Micro-Scale Energy and Machines

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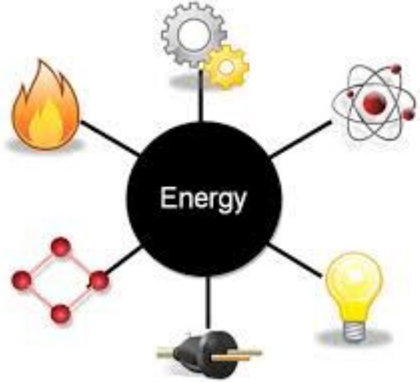
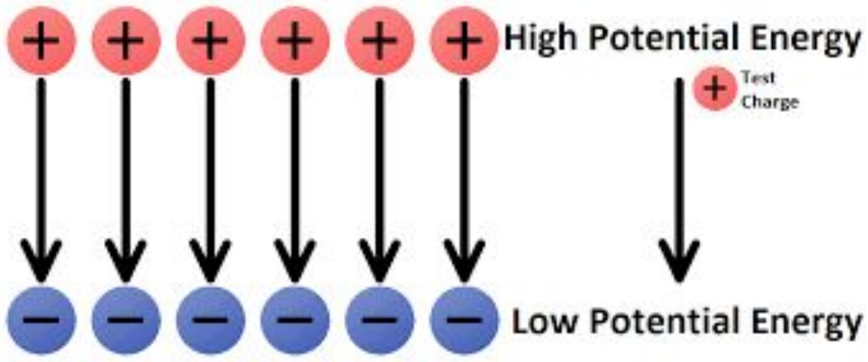
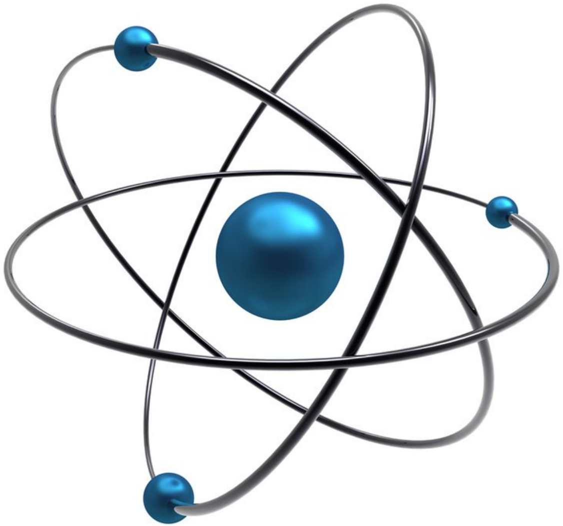
Micro-Scale Energy

- All forms of energy (Chemical, Mechanical, Electric) are in forms of Kinetic or Potential Energy
- $E=mc^2$, $m = E/c^2$
- Mass = mass of the parts + mass of the KE, PE, and heat



High Potential Energy → Low Potential Energy





Proton ← infinite distance → Electron, 0 PE

As they move, PE decreases and KE increases

Mass is a property that all energy exhibits

Simple Machines

Simple machines are devices that use only the forces directly applied and accomplish their task with a single motion.

