Energy

- Work
- Power
- Energy
- Forms of Energy
Work

- Work = Force * Distance
- Applied force and distance must be parallel to each other
- No work is done if Applied Force and distance are perpendicular!
- $W = 0$
Work

- Work = Force * Distance
- Units: Joule (or Calories)
- Prove $1 \text{ J} = 1 \text{ Kg m}^2/\text{s}^2$
- Joule = Work = F.d
- $1\text{ J} = 1 \text{ N. 1m}$
- $1\text{ J} = 1 (\text{Kg.m/s}^2). 1\text{m}$
- $1\text{ J} = 1 \text{ Kg m}^2/\text{s}^2$
\[ W = F_h \times d \]
\[ F_h = F \cos \theta \]
\[ \therefore W = F \cos \theta \times d \]
What is the work done on a ball that rolls horizontally for a distance of 2 m, when a force of 2 N is applied along an angle of 30 degrees?

\[ W = F \cos \theta \times d \]

\[ W = 2N \cos(30^\circ) \times 2m \]

\[ W = 3.46Nm \ (or) \ J \]
Power

• Power is work done per unit time
• $P = \text{work/time}$
• Units = Joule/Sec
• Watt = J/s
• 1 horsepower (hp) = 746 W or 550 ft.lb/s
• Power rating = work done/time
• Electric power is measured in metric prefixes:
  kilowatt = 1000 Watts, or Mega Watts = $10^6$ Watts
Activity Session

• Find your horsepower Rating.
  – Measure the total Distance of the stairway from floor to the top row.
  – Walk down the stair way, measure the time.
  – Calculate the power rating
  – Do the same procedure, but walk up the stair way instead, and calculate the power rating.
• Ability to do work is Energy
• Units : Joules (kg m²/s²)
• Work and energy are closely related!
• Forms of energy :
  – Electrical, Wind, Solar, Nuclear, Mechanical, Heat, Thermal etc.
Potential Energy

- Potential Energy is energy due to position
- Weight \((w) = mg\) (N)
- Work = Force \(\times\) Distance
- Force = Weight
- Distance = \(h\)
- Work done on the book = \(mgh = PE\)
Potential energy

- Work done on the book = Increasing the potential energy
- Higher the book is placed, greater is its potential.
- When the book falls, the stone is lifted up
  - In this case work is done by the book
Potential Energy

- Problem
- What is the potential energy of a 2 kg ball, that is at a height of 25 cm above the ground?
  - \( PE = mgh \)
  - \( PE = 4.9 \text{ N} \)
Kinetic Energy

- Work done to put an object in motion = Increasing kinetic energy
- Increased Kinetic energy = object moves faster
- KE = $\frac{1}{2}mv^2$
- Units = kg (m/s)$^2$ = kg m$^2$/s$^2$
- Is it same as Joule?