PHYS 202

Basic Equations and Constants

This sheet may be used on all tests and the final exam.

$\varepsilon_0 = 8.85 \times 10^{-12}\,\text{F/m}$ $\quad k = \dfrac{1}{4\pi\varepsilon_0} = 9\times 10^9\,\text{N}\cdot\text{m}^2/\text{C}^2$ $\quad \mu_0 = 4\pi \times 10^{-7}\,\text{N/A}^2$

$e = -1.60 \times 10^{-19}\,\text{C}$ $\quad N_A = 6.02\times 10^{23}/\text{mole}$ $\quad b = 2.898\times 10^{-3}\,\text{m}\cdot\text{K}$

$h = 6.626\times 10^{-34}\,\text{J}\cdot\text{s}$ $\quad h = 4.135\times 10^{-15}\,\text{eV}\cdot\text{s}$ $\quad c = 2.9979\times 10^{8}\,\text{m/s}$

$m_e = 9.11\times 10^{-31}\,\text{kg}$ $\quad m_p = 1.6726\times 10^{-27}\,\text{kg}$ $\quad m_\alpha = 4.002603\,\text{u}$

$R_\infty = 10{,}973{,}731/\text{m}$ $\quad 1\,\text{u} = 931.5\,\text{MeV}$ $\quad F = k\dfrac{q_1 q_2}{r^2}$

$\mathbf{F} = q\mathbf{E}$ $\quad V = k\dfrac{Q}{r} = \dfrac{Q}{4\pi\varepsilon_0 r}$ $\quad C = \dfrac{Q}{V}$

$C_p = C_1 + C_2 + C_3 + \ldots$ $\quad \dfrac{1}{C_s} = \dfrac{1}{C_1} + \dfrac{1}{C_2} + \dfrac{1}{C_3} + \ldots$ $\quad W = \tfrac{1}{2}CV^2$

$C = \dfrac{\kappa\varepsilon_0 A}{d}$ $\quad I = \dfrac{\Delta q}{\Delta t}$ $\quad R = \dfrac{V}{I}$ $\quad P = IV$

$R = \rho\dfrac{L}{A}$ $\quad \dfrac{1}{R_p} = \dfrac{1}{R_1} + \dfrac{1}{R_2} + \dfrac{1}{R_3} + \ldots$ $\quad R_s = R_1 + R_2 + R_3 + \ldots$

$\text{TPD} = \dfrac{R}{r+R}\mathcal{E}$ $\quad (1+x)^n = 1 + nx + \dfrac{n(n-1)x^2}{2} + \ldots$ $\quad \tau = pE\sin\theta$

$\tau = \mu B\sin\theta$ $\quad F = IlB\sin\theta$ $\quad F = qvB\sin\theta$ $\quad \mu = NIA$

$\Delta\phi_m = B\Delta A\cos\theta$ $\quad \mathcal{E} = -N\dfrac{\Delta\phi}{\Delta t}$ $\quad \mathcal{E} = Blv\sin\theta$ $\quad P = I^2R = \dfrac{V^2}{R}$

$V = V_0\sin\omega t$ $\quad V_{\text{rms}} = \dfrac{V_0}{\sqrt{2}}$ $\quad L = \dfrac{N\phi_m}{I}$ $\quad \dfrac{V_1}{V_2} = \dfrac{N_1}{N_2}$

$W = \tfrac{1}{2}LI^2$ $\quad \tau_L = L/R$ $\quad \tau_C = RC$ $\quad v = f\lambda$

$n = \dfrac{c}{v}$ $\quad n_1\sin\theta_1 = n_2\sin\theta_2$ $\quad \dfrac{1}{i} + \dfrac{1}{o} = \dfrac{1}{f}$ $\quad m = -\dfrac{i}{o}$

$M = \dfrac{\theta'}{\theta}$ $\quad f = \dfrac{R}{2}$ $\quad M = \dfrac{25\,\text{cm}}{\text{f}}$ $\quad M = -\dfrac{f_o}{f_e}$

$M = m_o M_e = \left(-\dfrac{16.0\,\text{cm}}{f_o}\right)\left(\dfrac{25\,\text{cm}}{f_e}\right)$ $\quad \sin\theta_c = \dfrac{n_2}{n_1}$ $\quad \tan\theta_B = \dfrac{n_t}{n_i}$

$n\lambda = d\sin\theta$ (maxima) $\quad f - \text{number} = \dfrac{f}{d}$ $\quad \theta_m = 1.22\dfrac{\lambda}{D}$ $\quad I = I_0\cos^2\theta$

$u = \dfrac{u' + v}{1 + u'v/c^2}$ $\quad l = l_0\sqrt{1 - v^2/c^2}$ $\quad \Delta t = \dfrac{\Delta t_0}{\sqrt{1 - v^2/c^2}}$ $\quad m = \dfrac{m_0}{\sqrt{1 - v^2/c^2}}$

$f = f_0\sqrt{\dfrac{1 + v/c}{1 - v/c}}$ (approaching) $\quad f = f_0\left(1 + \dfrac{gh}{c^2}\right)$ $\quad E = mc^2$ $\quad \text{KE} = mc^2 - m_0c^2$

$A = N\lambda$ $\quad N = N_0e^{-\lambda t}$ $\quad t_{1/2} = \dfrac{0.693}{\lambda}$ $\quad N = N_0e^{-0.693\,t/t_{1/2}}$

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$$\frac{1}{\lambda} = R_\infty\left(\frac{1}{n_f^2} - \frac{1}{n_i^2}\right) \qquad \lambda_{max}T = 0.29\times10^{-2}\ \text{m}\cdot\text{K} \qquad E = hf = \frac{hc}{\lambda}$$

$$\text{KE}_{max} = hf - \phi \qquad E = 10.2(Z-1)^2\ \text{eV} \qquad \lambda = \frac{h}{p} \qquad \lambda' - \lambda = \frac{h}{mc}(1-\cos\theta)$$

$$\Delta x\Delta p \geq \frac{h}{2\pi} \qquad \Delta E\Delta t \geq \frac{h}{2\pi} \qquad r = R_0 A^{1/3} \qquad \text{KE}_\alpha = \left(\frac{A}{A+4}\right)Q$$

$$\text{KE}_{th} = (1 + m_A/m_B)|Q| \qquad n\lambda = 2d\sin\theta \quad \text{(Bragg)}$$

$$V = \frac{I_{max} - I_{min}}{I_{max} + I_{min}} \qquad \gamma = \frac{I_1 + I_2}{2\sqrt{I_1 I_2}}V \qquad j = I/A = nev \qquad \mu = v/E \qquad \sigma = ne\mu$$