Macro-Scale Energy
(energy we can see in action)

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Energy

- The ability to do ***work***
- Scalar (magnitude, but NO direction)
- Conserved (can neither be created nor destroyed)
- Measured in Joules (J)

Work

- The energy needed to enact a force through some displacement
- $W = \int F \cdot dr$ (work equals force integrated over distance)
- A force can be exerted on an object but NOT do work
- Only forces that do work are ones that **contribute to motion**
- Can be done: **by** an object or **on** an object / by a **particular force** or by a **net force**

Negative Energy

- Forces done against motion do **negative work**
- Energy put **into** the system is **positive** and energy taken **out** of the system is **negative**

Kinetic Energy

- The *Energy of Motion*
- $KE = \frac{1}{2}mv^2$ (the **kinetic energy** of an object equals half the object's **mass** multiplied by the square of its **speed**)
- $W_{net} = \Delta KE$ (the net work done on an object is equal to the change in kinetic energy)

Potential Energy

- The *Energy of Position / Configuration*
- PE_g = mgh (the **gravitational potential energy** of an object is equal to the product of the object's **weight** and its **height)**
- PE is independent of the path taken

Law of Conservation of Energy

The total amount of 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 remains constant.

Power

- Average power is the rate at which work is done (or at which energy is transformed)
- $P = dW/dt$
- Measured in Watts (W)
- $1\ W = 1\ J/s$