INPUT		OUTPUT
$Work_{in}$	$=$	$Work_{out}$
$(F\,d)_{in}$	$=$	$(F\,d)_{out}$

$$MA = \frac{F_{out}}{F_{in}}$$

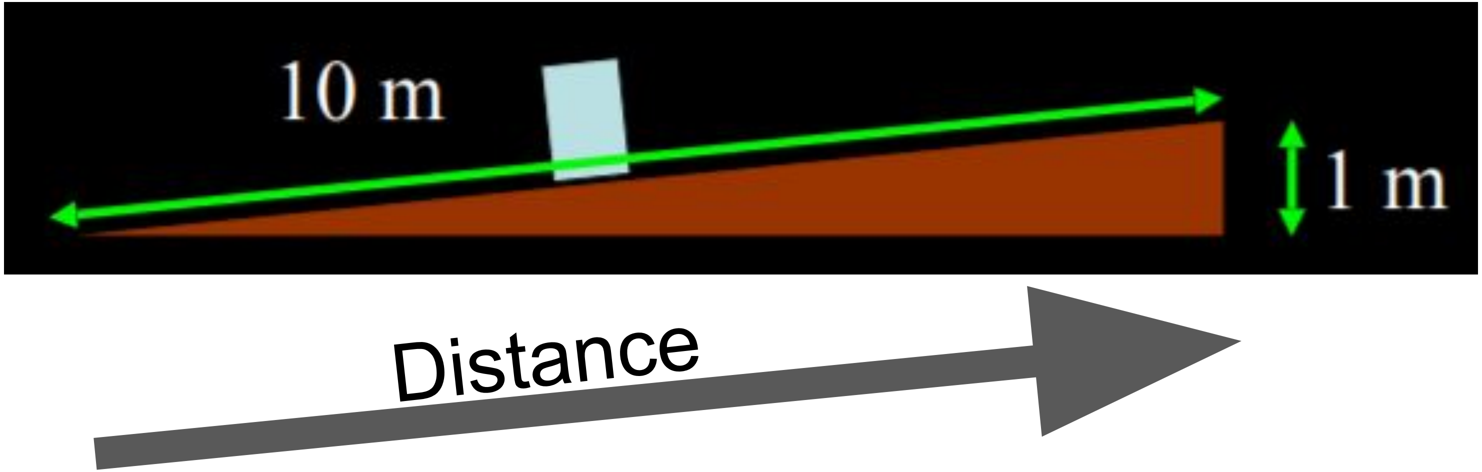
(Mechanical Advantage)

