Physics Formula Sheet

Chapter by chapter, topic by topic. Written by the PadhoNa team for quick revision.

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CHAPTER 15

Kinetic Theory of Gases

Ideal gas and kinetic theory

$$PV = nRT = Nk_BT, \qquad P = \tfrac{1}{3}\rho v_{\text{rms}}^2$$

AVERAGE KE

$$\bar{E} = \tfrac{3}{2}k_BT \text{ per molecule (translational)}$$

Molecular speeds and mean free path

$$v_{\text{rms}} = \sqrt{\frac{3RT}{M}}, \qquad v_{\text{avg}} = \sqrt{\frac{8RT}{\pi M}}, \qquad v_{\text{mp}} = \sqrt{\frac{2RT}{M}}$$

MEAN FREE PATH

$$\lambda = \frac{1}{\sqrt{2}\,\pi d^2 n} = \frac{k_BT}{\sqrt{2}\,\pi d^2 P}$$

Degrees of freedom and specific heats

EQUIPARTITION

$$\tfrac{1}{2}k_BT \text{ per degree of freedom;} \qquad U = \frac{f}{2}nRT$$

$$C_v = \frac{f}{2}R, \qquad C_p = C_v + R, \qquad \gamma = 1 + \frac{2}{f}$$

VALUES OF F

$$\text{monatomic } 3\ (\gamma = \tfrac{5}{3}); \qquad \text{diatomic } 5\ (\gamma = \tfrac{7}{5}); \qquad \text{non-linear polyatomic } 6\ (\gamma = \tfrac{4}{3})$$

MIXTURE

$$C_v = \frac{n_1C_{v1} + n_2C_{v2}}{n_1 + n_2}$$

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