DEVIL PHYSICS

THE BADDEST CLASS ON CAMPUS

AP PHYSICS

LSN 6-8, OTHER FORMS OF ENERGY: ENERGY TRANSFORMATIONS AND THE LAW OF CONSERVATION OF ENERGY

LSN 6-9, ENERGY CONSERVATION WITH DISSIPATIVE FORCES: SOLVING PROBLEMS

Questions From Reading Activity?

Big Idea(s):

- Interactions between systems can result in changes in those systems.
- Changes that occur as a result of interactions are constrained by conservation laws.

Enduring Understanding(s):

- Interactions with other objects or systems can change the total energy of a system.
- Certain quantities are conserved, in the sense that the changes of those quantities in a given system are always equal to the transfer of that quantity to or from the system by all possible interactions with other systems.
- The energy of a system is conserved.

Essential Knowledge(s):

- The energy of a system includes its kinetic energy, potential energy, and microscopic internal energy. Examples should include gravitational potential energy, elastic potential energy, and kinetic energy.

Essential Knowledge(s):

- The internal energy of a system includes the kinetic energy of the objects that make up the system and the potential energy of the configuration of the objects that make up the system.
  - Since energy is constant in a closed system, changes in a system's potential energy can result in changes to the system's kinetic energy.
  - The changes in potential and kinetic energies in a system may be further constrained by the construction of the system.

Essential Knowledge(s):

- Energy can be transferred by an external force exerted on an object or system that moves the object or system through a distance; this energy transfer is called work. Energy transfer in mechanical or electrical systems may occur at different rates. Power is defined as the rate of energy transfer into, out of, or within a system. [A piston filled with gas getting compressed or expanded is treated in Physics 2 as a part of thermodynamics.]

Learning Objective(s):

- The student is able to calculate the total energy of a system and justify the mathematical routines used in the calculation of component types of energy within the system whose sum is the total energy.
- The student is able to predict changes in the total energy of a system due to changes in position and speed of objects or frictional interactions within the system.

Learning Objective(s):

- The student is able to describe and make predictions about the internal energy of systems.
- The student is able to calculate changes in kinetic energy and potential energy of a system, using information from representations of that system.

Other Forms of Energy

Studied So Far

- Kinetic
- Potential
  - Gravitational
  - Elastic
- Friction
- Normal/Contact/Reaction

Other Forms

- Electric
- Nuclear
- Thermal
- Chemical

Other Forms of Energy

- Other Forms
  - Electric
  - Nuclear
  - Thermal
  - Chemical
- *Can these other forms of energy be classified as potential or kinetic?*

Other Forms of Energy

Potential

- Chemical
- Nuclear
- Magnetic
- Electric

Kinetic

- Thermal
- Nuclear
- Magnetic
- Electric

Law of Conservation of Energy

- Energy never created or destroyed
- Instead, it is transferred of transformed
- Energy transfer frequently involves work

Law of Conservation of Energy

"The total energy is neither increased nor decreased in any process. Energy can be transformed from one form to another, and transferred from one body to another, but the total amount of energy remains constant."

Law of Conservation of Energy

- Laws of Newtonian Physics tend to break down at the sub-atomic level
  - $E = mc^2$
  - General Relativity
  - Special Relativity
  - Light
- Law of Conservation of Energy has never been found to fail

Law of Conservation of Energy

- Non-Conservative Forces
- Dissipative Forces
- Resistance Forces

- Friction and Wind Resistance

- These do work to transform mechanical energy into other, less useful forms of energy

Law of Conservation of Energy

- Conservation of Mechanical Energy

$$KE_1 + PE_1 = KE_2 + PE_2$$

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

$$PE = mgh, \frac{1}{2}kx^2, G\frac{Mm}{r}, k\frac{q_1 q_2}{r}, \frac{3}{2}kT^2$$

Law of Conservation of Energy

- Conservation of Energy

$$KE_1 + PE_1 = KE_2 + PE_2 + E_D$$

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

$$PE = mgh, \frac{1}{2}kx^2, G\frac{Mm}{r}, k\frac{q_1 q_2}{r}, \frac{3}{2}kT^2$$

$$E_D = F_N \mu d, F_R d, E_R$$

Problem Solving Process

1) Draw a picture.
2) Determine the system: Objects involved and their environment.
3) What are you looking for: Determine initial point (subscript 1 or i) and final point (subscript 2 or f).
4) For vertical changes, determine reference point (y = 0) and direction of positive movement or change.

Problem Solving Process

5) For elastic objects, determine neutral point (x, y = 0).
6) Determine whether to use Conservation of Mechanical Energy or Conservation of Energy depending on whether non-conservative forces are present.
7) Solve for the unknown quantity / quantities.

Sample Problem

- Homework Problem #54

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QUESTIONS?

Homework

#47-54