

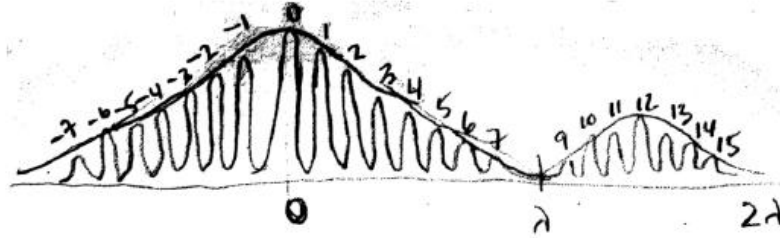
Section A - Multiple Choice

1. C
2. A
3. D
4. B
5. A
6. D
7. D
8. D
9. A
10. A
11. C
12. B (this question is vague and will be replaced after W16)
13. D
14. A
15. E
16. E (small angle approximation doesn't hold)
17. E
18. A
19. B
20. B

Section B – Problems

1.
 - (a) $\omega = 105 \text{ rad/s}$
 - (b) $x(t) = 0.06\text{m} \sin(105t + 0.524)$
 - (c) $x = -0.06 \text{ m}$
 - (d) $a = 658 \text{ m/s}^2$
 - (e) $k = 43.9\text{kN/m}$
2.
 - (a) $T = 5.3 \text{ s}$
 - (b) $v = 0.237 \text{ m/s}$
 - (c) $g = 2.81 \text{ m/s}^2$
 - (d) $E = 0.0422 \text{ J}$
- 3A
 - (a) $y(x,t) = .25 \sin\left(\frac{\pi}{3}x + 40\pi t\right)$
 - (b) $\frac{\lambda}{2} = 3\text{cm}$
- 3B $\lambda_1 = 1.05 \text{ m}, \lambda_2 = 0.740 \text{ m}$
- 3C a) 9 b) 9.54 dB
4.
 - (a) $f_{\text{beat}} = 9.2 \text{ kHz}$
 - (b) $L_{\text{open-closed}} = 0.425\text{m}, L_{\text{open-open}} = 0.567\text{m}$
5.
 - (a) thickness = 470.5nm
 - (b) $\lambda = 1.15\text{m}$

- 6A (a) 15 bright fringes in central diffraction maximum
 (b) $I/I_{max} = 5.78 \times 10^{-5}$ (this answer is extremely sensitive to rounding)
 (c)



- 6B $D = 1.88 \text{ m}$ (Rayleigh Criterion)

- 7A (a) $\phi = 5.05 \text{ eV}$
 (b) $\lambda = 169 \text{ nm}$
 (c) 1.19×10^{17} photons
- 7B (a) $\Delta\lambda = 1.596 \times 10^{-12} \text{ m}$
 (b) $K = 3.51 \times 10^{-14} \text{ J}$
- 8A (a) $E_3 = 6.7 \times 10^{-17} \text{ J}$
 (b) $\lambda = 0.060 \text{ nm}$
- 8B (a) $n = 4, n = 2$
 (b) $\lambda = 487 \text{ nm}$
- 9A (a) $l = 9.0 \times 10^{10} \text{ m}$
 (b) $t' = 375 \text{ s}$
- 9B (a) $t = 21 \text{ y}$
 (b) 14.7 ly
 (c) 10.5 ly
- 10A (a) $K = 1.4 \times 10^5 \text{ eV}$
 (b) $E = 6.51 \times 10^5 \text{ eV}$
 (c) $v = 0.62c$
- 10B (a) $E = 1.08 \times 10^{14} \text{ J}$
 (b) $P = 2.7 \times 10^{19} \text{ W}$