Energy and Work

- **Energy** – The ability to do Work (or cause a change). Measured in Joules (J). When work is done, energy is transformed or transferred.
- **Work** – Force (push or pull) applied to an object and the object moves in the same direction as the force. Measured in Joules (J)

Work

- In order to do work
  1) applied force must make object move
  2) movement must be in the same direction as the applied force

Equation: $W = F\Delta x$ (J) → change in (Newton) → displacement (direct route) (meters/seconds)

(or k, or €)

Work Practice

- 1) You push a refrigerator with a force of 100N. If the displacement of the refrigerator is 5m, how much work did you do?

$W = 100N \cdot 5m = 500$ Joules (J)

Work Practice

- 2) A force of 75N is exerted on a 45-kg couch and the couch is moved 5m. How much work is done in moving the couch?

$W = 75N \cdot 5m = 375J$

- Examples of work:
  - Lifting weights
  - pushing cart
  - throwing a ball/object

~~Different Types of Energy~~

- Thermal Energy: – heat
  ex. christmas lights, sun

~~Different Types of Energy~~

- 2) Chemical Energy: –
  ex. pills, food, batteries

~~Different Types of Energy~~

- 3) Electrical Energy: – lightning, computer, electrical towers
  ex. electrons excited
  Clouds charged w/ electricity
- 4) Radiant Energy: Light & Heat
  Sun, traffic light, lightbulb
  Hot & bright

overlap

~~Different Types of Energy~~

- 5) Nuclear Energy:
  Bomb

~~Kinetic Energy~~

- Energy of motion
- ~~Examples:~~ Running, ~~roller coaster going downhill~~, car moving, bird flying
- Kinetic Energy (KE) = $mv^2/2$
- m = mass
  v = velocity (squared)

Gravitational Potential Energy

- The energy an object is able to store because of its position or condition
- **Examples:** Stretching of a rubber band, baseball in a glove, slinky pushed down, book on a shelf
- **P.E. = mgh** $9.8\ m/s^2$ mass · gravity · height
- m = mass, g = acceleration rate due to gravity (9.8 m/s^2), h = height

Conversion from potential energy to kinetic energy

- **Football Player** – QB's arm is holding the football ready to throw (P.E.), he releases and the ball flies through the air (K.E.)
- **Apple** – An apple hanging from a tree has (P.E.) and then falls to the ground (K.E.)
- **Waterfall** – At the top of the waterfall there is (P.E.), and as the water spills over and starts to fall it has (K.E.)

Calculations

- 1) What is the K.E. of a 45kg bike moving at 13m/sec?

$mv^2/2$ $\quad \frac{45kg(13m/s)^2}{2} = \frac{45 \times 169}{2} = \frac{7605}{2} = 3802.5\ J$ (169 = 13^2; square then multiply; divide)

Calculations

- 2) A 30kg (mass) child climbs 15m (height) up a tree. When he stops to have a look around what is his P.E.?

$PE = m \cdot g \cdot h$ $\quad 30kg \cdot 9.8\ m/s \cdot 15m$

$m = 30kg \quad g = 9.8 \quad h = 15m$ $\quad m \times g \cdot h$

$4410\ J$