to that object. This means that the work is equal to the change in energy.
- If the force is great enough to move the object, then the energy transferred becomes kinetic energy

A. Work is found using the formula:

W = F (d) The unit is Joules (J)!

WORK PRACTICE PROBLEM #1

Calculate the work done by a 15N force over a distance of 7.5 meters.

MONDAY 11/30 - BELLRINGER

1. What is work?

2. What is the work formula?
3. What is the unit for work?
4. Calculate the work done by a 25 N force over a distance of 5.0 meters.

5. What would the formula be if I asked to solve for distance?

   ...for Force?

POTENTIAL & KINETIC ENERGY

- Mechanical energy is the sum of the potential and kinetic energy of a system
  - Potential energy (PE): stored energy due to object's position
  - Kinetic energy (KE): energy of moving object due to object's motion
  - As PE is converted to KE (or vice versa), the mechanical energy remains the same

What happens to the mechanical energy when an apple falls from a tree?

- PE decreases

- KE increases since apple is in motion

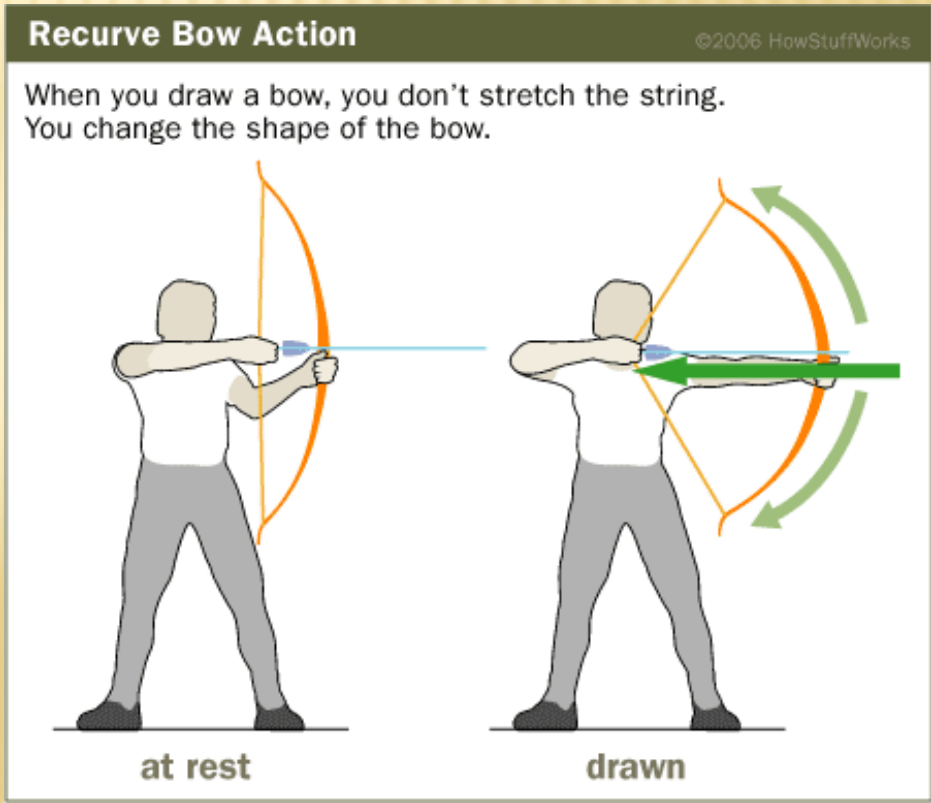
- Mechanical energy remains constant since energy is transforming [PE→KE]

MORE ON POTENTIAL ENERGY

Gravitational Potential Energy (GPE): is greater when there is a greater height or greater mass

- Formula for GPE: (mass) ($a_{gravity}$) (height)
- Unit is Joules (SI unit for energy)

Elastic Potential Energy: based on the stretch or compression of an object (rubber band or spring)



