Physics Formula Sheet

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

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CHAPTER 26

Ray Optics

Reflection and mirrors

MIRROR FORMULA

$$\frac{1}{v}+\frac{1}{u}=\frac{1}{f}, \qquad f=\frac{R}{2}, \qquad m=-\frac{v}{u}$$

Use the sign convention: distances measured from the pole, along the incident light positive.

PLANE MIRRORS

$$\text{images of an object between mirrors at angle } \theta: \; n=\frac{360^\circ}{\theta}-1 \;\; (\text{if } 360^\circ/\theta \text{ is even})$$

ROTATING MIRROR

$$\text{mirror turns by } \theta \Rightarrow \text{reflected ray turns by } 2\theta$$

Refraction and total internal reflection

SNELL'S LAW

$$n_1 \sin i = n_2 \sin r, \qquad n=\frac{c}{v}$$

APPARENT DEPTH

$$d'=\frac{d}{n}; \qquad \text{shift}= t\left(1-\frac{1}{n}\right)$$

CRITICAL ANGLE

$$\sin C=\frac{1}{n} \;\; (\text{denser to rarer, into air})$$

SPHERICAL SURFACE

$$\frac{n_2}{v}-\frac{n_1}{u}=\frac{n_2-n_1}{R}$$

Lenses

LENS FORMULA

$$\frac{1}{v}-\frac{1}{u}=\frac{1}{f}, \qquad m=\frac{v}{u}$$

LENS MAKER'S FORMULA

$$\frac{1}{f}=(n-1)\left(\frac{1}{R_1}-\frac{1}{R_2}\right)$$

POWER AND COMBINATIONS

$$P=\frac{1}{f}\ (\text{in m}); \qquad P=P_1+P_2\ (\text{in contact}); \qquad \frac{1}{F}=\frac{1}{f_1}+\frac{1}{f_2}-\frac{d}{f_1 f_2}$$

DISPLACEMENT METHOD

$$f=\frac{D^2-x^2}{4D}$$

Prism and dispersion

$$A=r_1+r_2, \qquad \delta=i+e-A$$

MINIMUM DEVIATION

$$n=\frac{\sin\frac{A+\delta_m}{2}}{\sin\frac{A}{2}}$$

THIN PRISM

$$\delta=(n-1)A$$

DISPERSION

$$\theta=(n_v-n_r)A, \qquad \omega=\frac{n_v-n_r}{n_y-1}$$

ACHROMATIC / NO DEVIATION

$$\frac{\omega_1}{f_1}+\frac{\omega_2}{f_2}=0; \qquad (n_1-1)A_1=(n_2-1)A_2$$

Optical instruments

SIMPLE MICROSCOPE

$$m=1+\frac{D}{f}\ (\text{image at } D), \qquad m=\frac{D}{f}\ (\text{at infinity})$$

COMPOUND MICROSCOPE

$$m=\frac{v_o}{u_o}\left(1+\frac{D}{f_e}\right); \qquad \text{at infinity } m\approx\frac{L}{f_o}\cdot\frac{D}{f_e}$$

TELESCOPE

$$m = \frac{f_o}{f_e}\ (\text{normal adjustment}), \qquad L = f_o + f_e$$

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