QUES 03:-

In changing the state of a gas adiabatically from an equilibrium state A to another equilibrium state B, an amount of work equal to 22.3 J is done on the system. If the gas is taken from state A to B via a process in which the net heat absorbed by the system is 9.35 cal, how much is the net work done by the system in the latter case? (Take 1 cal = 4.19 J)

Sol. The work done (W) in changing the state of system from A to B = 22.3 J.

In adiabatic process there is no exchange of heat.

$\therefore \Delta Q = 0$

$\Delta W = -22.3$ J (negative sign is due to work is done on the system)

From the first law of thermodynamics

$\Delta Q = \Delta U + \Delta W$

Where,

ΔU = Change in the internal energy of the gas

ΔW = work done

$\therefore \Delta U = \Delta Q - \Delta W = 0 - (-22.3) = 22.3$ Joule

The net heat absorbed by the system

$\Delta Q = 9.35$ calory $= 9.35 \times 4.19 = 39.1765$ Joule

Heat absorbed, $\Delta Q = \Delta U + \Delta W$ (by first law of thermodynamics)

$\therefore \Delta W = \Delta Q - \Delta U$

$= 39.1765 - 22.3$

$= 16.8765$ Joule

Therefore, 16.88 Joule of work is done by the system in changing the state.