Mayer's Formula.

Out of two principle specific heats of a gas, Cp is more than Cv because in case of Cv, volume of gas is kept constant and heat is required only for raising the temperature of one gram mole of the gas through 1°C or 1 K.

No heat, what so ever, is spent in expansion of the gas.

It means that heat supplied to the gas increases its internal energy only i.e.

$$(\Delta Q)_v = \Delta U = \mu C_v \Delta T \quad \text{.....(i)}$$

While in case of Cp the heat is used in two ways

(i) In increasing the temperature of the gas by ΔT

(ii) In doing work, due to expansion at constant pressure (ΔW)

So $(\Delta Q)_p = \Delta U + \Delta W = \mu C_p \Delta T$ .....(ii)

From equation (i) and (ii) $\mu C_p \Delta T - \mu C_v \Delta T = \Delta W$

$\Rightarrow$ $\mu \Delta T(C_p - C_v) = P\Delta V$ [For constant P, $\Delta W = P\Delta V$]

$\Rightarrow$ $C_p - C_v = \dfrac{P\Delta V}{\mu \Delta T}$ [From $PV = \mu RT$, At constant pressure $P\Delta V = \mu R\Delta T$]

$\Rightarrow$ $C_p - C_v = R$

This relation is called Mayer's formula and shows that $C_p > C_v$ i.e. molar specific heat at constant pressure is greater than that at constant volume.