

ENERGY & THE 1st LAW OF THERMO.

1st Law : concerning quantity of energy

Energy is conserved

(Amount of energy is constant, but can change forms)

(e.g. potential, kinetic, electrical, chemical, etc.)

$$E = \text{Total system energy} [J, kJ]$$

$$e = \frac{E}{m} \left[\frac{kJ}{kg} \right] (\text{specific energy})$$

Energy

— Macroscopic – system energy which value depends on a *reference point* (Kinetic Energy (KE), Potential Energy (PE))

— Microscopic – energy due to *molecular interactions & activity* (independent of any reference point) (Internal Energy, U)

Total System Energy

$$E = KE + PE + U \quad [\text{kJ}]$$

$$e = ke + pe + u \quad [\text{kJ/kg}]$$

Kinetic Energy (KE)

$$\begin{aligned} \text{KE} &= \frac{mV^2}{2} & \Delta\text{KE} &= \frac{m}{2} \left[\vec{V}_2^2 - \vec{V}_1^2 \right] \\ \text{ke} &= \frac{\text{KE}}{m} = \frac{V^2}{2} & \Delta\text{ke} &= \frac{\Delta\text{KE}}{m} = \frac{(V_2^2 - V_1^2)}{2} \end{aligned}$$

Potential Energy (PE)

$$\begin{aligned} \text{PE} &= mgz & \Delta\text{PE} &= mg(z_2 - z_1) \\ \text{pe} &= \frac{\text{PE}}{m} = gz & \Delta\text{pe} &= \frac{\Delta\text{PE}}{m} = g(z_2 - z_1) \end{aligned}$$

Internal Energy, U

— Molecular movement

(vibration, collision, etc)

sensible energy (molecular activity \propto temperature)

— Bond Energy between

molecules (phase change)

latent energy

(constant temperature)

— Bond Energy between atoms in a molecule

chemical energy

— Bond Energy between protons & neutrons in the nucleus

nuclear energy

Modes of Energy Transfer

Energy Interaction
between System and
Surrounding

Energy can cross the boundary
(transferred) by **2 methods**;

HEAT & WORK