Isochoric and Isobaric process

Isochoric process

Volume of a gas remains constant.

It is valid for a given mass of a gas.

Process equation is,

$$\frac{P}{T} = \text{Constant}$$

If a system undergoes change from A to B such that volume remains constant i.e. under the isochoric process then,

$$A \xrightarrow[\text{Process}]{\text{Isochoric}} B$$

(P_1, V, T_1) (P_2, V, T_2) $\therefore \frac{P_1}{T_1} = \frac{P_2}{T_2}$

In an isochoric process, work done by a gas is zero

i.e. $W = 0$ [V = constant]

The change in internal energy is given by,

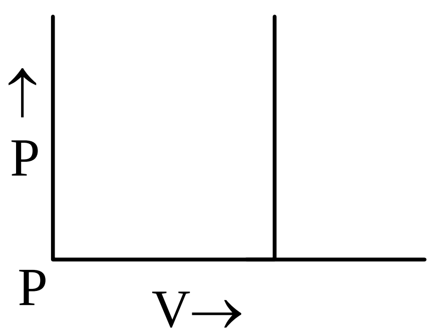
$$dU = nC_V.(T_2 - T_1)$$

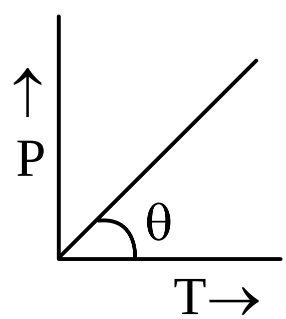
Heat supplied to a gas by first law of thermodynamics becomes,

$$dQ = dU$$
$$= nC_V (T_2 - T_1)$$

Hence for an isochoric process, heat supplied to the system is completely utilized to increase the internal energy.

A graph is plotted between pressure versus volume and pressure versus temperature which is,





Isobaric process

Pressure of a gas remains constant.

Process equation is,

$$\frac{V}{T} = \text{Constant}$$

If a system undergoes change from A to B such that pressure remains constant i.e. under the isobaric process then,

$$A \xrightarrow[\text{Process}]{\text{Isobaric}} B$$

$$(P, V_1, T_1) \qquad\qquad (P, V_2, T_2)$$

$$\therefore \quad \frac{V_1}{T_1} = \frac{V_2}{T_2}$$

In an isobaric process, work done by a gas is,

$$W = P(V_2 - V_1)$$

$$= nR\,(T_2 - T_1)$$

The change in internal energy is given by

$$dU = nC_V\,(T_2 - T_1)$$

Heat supplied to a gas,

$$dQ = nC_P\,(T_2 - T_1)$$

From first law of thermodynamics

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

$$nC_P\,(T_2 - T_1) = nR\,(T_2 - T_1) + nC_V\,(T_2 - T_1)$$

$$C_P - C_V = R$$