14.5 Mechanical Energy and Conservation of Mech. Energy

Def (Total chg in mech. energy of system) $\Delta E_m = \Delta K_{sys} + \Delta U_{sys}$

→ closed system, only conservative internal forces: $\Delta E_m = 0$

→ completely reversible processes: closed system, processes take place, only conservative forces act

14.7 Chg of Mech. En. for closed system w/ Internal Non-conserv. Forces

→ suppose internal forces are both conservative and non-conservative

$W = W_c + W_{nc}$

W_c ↗ path-indep.

W_{nc} ↘ path dep.

$W_c = -\Delta U \Rightarrow W = -\Delta U + W_{nc} = \Delta K$

$\Rightarrow W_{nc} = \Delta K + \Delta U = \Delta E_{mech}$

$\Delta E_{sys} = \Delta E_m - W_{nc} = 0$ energy conserved but some mech. en. transferred to non-recoverable energy W_{nc}
ie there is an irreversible process happening

14.7.1 Chg of Mech. En. for a Non-closed System

→ system now in contact w/ surroundings

→ $\Delta E_{sys} = -\Delta E_{surroundings}$

→ chg in energy of the system can be due to external work done on the sys.

$$W_{ext} = \int_A^B \vec{F}_{ext} \cdot d\vec{r}$$

$W_{ext} > 0 \Rightarrow \Delta E_{surround.} < 0$

→ chg in energy can also be due to thermal energy flowing in/out
This flow is denoted Q.
Convention: $Q > 0 \Rightarrow$ en. flows into sys, $\Delta E_{sur.} < 0$

$\Rightarrow W_{ext} + Q = \Delta E_{sys}$ (First Law of Thermodynamics)