

Equation sheet for PHY 300 exam 1 (this version as of the morning of March 6). You will be given this sheet in class.

$$A \cos \omega_1 t + A \cos \omega_2 t = 2A \cos\left(\frac{\omega_1 + \omega_2}{2}t\right) \cos\left(\frac{\omega_1 - \omega_2}{2}t\right) \Rightarrow 2Ae^{i\bar{\omega}t} \cos(\Delta\omega t)$$

$$\text{Random phases: } |R| = \sqrt{\sum_{i=1}^N NA_i^2} \Rightarrow \sqrt{N}|A| \quad \text{Identical phases: } |R| = N|A|$$

$$\frac{d^2x}{dt^2} + \gamma \frac{dx}{dt} + \omega_0^2 x = \frac{F_0}{m} \cos \omega t \quad (4-7)$$

$$\omega_0^2 = \frac{k}{m} \quad \gamma = \frac{b}{m} \quad (3-30) \quad Q = \frac{\omega_0}{\gamma} \quad (3-37)$$

$$A(\omega) = \frac{F_0/m}{[(\omega_0^2 - \omega^2)^2 + (\gamma\omega)^2]^{1/2}} = \frac{F_0}{k} \frac{\omega_0/\omega}{[(\frac{\omega_0}{\omega} - \frac{\omega}{\omega_0})^2 + \frac{1}{Q^2}]^{1/2}} \quad (4-11; 4-14)$$

$$\tan \delta(\omega) = \frac{\gamma\omega}{\omega_0^2 - \omega^2} = \frac{1/Q}{\frac{\omega_0}{\omega} - \frac{\omega}{\omega_0}} \text{ for } A \cos(\omega t - \delta) \quad (4-11; 4-14)$$

$$P_{\max} = \frac{QF_0^2}{2m\omega_0} \quad (4-24) \quad \bar{P}(\omega) = \frac{F_0^2\omega_0}{2kQ} \frac{1}{(\frac{\omega_0}{\omega} - \frac{\omega}{\omega_0})^2 + \frac{1}{Q^2}} \quad (4-23)$$

$$\omega^2 = \omega_0^2 - \frac{\gamma^2}{4} \quad (3-34) \quad \Delta\omega = \frac{\omega_0}{2Q} \quad (4-27) \quad E(t) = E_0 e^{-\gamma t} \quad (3-36)$$

$$\omega'^2 = \omega_0^2 + 2\omega_c^2 \quad \omega_n = 2\omega_0 \sin\left[\frac{n\pi}{2(N+1)}\right] \quad (5-25) \quad A_{pn} = C_n \sin\left[\frac{pn\pi}{N+1}\right] \quad (5-26)$$

$$\frac{\partial^2\psi}{\partial x^2} = \frac{1}{v_p^2} \frac{\partial^2\psi}{\partial t^2} \quad (7-9) \quad v_p = \frac{\omega}{k} \quad (7-27) \quad v_g = \frac{d\omega}{dk} \quad (7-28) \quad v_p = \sqrt{\frac{T}{\mu}}$$

$$\sin \theta \simeq \theta - \frac{\theta^3}{3!} \quad \cos \theta \simeq 1 - \frac{\theta^2}{2!} \quad e^x \simeq 1 + x \quad \sin^2 \frac{\beta}{2} = \frac{1}{2}(1 - \cos \beta)$$

$$\sin(\alpha \pm \beta) = \sin \alpha \cos \beta \pm \cos \alpha \sin \beta \quad \cos(\alpha \pm \beta) = \cos \alpha \cos \beta \mp \sin \alpha \sin \beta$$

$$\sin \alpha + \sin \beta = 2 \sin \frac{\alpha + \beta}{2} \cos \frac{\alpha - \beta}{2} \quad \cos \alpha + \cos \beta = 2 \cos \frac{\alpha + \beta}{2} \cos \frac{\alpha - \beta}{2}$$