

PHYS 1312 Fall 2016 Test 2

Equation Sheet

Test 1 equations

$$v = f\lambda \quad \omega = 2\pi f \quad f = 1/T \quad v_{\text{sound}} = \left(\frac{\gamma k_B T}{m}\right)^{1/2} \quad (1)$$

$$y(x, t) = A \sin(kx \mp \omega t + \phi_0) = A \sin \varphi \quad k = 2\pi/\lambda \quad (2)$$

$$\Delta\varphi = \frac{2\pi}{\lambda}\Delta x + \Delta\phi_0 = m2\pi \quad f_o = f_s \left(\frac{1 \pm v_0/v}{1 \mp v_s/v}\right) \quad (3)$$

$$f_n^{oo} = n \frac{v}{2L} \quad f_n^{oc} = n \frac{v}{4L} \quad (4)$$

$$n = \frac{c}{v} \quad n_1 \sin \theta_1 = n_2 \sin \theta_2 \quad (5)$$

$$\frac{1}{p} + \frac{1}{q} = \frac{1}{f} \quad \frac{n_1}{p} + \frac{n_2}{q} = \frac{n_2 - n_1}{R} \quad \frac{1}{f} = (n - 1) \left(\frac{1}{R_1} - \frac{1}{R_2} \right) \quad (6)$$

$$f = \frac{R}{2} \quad M = \frac{h'}{h} = \frac{-q}{p} \quad I \propto \frac{D^2}{f^2} \quad (7)$$

$$f\text{-number} = f/D \quad P = \frac{1}{f} \quad m = \frac{\theta}{\theta_0} \quad m_{\text{max}} = 1 + \frac{25 \text{ cm}}{f} \quad (8)$$

$$M_0 = \frac{-L}{f_0} \quad M = M_0 m_e = -\frac{L}{f_0} \frac{25 \text{ cm}}{f_e} \quad m = -\frac{f_0}{f_e} \quad (9)$$

Test 2 equations

$$\delta = r_2 - r_1 = d \sin \theta_{\text{bright}} = m\lambda \quad d \sin \theta_{\text{dark}} = \left(m + \frac{1}{2}\right)\lambda \quad (10)$$

$$y_{\text{bright}} \approx \frac{\lambda L m}{d} \quad y_{\text{dark}} \approx \frac{\lambda L}{d} \left(m + \frac{1}{2}\right) \quad I = I_{\text{max}} \cos^2(\phi/2) \quad (11)$$

$$E(t) = E_0 \sin(\omega t + \phi) \quad \phi = \frac{2\pi}{\lambda} \delta \quad (12)$$

$$\beta = \frac{2\pi}{\lambda} a \sin \theta \quad a \sin \theta_{\text{dark}} = m\lambda \quad I = I_{\text{max}} \left[\frac{\sin(\beta/2)}{\beta/2} \right]^2 \quad (13)$$

$$\theta_{\min} = \frac{\lambda}{a} \quad \theta_{\min} = 1.22 \frac{\lambda}{D} \quad R = \frac{\lambda_{\text{avg}}}{\Delta\lambda} = Nm \quad (14)$$

$$\delta = 2d \sin \theta = m\lambda \quad (15)$$

$$\vec{F}_e = \frac{k_e q_1 q_1}{r^2} \hat{r} \quad k_e = \frac{1}{4\pi\epsilon_0} \quad \vec{E} = \vec{F}_e/q \quad (16)$$

$$|\vec{E}_{\text{axis}}| \approx \frac{k_e 2qs}{r^3} \quad |\vec{E}_{\text{perp}}| \approx \frac{k_e qs}{r^3} \quad \vec{p} = q\vec{s} \quad (17)$$

Math relations and constants

$$\sin(A \pm B) = \sin A \cos B \pm \cos A \sin B \quad (18)$$

$$\cos(A \pm B) = \cos A \cos B \mp \sin A \sin B \quad (19)$$

$$\sin x = x - \frac{x^3}{3!} + \frac{x^5}{5!} - \dots \quad \cos x = 1 - \frac{x^2}{2!} + \frac{x^4}{4!} \dots \quad (20)$$

$$\frac{d}{dx} \left[\frac{u}{v} \right] = \frac{1}{v} \frac{du}{dx} - \frac{u}{v^2} \frac{dv}{dx} \quad (21)$$

$$(1 + \epsilon)^n \approx 1 + n\epsilon, \epsilon \ll 1 \quad (22)$$

$$\text{Circumference} = 2\pi r \quad A = \pi r^2 \quad V = \frac{4}{3}\pi r^3 \quad (23)$$

$$c = 3 \times 10^8 \text{ m/s} \quad k_e = 8.99 \times 10^9 \text{ Nm}^2/\text{C}^2 \quad \epsilon_0 = 8.854 \times 10^{-12} \text{ C}^2/(\text{Nm}^2) \quad (24)$$

$$e = 1.602 \times 10^{-19} \text{ C} \quad m_e = 9.11 \times 10^{-31} \text{ kg} \quad k_B = 1.38 \times 10^{-23} \text{ J/K} \quad (25)$$