Answer on Question #53683, Physics Mechanics Kinematics Dynamics

Define molar specific heat of a gas at constant volume (C_V) and constant pressure (C_p). Obtain the ratio C_p/Cv for a hydrogen gas using the law of equipartition of energy.

Solution

If $\Delta V = const$ then $Q = \Delta U = \frac{i}{2} nR\Delta T$ (where n number of moles; $R = 8.314 J/(K \cdot mol)$ is the gas constant; i is the number of degrees of freedom), and $C_V = \frac{Q}{v\Delta T} = \frac{i}{2} R$.

If $\Delta p = const$ then $Q = \Delta U + A = \frac{i}{2} nR\Delta T + nR\Delta T = \frac{i+2}{2} nR\Delta T$ and $C_P = \frac{Q}{v\Delta T} = \frac{i+2}{2} R$.

For a diatomic gas (such as hydrogen), the number of degrees of freedom $i = 5$.

So, $C_P / C_V = \frac{i+2}{i} = \frac{5+2}{5} = 7/5$.

Answer: $C_P / C_V = \frac{i+2}{i} = 7/5$