Acoustics

1. Ultrasonic, infrasonic and audio waves travel through a medium with speed v_u, v_i & v_a respectively, then
   a. $v_u = v_i = v_a$ b. $v_u > v_i > v_a$ c. $v_u < v_i = v_a$ d. $v_u < v_i < v_a$
2. What causes reverberation
   a. interference   b. refraction   c. diffraction   d. reflection
3. Roaring of lion and buzzing of mosquito differ in
   a. velocity   b. frequency   c. wavelength   d. amplitude
4. The tones that are separated by three octaves have a frequency ratio of
   a. 3   b. 6   c. 8   d. 16
   [Hint: frequency of nth octave: $f_n = 2^n f$]
   [one octave: one time power of 2 ($f' = 2^1 f$) two octaves: two times power of 2 ($f' = 2^2 f = 4f$)]
5. Which of the following is the most important factor that helps to recognize a person by his voice alone?
   a.   intensity   b. pitch   c. quality   d. all are important
6. You may hear and recognize the voice of your friend behind the wall on an account of
   a.   diffraction and loudness   b. diffraction and quality
   c.   interference and quality   d. interference and pitch
7. Sweetness of sound depends upon its
   a. wavelength   b. amplitude
   c. frequency   d. waveform (periodicity and regularity) or overtones

Pressure amplitude

1. If pressure amplitude of a sound wave is tripled, the intensity of sound increases to
   a. 3 times   b. 6 times   c. 9 times   d. $\sqrt{3}$ times
2. If pressure of a sound wave is doubled, the intensity of sound
   a. increases 2 times   b. decreases 2 times
   c. increases 4 times   d. increases 8 times

1. (a) How does pressure amplitude change with displacement amplitude? Show that pressure wave varies with displacement wave by phase of 90°.
   (b) If the intensity of the song at your position is $1.4 \times 10^{-8} Wm^{-2}$ and frequency is 6kHz, what are the pressure and displacement amplitudes? [velocity of sound= $320 ms^{-1}$; density of air= $2.29 Kgm^{-3}$.]   ($3.39 \times 10^{-3} Pa, 2.18 \times 10^{-10} m$)
   (c) The displacement antinode is called as pressure node. Explain. Find the intensity of the sound wave in air whose maximum pressure variation is $3 \times 10^{-2} pa$, The density of air is $\rho = 1.20 kg/m^3$ and the speed of sound is $340 m/s$.
2. a) What is pressure amplitude? Describe sound wave as a pressure wave and deduce an expression for the pressure amplitude.
   b) i. Interpret sound wave graphically using comparison graph between displacement & pressure variation equation.
   ii. Compare pressure amplitude & displacement amplitude for interpretation of sound wave. Which of them have more effect on intensity of sound? Explain.
   c) Water at 20°C has a bulk modulus of 2.2 x 10^9 Pa and the speed of sound in water at this temperature is 1480 m/s. For 1000 Hz, sound waves in water at 20°C, what displacement amplitude is produced if the pressure amplitude is 3 x 10^{-2} Pa.
   (3.2×10^{-32} m)

Intensity and intensity level

1. Phon is the unit of
   a.   frequency   b. amplitude   c. intensity   d. loudness
2. The intensity of a sound gets reduced by 20% on passing through a slab. The reduction in intensity on passing through two consecutive slabs is
   a.   50%   b. 40%   c. 36%   d. 30%
3. An infinite line source emits waves in a non-absorbing medium. The intensity at a distance R from the source varies as:
   a. R   b. 1/R   c. R^2 d. 1/R^2
4. A beam of sound is 10^6 times as intense as that with minimum audible intensity. The intensity level of the beam is
   a. 10^6 dB   b. 60 dB   c. 6 dB   d. 0.6 dB
5. The maximum tolerable sound intensity in dB is
   a.   0 dB   b. 1 dB   c. 120 dB   d. 200 dB
6. The intensity of sound gets reduced by 15% on passing through a block. If it passes through two such blocks the intensity of the outgoing sound is
   a.   27%   b 37%   c. 72%   d. 82%
7. The intensity of sound gets reduced by 10% on passing through a block. If it passes through two such blocks, the reduction in intensity of the outgoing sound is
   a.   19%   b. 18%   c. 91%   d. 81%
8. The intensity levels of two waves of same frequency in a given medium are 20 dB and 60 dB. Then the ratio of their amplitude is
   a.   1:4   b. 1:16   c. 1:100   d. 1:104
9. The reference intensity of audibility is $10^{-12} W m^{-2}$. The sound level for intensity $10^{-4} W m^{-2}$ will be:
   a.   8 dB b. 80 dB c. 108 dB d. 160 dB
10. The noise level in ordinary conversation is
   a. 20 dB   b. 65 dB   c. 100 dB   d. 120 dB

1. (a) What is intensity of sound?
   (b) Show that intensity varies directly proportional to the square of amplitude of sound.
   (c) Does amplitude of sound decrease with distance from the source? Explain.
   (d) Define bel and decibel? Write their relation.
2. (a) What do you mean by intensity and intensity level of sound? Is there any relation between them?
   (b) What is the minimum value of sound intensity that normal ear can hear clearly.