Ramp

Work = Force x Distance

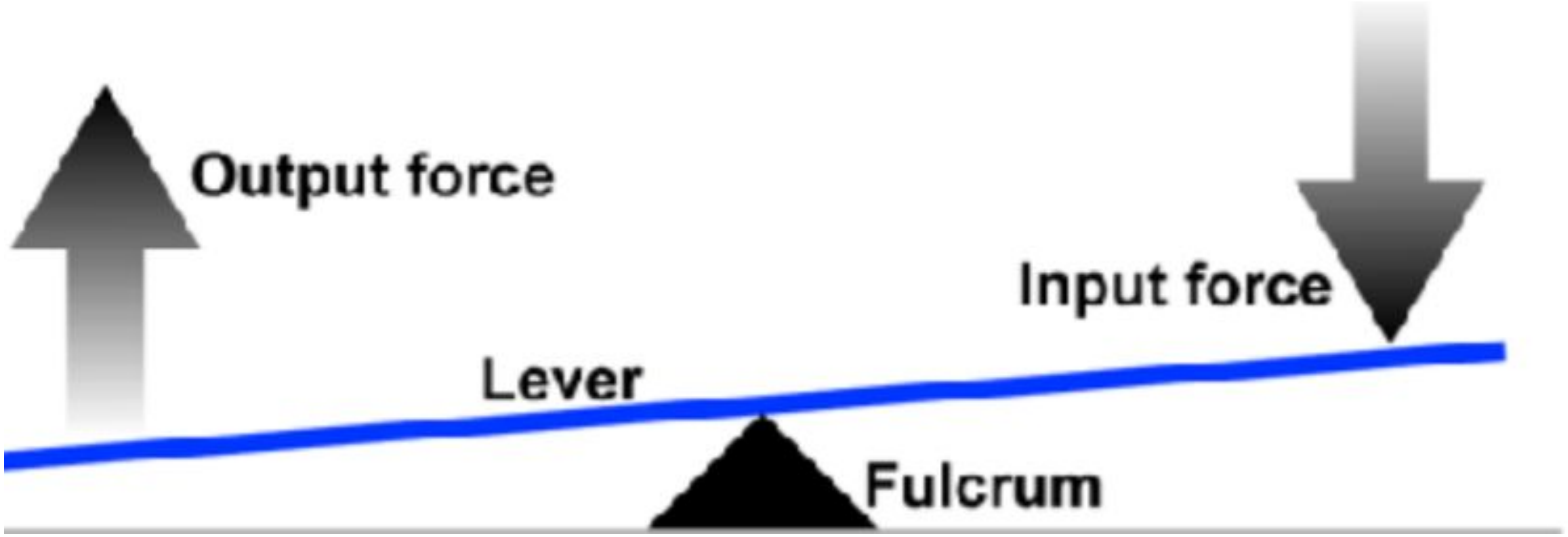
Distance = Path object takes

Force needed to move object

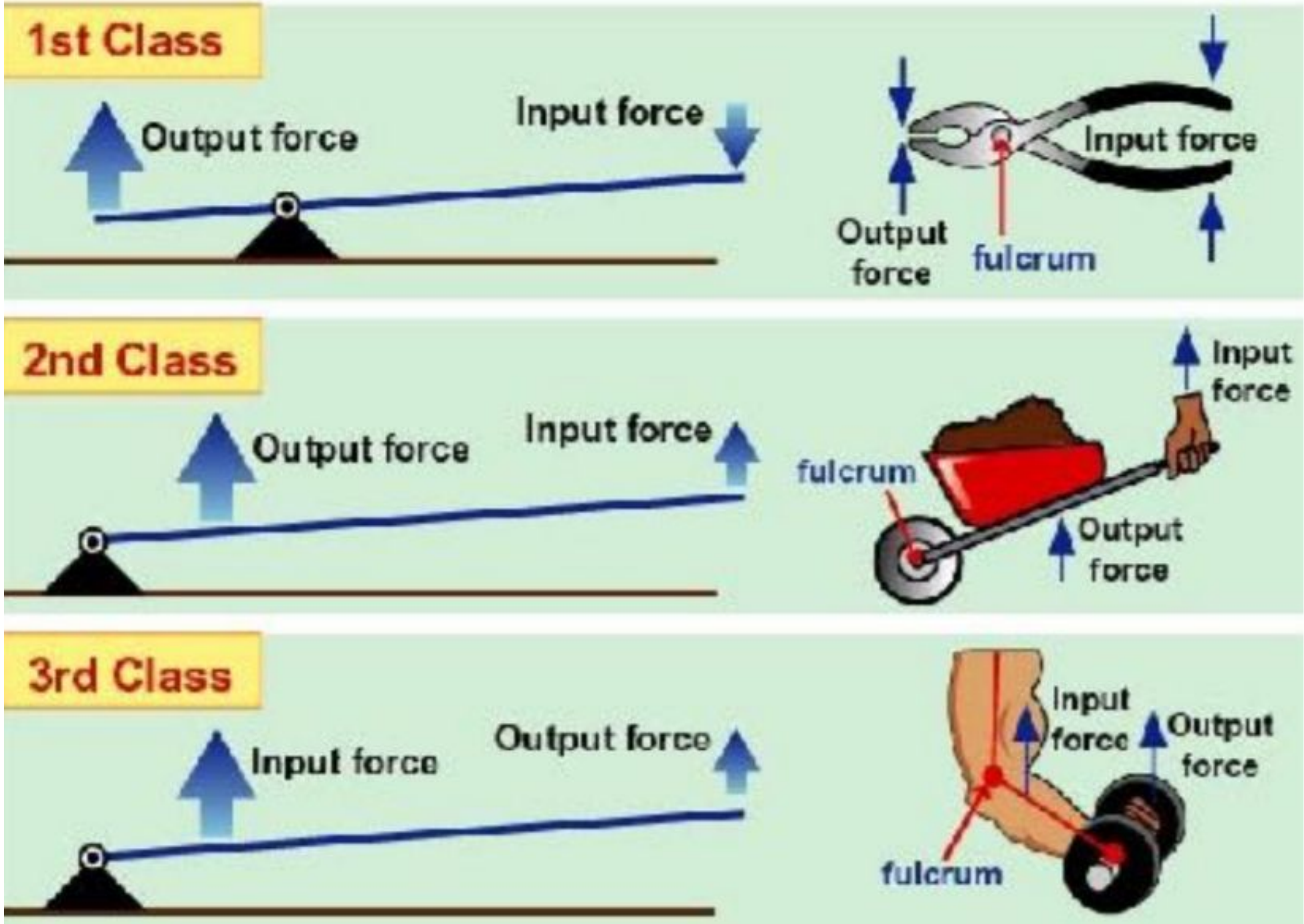


Lever

A lever includes a stiff structure (the lever) that rotates around a fixed point called the fulcrum.

