Thermodynamics
3rd lecture

DR. S.K. JHA
Asst. Prof (Guest)
Dept of chemistry.

Specific heat capacities of Gas (C)

Amount of heat required to raise the temperature by unit degree for unit mass of the substance is called specific heat capacity. It is indicated by 'C'.

$$C = \frac{Q}{m\Delta T}$$

Specific heat capacity of gas can vary from zero to infinity.

i.e

C_{Is} Heat Capacity (C) for Isothermal process $= \frac{Q}{m\Delta T}$

Here $\Delta T = 0$, So, $C = \infty$

Heat Capacity (C) for adiabatic process: $= \frac{Q}{m\Delta T}$

for adiabatic, $q = 0$, So $C = 0$.

Heat Capacity at Constant volume (C_v)

$$C_v = \frac{Q}{m\Delta T}$$

$$C_v = \frac{Q}{1 \times 1}$$

It is heat required to raise the temperature for 1 g of substance by 1° at constant volume. (C_v)

$C_v = Q$., unit of C_v J/g°C

Heat Capacity at Constant pressure: C_p

$C_p = \frac{Q}{m \times \Delta T}$, again $m = 1g$, $\Delta T = 1$ at Const P.

$C_p = Q$. unit, J/g°C

Molar heat Capacities of gas:-

The amount of heat required to raise the temperature by 1° for 1mole of gas is Called molar ~~gas~~ Heat Capacities.

Molar heat capacity of gas at constant volume Cv.

$$C_v = \frac{Q}{n\Delta T}$$

Here one mole of gas temperature is raised by 1° at constant volume.

Heat Capacity of gas at Constant Pressure:

$$C_p = \frac{Q}{n\Delta T}$$

cv & Cv:

cv (specific heat capacity of gas at constant volume) can be changed into (molar specific heat capacity at constant volume) as follows

$$C_v = c_v \times \text{molar mass}$$

Similarly

$$C_p = c_p \times \text{Molar mass}.$$

Relation between C_p & C_v for an ideal gas.

for an ideal gas $C_v = \frac{dE}{dT}$

$$C_p = \frac{dH}{dT}$$

$$C_p - C_v = \frac{dH}{dT} - \frac{dE}{dT}$$

we know

$$H = E + PV$$

& $PV = RT$ for one mole of gas.

$$H = E + RT$$

Differentiating with respect to temperature T.

$$\frac{dH}{dT} = \frac{dE}{dT} + R$$

or $\frac{dH}{dT} - \frac{dE}{dT} = R$

$C_p - C_v = R$ for one mole of gas

where $R = 1.978\ Cal.\ K^{-1} mol^{-1}$

$R = 8.314\ J K^{-1} mol^{-1}$