


CHAPTER 10

Interactive Science



10-1

What is Energy



Energy: ORIGIN mid 16th cent. (denoting force or vigor of expression): from French *énergie*, or via late Latin from Greek *energeia*, from *en-* 'in, within' + *ergon* 'work.'
3 Physics the property of matter and radiation that is manifest as a capacity to perform work

- ❖ Energy is the ability to Cause Change.
- ❖ Mr. Martin sez: It's also the ability to do work.

What does that mean?

- ❖ Energy can cause a change in a substance's location, position, temperature, velocity, or acceleration.
- ❖ Other examples?

Joules

- ❖ Last chapter, we defined joules as:
 - ❖ 1. the SI unit of work.
 - ❖ 2. the amount of ENERGY require to raise a one newton weight by one meter.

Joules: are also...

- ❖ Well, if energy is the ability to do work...
- ❖ And if joules measure an amount...
- ❖ Joules are the amount of energy used to cause a change



10-2

Forms of Energy—Be aware that many definitions are different than your book's definitions in this section.



Mechanical Energy

- ❖ The motion, position, or shape of an object is called mechanical energy.
- ❖ A combination of its kinetic and potential energy. (Add them.)

Kinetic Energy

- ❖ The opposite of Potential Energy.
- ❖ Potential is stored in an object
- ❖ Kinetic, therefore, is not stored--it is in motion
- ❖ Kinetic Energy: The energy an object has due to its mass and motion.
- ❖ “Anything in motion has kinetic energy”.

Electromagnetic (Radiant) Energy

- ❖ A form of energy that travels through space in waves.

Nuclear Energy

Stored in the nucleus of an atom

$E=mc^2$ states that at the speed of light mass = energy,

and that each atom contains a huge amount of nuclear energy that can be released during a nuclear reaction

Thermal Energy

- ❖ The total kinetic and potential energy of the particles in an object.:
- ❖ The heat of an object. Heat energy.

Sound Energy

- ❖ Energy transmitted in the form of sound waves.

Light Energy

- ❖ Energy transmitted in the form of light waves or light particles.

Electrical Energy

- ❖ The energy of electric charges; when it's potential it's called electrostatic potential.

Potential Energy

- ❖ Energy stored in an object
- ❖ bent out of shape, or elevated;
- ❖ fuel, or electric charge
- ❖ Four Types

Elastic Potential Energy

- ❖ The energy stored in an object as a result of deformation of an object
- ❖ stretched; compressed; bending, twisting, shearing
- ❖ springs; bow & arrow; bouncy ball; catapult, rubber band

Gravitational Potential Energy

- ❖ the energy an object has when it is in an elevated position
- ❖ anything that can fall or drop
- ❖ books on a desk; swing on a swingset; drop of water on a faucet; baseball in the air; hot air

Chemical Potential Energy

- ✦ Energy stored due to the arrangement of molecules
- ✦ Fuel, food

Electrostatic Potential Energy

- ✦ Energy stored in electrical charges


$e = \text{energy}; m = \text{mass}$

$c = \text{constant speed of light}$

- ❖ $e = mc^2$ means that if you know the mass of an object, you can measure the amount of energy it has.
- ❖ Einstein: $\text{energy} = \text{mass} \times \text{speed of light}^2$
- ❖ p. 127: $\text{kinetic energy} = \text{mass} \times \text{speed}^2$

[http://en.wikipedia.org/wiki/ Kinetic energy](http://en.wikipedia.org/wiki/Kinetic_energy)

- ❖ There are several different equations that may be used to calculate the kinetic energy of an object. In many cases they give almost the same answer to well within measurable accuracy. Where they differ, the choice of which to use is determined by the velocity of the body or its size. Thus, if the object is moving at a velocity much smaller than the speed of light, the [Newtonian \(classical\) mechanics](#) will be sufficiently accurate; but if the speed is comparable to the speed of light, [relativity](#) starts to make significant differences to the result and should be used.



10-3

Energy Transformations and Conservation: Includes significant information to supplement your book.



10-3 Vocab:

- ❖ First Law of Thermodynamics:
- ❖ Energy can NOT be created.
- ❖ Energy can NOT be destroyed.
- ❖ Energy CAN be changed from one form to another, and often does.

10-3 Vocab

- ❖ Second Law of Thermodynamics:
- ❖ Whenever energy is converted, waste is produced.
- ❖ Results: No machine is 100% efficient
- ❖ Waste Heat, friction, waste sound occur
- ❖ Energy input never quite matches energy output

Laws of Thermodynamics



Section Two Vocab:

- ❖ Perpetual Motion: a machine which, once started, would continue operating forever with no loss of motion, no waste heat, no friction, and no additional energy input
- ❖ Impossible due to Second Law of Thermodynamics