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) $\omega = 105$ rad/s
   (b) $x(t) = 0.06\text{m} \sin(105t + 0.524)$
   (c) $x = -0.06$ m
   (d) $a = 658$ m/s^2
   (e) $k = 43.9$kN/m

2. (a) $T = 5.3$ s
   (b) $v = 0.237$ m/s
   (c) $g = 2.81$ m/s^2
   (d) $E = 0.0422$ J

3A (a) $y(x,t) = .25\sin(\frac{\pi}{3}x + 40\pi t)$

   (b) $\frac{\lambda}{2} = 3cm$

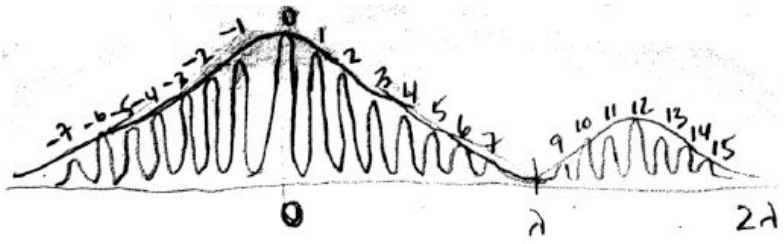
3B $\lambda_1 = 1.05$ m, $\lambda_2 = 0.740$ m

3C a) 9 b) 9.54 dB

4. (a) $f_{beat} = 9.2$ kHz
   (b) $L_{open\text{-}closed} = 0.425$m, $L_{open\text{-}open} = 0.567$m

5. (a) thickness = 470.5nm
   (b) $\lambda = 1.15$m

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



6B D = 1.88 m (Rayleigh Criterion)

7A (a) $\phi = 5.05$ eV
(b) $\lambda = 169$ nm
(c) 1.19E17 photons
7B (a) $\Delta\lambda = 1.596\text{x}10^{-12}$ m
(b) $K = 3.51\text{x}10^{-14}$ J

8A (a) $E_3 = 6.7\text{x}10^{-17}$ J
(b) $\lambda = 0.060$ nm
8B (a) $n = 4$, $n = 2$
(b) $\lambda = 487$ nm

9A (a) $l = 9.0\text{x}10^{10}$ m
(b) t' = 375s
9B (a) $\gamma m = 2.29\text{x}10^{9}$ kg
(b) x and z dimensions are unchanged, $l_x = 43.6$m
(c) $\rho = 5.25\text{x}10^{3}$ kg/m^3

10A (a) $K = 1.4\text{x}10^{5}$ eV
(b) $E = 6.51\text{x}10^{5}$ eV
(c) v = 0.62c
10B (a) $E = 1.08\text{x}10^{14}$ J
(b) $P = 2.7\text{x}10^{19}$W