Concept of Heat

Heat is defined as energy in transit. Heat can flow from a body or to a body. If a body is at a content temperature, it has both mechanical & thermal energies due to the molecular agitations and it is not possible to separate them. So, in this case, we cannot talk of heat energy. It means, if flow of heat stops, the word heat cannot be used. It is only used when there is transfer of energy between two or more systems.

Thus suppose two system A & B in thermal contact with one another and surrounded by adiabatic walls.

For the system A,

$$Q = U_2 - U_1 + W \quad \text{——— (1)}$$

where →

Q = heat energy
U_1 = initial internal energy.
U_2 = final internal energy.
W = work done.

Similarly for the system B,

$$Q' = U_2' - U_1 + W' \quad \text{——— (2)}$$

Adding eqn (1) & (2)

$$Q + Q' = (U_2 - U_1) + W + (U_2' - U_1') + W'$$

$$Q + Q' = [(U_2 + U_2') - (U_1 + U_1')] + (W + W') \quad \text{——— (3)}$$

The total change in the internal energy of the composited system

$$= [(U_2 + U_2')] - (U_1 + U_1')]$$

The work done by the composite system $= W + W'$

So, heat transferred by composite system
$= Q + Q'$.

Since composite system is surrounded by adiabatic walls and the net heat transffered is zero.

$\therefore \quad Q + Q' = 0$

or $\quad Q = -Q'$ ——— (4)

Thus, for two system A & B in thermal contact with each other and the composite system surrounded by adiabatic walls, the heat gained by one system is equal to the heat lost by the other system.

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