Work Done During An Isothermal Process

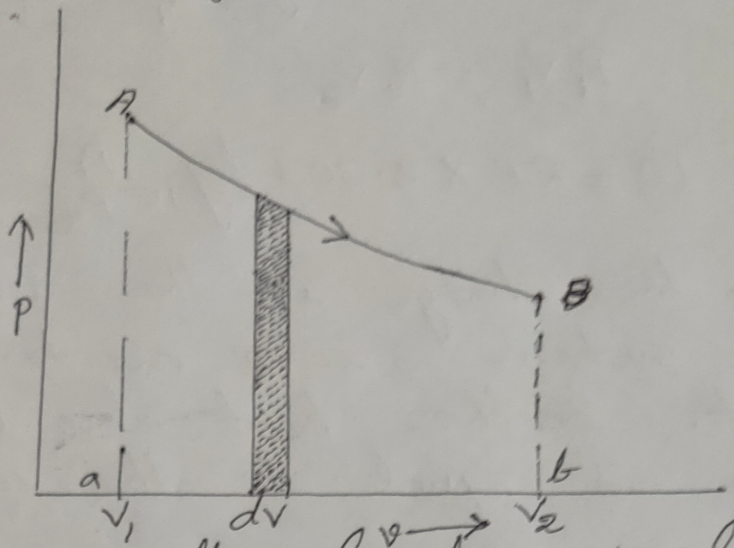

Fig:-1.

When a gas is allowed to expand isothermally, work is done by it.

Let the initial and final volumes be V_1 and V_2 respectively. Fig ① is indicator diagram. The area of the shaded strip represents the work done for a small change in volume dV, during changes in volume from V_1 to V_2.

$$\text{Work done} = \int_{V_1}^{V_2} P\,dV = \text{Area ABba}$$

Considering one gram molecule of the gas

$$PV = RT$$

or $$P = \frac{RT}{V}$$

$$\therefore W = RT \int_{V_1}^{V_2} \frac{dV}{V}$$

$$\therefore \quad W = RT \times 2.303 \log_{10} \frac{V_2}{V_1} \qquad \text{——— (1)}$$

Also $\quad P_1 V_1 = P_2 V_2$

$$W = RT \times 2.303 \log_{10} \frac{P_1}{P_2} \qquad \text{——— (2)}$$

Here, the change in the internal energy of the system is zero as temperature remains constant. So the heat absorbed by the system is equal to the work done by it.

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