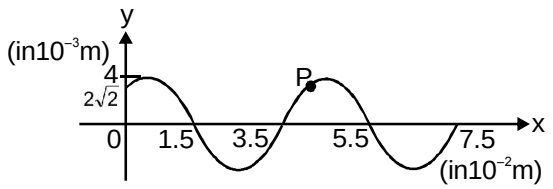
Exercise - IV (TOUGH SUBJECTIVE PROBLEMS)

1. The figure shows a snap photograph of a vibrating string at t = 0. The particle P is observed moving up with velocity 20π cm/s. The angle made by string with x-axis at P is 6°.



(a) Find the direction in which the wave is moving

(b) the equation of the wave

(c) the total energy carried by the wave per cycle of the string, assuming that μ, the mass per unit length of the string = 50 gm/m.

2. A uniform rope of length L and mass m is held at one end and whirled in a horizontal circle with angular velocity ω. Ignore gravity. Find the time required for a transverse wave to travel from one end of the rope to the other.

3. A symmetrical triangular pulse of maximum height 0.4m and total length 1 m is moving in the positive x-direction on a string on which the wave speed is 24 m/s. At t = 0 the pulse is entirely located between x = 0 and x = 1 m. Draw a graph of the transverse velocity of particle of string versus time at x = +1m.

4. In a stationary wave pattern that forms as a result of reflection of waves from an obstacle the ratio of the amplitude at an antinode and a node is β = 1.5. What percentage of the energy passes across the obstacle?

5. A string, 25 cm long, having a mass of 0.25 gm/cm, is under tension. A pipe closed at one end is 40 cm long. When the string is set vibrating in its first overtone, and the air in the pipe in its fundamental frequency, 8 beats/sec are heard. It is observed that decreasing the tension in the string, decreases the beat frequency. If the speed of sound in air is 320 m/s, find the tension in the string.

6. A metal rod of length l = 100 cm is clamped at two points. Distance of each clamp from nearer end is a = 30cm. If density and Young's modulus of elasticity of rod material are ρ = 9000 kgm^{-3} and Y = 144 GPa respectively, calculate minimum and next higher frequency of natural longitudinal oscillations of the rod.