3. Consider two containers A and B containing identical gases at the same pressure, volume and temperature. The gas in container A is compressed to half of its original volume isothermally while the gas in container B is compressed to half of its original value adiabatically. The ratio of final pressure of gas in B to that of gas in A is

1) $\left(\frac{1}{1-\gamma}\right)^2$
2) $\left(\frac{1}{\gamma-1}\right)^2$
3) $\left(\frac{1}{2}\right)^{\gamma-1}$
4) $2^{\gamma-1}$

Sol. 4) $2^{\gamma-1}$

for container A (gas is compressed to half of its original volume) Isothermal compression

$\Rightarrow P_1V_1 = P_2V_2$

Let original volume be $2V_0$ then after compression it becomes V_0

$\Rightarrow P_0(2V_0) = P_2(V_0)$

$\Rightarrow P_2 = 2P_0$ ...(1)

For container B (gas is compressed to half of its original volume) Adiabatic compression

$\Rightarrow P_1V_1^{\gamma} = P_2V_2^{\gamma}$

Let original volume be $2V_0$ then after compression it becomes V_0

$= P_1(2V_0)^{\gamma} = P_2(V_0)^{\gamma}$

$\Rightarrow P_2 = \left(\frac{2V_0}{V_0}\right)^{\gamma} P_0$

$\Rightarrow P_2 = 2^{\gamma}P_0$..... (2)

Ratio of final pressure of gas in B to that of gas in A will be obtained by (2) / (1)

$= \frac{2^{\gamma}}{2}$

$= 2^{\gamma-1}$