TEST QUESTIONS (CONTINUED)

if $\omega = 500$ rad/s, $\rho_0 = 1.2$ kg/m^3 and $V_s = 340$ m/s while $I = I_0 = 10^{-12}$ Watt/m^2

12. How would the answer to Prob 11 change if the Intensity was 60 db?

13. The amplitude of the pressure wave of Prob 12 is

$$P_m = \gamma k S_m P_0$$

where

$\gamma = 1.4$, $P_0 = 10^5$ N/m^2. How large is P_m for 60 db sound?

(length L)

14. When a tube is open at both ends the wavelengths of the modes in it are given by

$$\lambda_n = \frac{2L}{n} \quad n = 1, 2, 3, \ldots$$

If it is open at one end and closed at the other

$$\lambda_n = \frac{4L}{(2n-1)}, \quad n = 1, 2, 3, \ldots$$

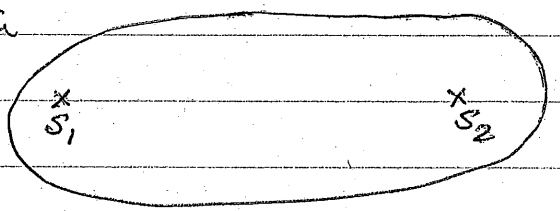
Why this difference?

15. A piano tuner finds that after some initial tuning of the "A" string she hears 4 beats with respect to a 440 Hz tuning fork. What are the possible frequencies of the sound

emitted by the string? (ii) If after the initial tuning she loosens the string very slightly and finds that now she hears 6 beats which of the two answers to part (i) is correct?

16. You are travelling toward a hill when you blow your horn ($f = 500$ Hz). If your speed is 30 mph and the speed of sound is 340 m/s, how many beats will you expect to discern between your horn and the sound reflected by the hill?

17. Two sources of sound having same frequency and wavelength are 10 meters apart. If the wavelength of sound is One meter and the waves leave S_1 and S_2 in phase, how many maxima will you encounter as you walk around the path shown.



18. If in Prob 20 you were to stand exactly in the middle of the line joining S_1 and S_2 and heard NOTHING. What would it tell you about the phase difference of the waves starting at the same time from S_1 and S_2.

19 What is light? (IT'S WAVES (CAN YOU SEE IT))

20 Sound and Light are both waves. List five notable differences between them.

21. The energy density in an $\underline{E}$-field is $\eta_E = \frac{1}{2}\epsilon_0 E^2$ and in a $\underline{B}$-field it is $\eta_B = \frac{B^2}{2\mu_0}$. Which is larger if $E = cB$ and $c = \frac{1}{\sqrt{\mu_0 \epsilon_0}}$? Why?

22 Show that $\frac{1}{\sqrt{\mu_0 \epsilon_0}}$ has the dimensions of velocity.

23 You are sitting 2 meters away from a 100 Watt tungsten filament lamp. What is the amplitude of the $\underline{E}$-field entering your eye if the efficiency of the lamp is about 2.5 per cent. Why?

24. You are standing near a window when you see a lightning flash. 5 secs. later you hear the thunder. If the speed of sound is 340 m/s, how far was the flash? Why?

25. Two slits each of width w are d meters apart. If w << d one observes only an interference pattern in a double slit Experiment. Why?

26 Show that for two incoherent sources of light, the total intensity is just the sum of the two intensities.

27 In 2-slit interference the first minimum occurs when

$$\sin\theta_1 = \frac{\lambda}{2d}$$

where d is the separation of the slits. In single slit diffraction the first minimum is at

$$\sin\theta_1 = \frac{\lambda}{w}$$

where w is the slit width. Why the difference?

28 Show that the interference pattern for two slits consists of equally spaced, equal intensity fringes

$$\text{Spacing} = \frac{D\lambda}{d}$$

d = split separation

D = Slit-screen distance

$$I_{max} = \frac{1}{2}\epsilon_0 c (4E_{max}^2)$$

29. In a single slit diffraction pattern the intensities of the maxima vary as $1 : \frac{4}{9\pi^2} : \frac{4}{25\pi^2} : \frac{4}{49\pi^2} \ldots$ why?

30. In single slit diffraction the minima occur at angles

$$\sin\theta_n = \frac{n\lambda}{W}$$

$n = 1, 2, 3 \ldots$ why?