34. If the distance between the source of sound and a cliff is D. If the velocity of sound is v. The time taken to hear the second echo is

    (a) $\frac{2v}{D}$ (b) $\frac{D}{2v}$ (c) $\frac{4v}{D}$ (d) $\frac{4D}{v}$

35. For sound CO_2 behaves as

    (a) convex lens   (b) concave lens   (c) convex mirror   (d) concave mirror

36. Which of the following is the ratio of the velocity of sound in hydrogen to that in helium at 0°C?

    (a) $\sqrt{21}/3$ (b) $3/\sqrt{21}$ (c) $\sqrt{42}/5$ (d) $5/\sqrt{42}$

Subjective Question:

1. a. What are transverse waves? Why are they called as shear wave?   2

    b. Amongst solids, liquids, and gases, in which type of media, transverse wave motion is possible? Why?   2

    c. The sound of an explosion on the surface of a pond is heard by a boatman 50m away and by a sea diver 50m below the point of explosion.

        i.   Of the two persons mentioned, who would hear the sound first? Explain.   2

        ii.   If the point of explosion was above the surface of the water, who would hear the sound first? Explain.   2

    d. Calculate the bulk modulus of a liquid in which longitudinal waves with a frequency of 250Hz have a wavelength of 8m if the density of the liquid is $900kg/m^3$.   [Ans: $3.6 \times 10^9 Pa$]   2

    e. Relate speed of sound in different material medium.   1

    f. Velocity of sound in air at NTP is 332 m/s. What will be the velocity when pressure is doubled, at constant temp.?   1

2. The speed of sound derived from Newton's formula was corrected by Laplace.

    a. What was the correction made by Laplace over Newton's theory?   1

    b. Write the Laplace formula of velocity of sound in air. Discuss the effect of pressure and temperature on the speed of sound in air.   2

    c. At what temperature the velocity of sound is double than at 27^oC?   2

    d. What is the percentage increase in speed of sound when the temperature increases from -5^oC to 32^oC?   [6.7%] 2

3. a. Use the formula, $v = \sqrt{\frac{\gamma P}{\rho}}$ to explain why the of sound in air

      i) is independent of pressure   ii) increases with temperature   iii) increase with humidity

        Demonstrate your reasoning including graphical sketch in each case.   3

    b. At what temperature, the velocity of sound in air is increased by 50% to that at 27°C?   2

4. a. Write Newton's formula for the speed of sound in the gas. Why and what correction was applied by Laplace?   2

    b. Discuss the effect of temperature and pressure on the velocity of sound in air.   2

    c. A displacement wave is represented by $y = 0.25 \times 10^{-3} \sin(500t - 0.025x)$ where $y, t,$ and x are in cm, second and meters respectively. Deduce

      (i) amplitude (ii) angular frequency (iii) wavelength and (iv) speed of the wave.   4

5. According to Laplace, the propagation of sound through air occurs adiabatically and the expression for the velocity of sound is $v = \sqrt{\frac{\gamma P}{\rho}}$.

    a. Air gets thinner as we go up in the atmosphere, will the velocity of sound change? Explain.   2

    b. Does the sound of explosion travel faster than the sound produced by a humming bee? Explain.   2

    c. Sound at a distance can be heard distinctly at night than in the day time, why?   2

    d. The frequency of a tuning fork is $512\ Hz$ and the velocity of sound in air at $0\ oC$ is $332\ m/s$, find the distance through which sound travels while the fork completes 32 vibrations at $20\ ^oC$.   [$21.5\ m$]   2