Chapter 8 – Conservation of energy

I. Work done on a system by an external force

II. Conservation of mechanical energy

II. External work and thermal energy

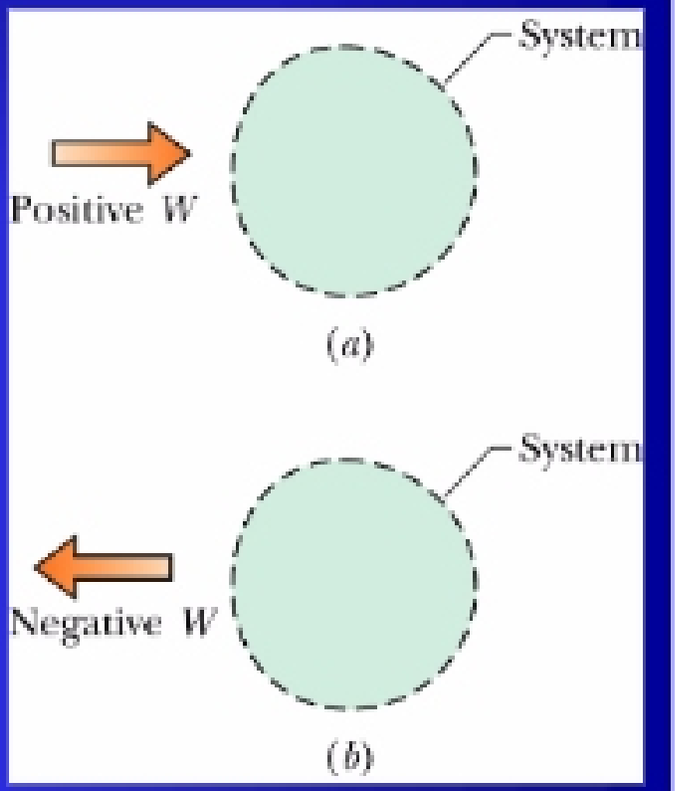
III. External forces and internal energy changes

IV. Power

I. Work done on a system by an external force

Work is energy transfer "to" or "from" a system by means of an external force acting on that system.

When more than one force acts on a system their net work is the energy transferred to or from the system.



No Friction: $W = \Delta E_{mec} = \Delta K + \Delta U \rightarrow$ **Ext. force**

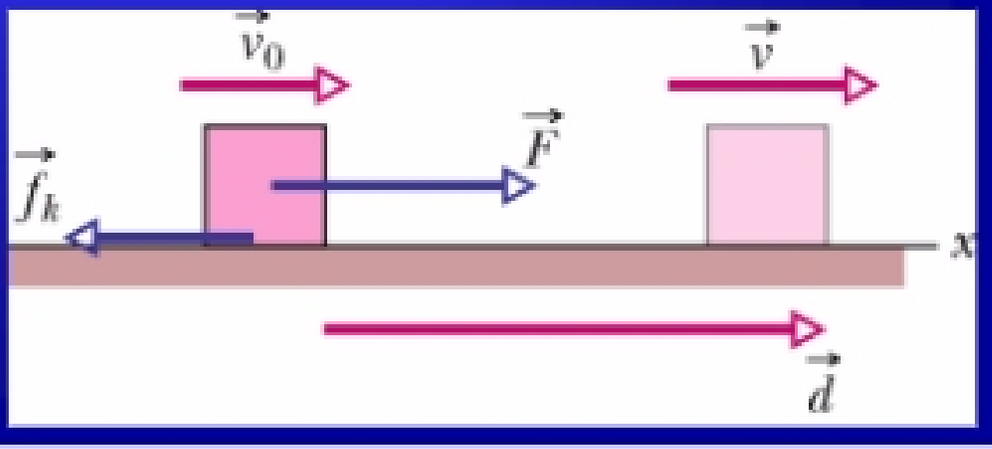
Remember! $\Delta E_{mec} = \Delta K + \Delta U = 0$ only when:

- System isolated.
- No ext. forces act on a system.
- All internal forces are conservative.

Friction:

$$F - f_k = ma$$

$$v^2 = v_0^2 + 2ad \rightarrow a = 0.5(v^2 - v_0^2)/d$$



$$F - f_k = \frac{m}{2d}(v^2 - v_0^2) \rightarrow Fd - f_k d = \frac{1}{2}m(v^2 - v_0^2) \rightarrow Fd = \frac{1}{2}mv^2 - \frac{1}{2}mv_0^2 + f_k d$$

$$W = Fd = \Delta K + f_k d$$

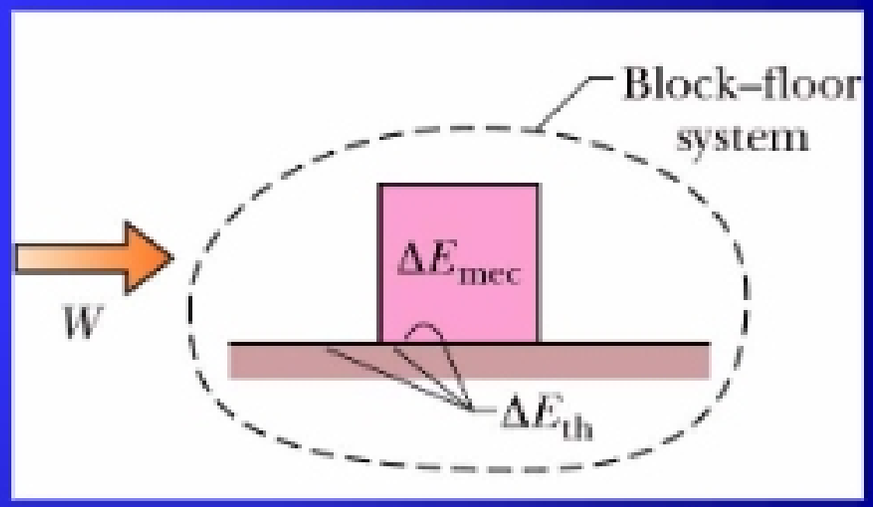
General:

$$W = Fd = \Delta E_{mec} + f_k d$$

Example: Block sliding up a ramp.

Thermal energy:

$$\Delta E_{th} = f_k d$$



Friction due to cold welding between two surfaces. As the block slides over the floor, the sliding causes tearing and reforming of the welds between the block and the floor, which makes the block-floor warmer.

Work done on a system by an external force, friction involved

$$W = Fd = \Delta E_{mec} + \Delta E_{th}$$