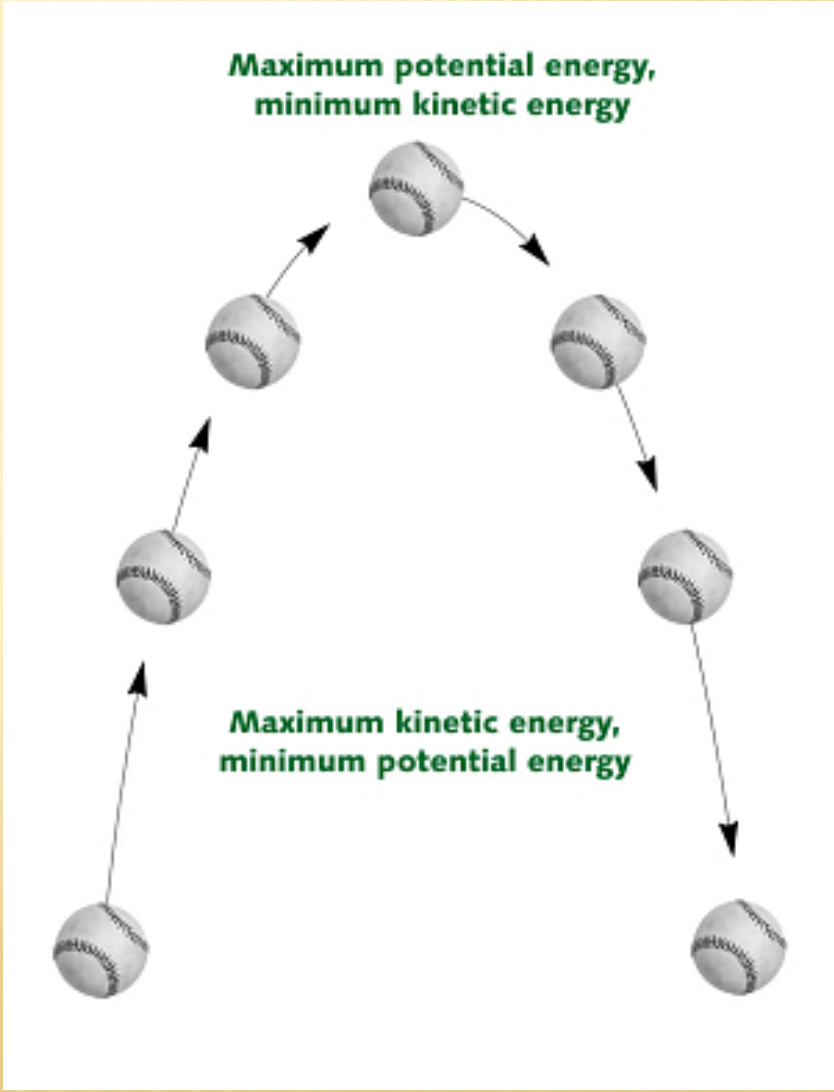
MORE ON KINETIC ENERGY

1. Kinetic energy is greater when the speed of the object is greater.

2. Kinetic energy is greater when the mass of the object is greater.

3. Kinetic energy is found using the formula:

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



CALCULATING WORK, GPE & KE

1. How much work is done when pushing a couch with a force of 75 N and it moves 5 m across the floor?
2. Calculate the work done by a 20kg object with an acceleration of 12.2 m/sec^2 for a total distance of 76 meters.
3. What is the force required to move an object with 120J of energy a total distance of 350 meters?
4. A 0.06 kg tennis ball starts to fall from a height of 2.9 m. How much GPE does the ball have at that height?
5. Tennis ball #1 is held out a 2nd floor window (3.5 m from ground). Tennis ball #2 is held out a 3rd floor window (6.25 m from ground). Which tennis ball has more GPE, and by how much? [both tennis balls have a mass of 0.10 kg]
6. Find the KE of a 250 kg otter who swims 16.5 meters/sec.

Section Review p.105 #1-4

Self Check

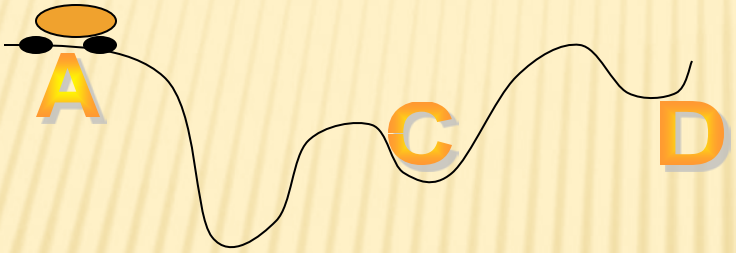
1. **Explain** whether an object can have kinetic energy and potential energy at the same time.
2. **Describe** three situations in which the gravitational potential energy of an object changes.
3. **Explain** how the kinetic energy of a truck could be increased without increasing the truck's speed.
4. **Think Critically** The different molecules that make up the air in a room have on average the same kinetic energy. How does the speed of the different air molecules depend on their masses?

Section Review p.105 #5 - 7

Applying Math

5. **Calculate Kinetic Energy** Find the kinetic energy of a ball with a mass of 0.06 kg moving at 50 m/s.
6. **Use Ratios** A boulder on top of a cliff has potential energy of 8,800 J, and has twice the mass of a boulder next to it. What is the GPE of the smaller boulder?
7. **Calculate GPE** An 80-kg diver jumps from a 10-m high platform. What is the gravitational potential energy of the diver halfway down?

1. **What is the difference between KE and PE?**
2. **The muscles of a runner transform chemical energy into _____ energy.**
3. **At which point does the roller coaster have the *greatest kinetic energy*? Why?**



4. **At which point does the rock have the *greatest potential energy* as it thrown from the catapult?**

B