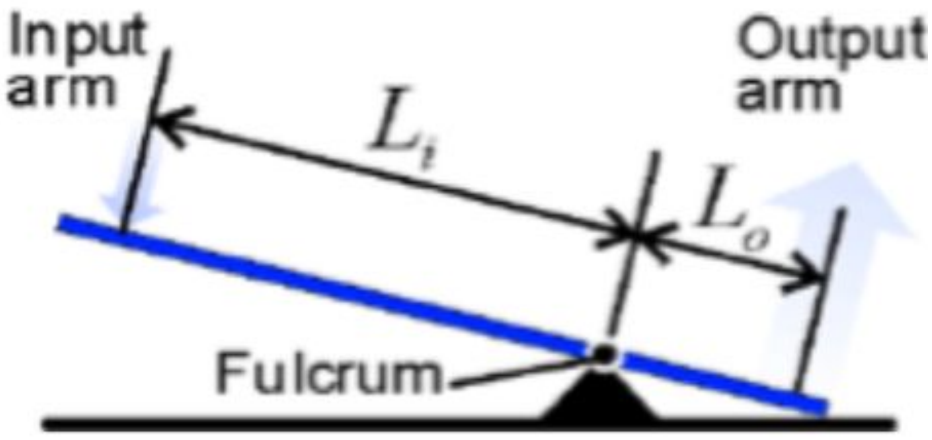


The 3 Classes of Levers



Mechanical Advantage Lever

$$MA_{lever} = L_{in}/L_{out}$$

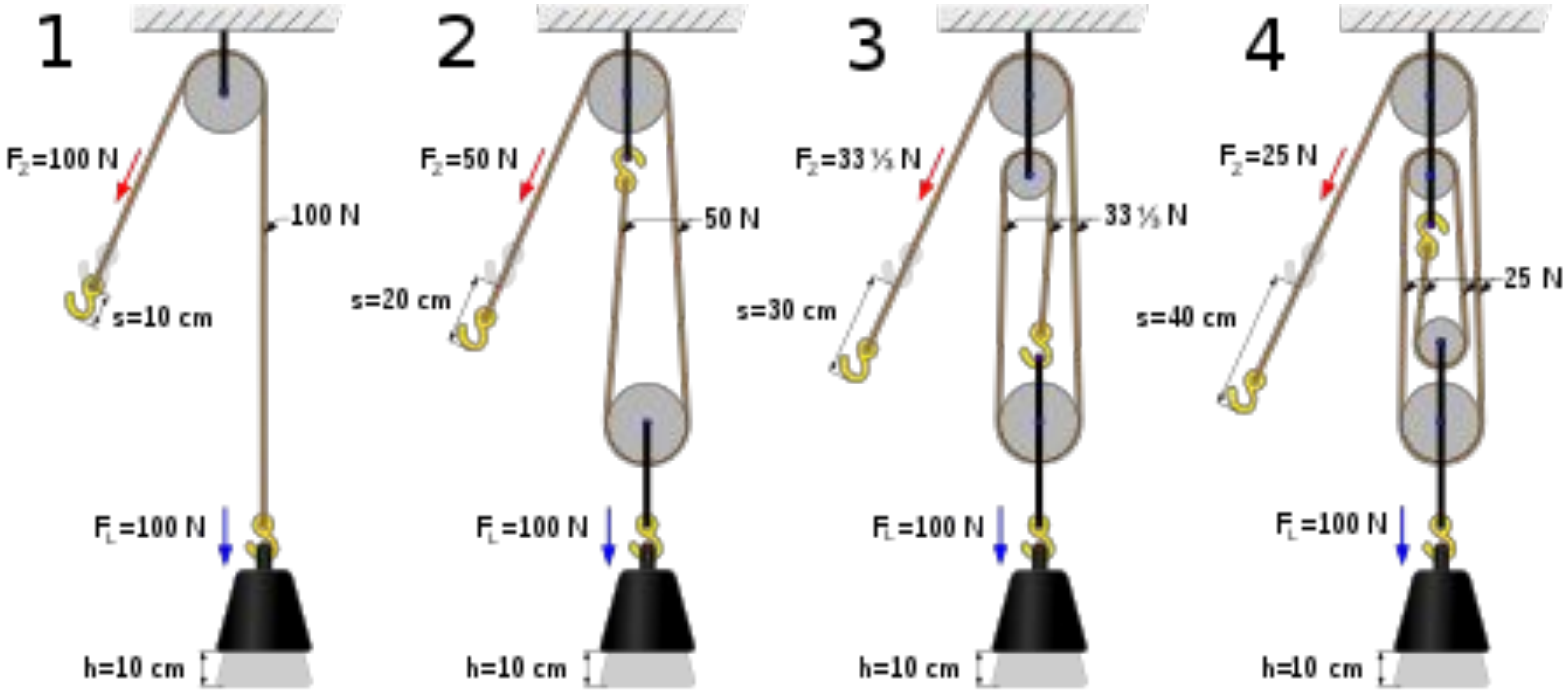


The Mechanical Advantage equal to

$$\frac{\text{Distance of Input Force to Fulcrum}}{\text{Distance of Output Force to Fulcrum}}$$

Pulleys

Like levers and ramps, pulleys sacrifice displacement to achieve greater force



Efficiency

Efficiency = Output Work / Input Work