

SECTION 'B' (Short-Answer Questions) (36)

NOTE: Answer any NINE part questions from this section. All questions carry equal marks. Draw diagrams where necessary. Use of scientific calculator is allowed. All notations are used in their usual meanings

2. i) Prove that following equations are dimensionally correct:

$$* T = 2\pi \sqrt{\frac{L}{g}}$$

$$* S = vit + \frac{1}{2}at^2$$

ii) A 50g bullet is fired into a 10kg block that is suspended by a long cord so that it can swing as a pendulum. If the block is displaced so that its center of gravity rises by 10cm, find the initial velocity of bullet.

iii) Define escape velocity. Derive the expression for escape velocity on earth's surface.

iv) Calculate the viscous drag on a drop of oil of 0.1mm radius falling through air at its terminal velocity.

(viscosity of air $1.8 \times 10^{-5} Pa - s$, density of oil = $850 kg/m^3$).

v) Define Electric flux, give its SI unit. Under what condition the electric flux through a surface will be:

a) maximum b) minimum

vi) Derive an expression for the equivalent capacitance of three unequal capacitors connected in series OR parallel.

vii) Derive an equation for balanced Wheatstone bridge.

viii) Three resistors of 1Ω , 2Ω and 3Ω are connected in series. What is the total resistance of the combination? If the combination is connected to a battery of emf 24 V and negligible internal resistance. Find the potential drop across each resistor.

ix) If the speed of sound in air at $27^\circ C$ is 345 m/s. Find the speed at $127^\circ C$.

x) How many lines per centimeter are there in a grating which gives 1st order spectrum at an angle of when the wavelength of light is

xi) A helicopter is ascending at a rate of / . At a height of 80m above the ground, a packet is dropped. Find the time taken by packet to reach the ground.

xii) State Pascal's law. Give the working of hydraulic lift.

xiii) A source of sound and listener are moving towards each other with velocities 0.5 and 0.2 times the speed of sound respectively. If the source is emitting 2kHz tone, calculate the frequency heard by the listener. (Speed of sound = /)

xiv) Derive an expression for centripetal acceleration

SECTION "C" (Detailed Answer Questions)(32)

Attempt any TWO questions from this section. All questions carry equal marks. Draw diagrams where necessary.

3. a) Two vectors and making angles and with the horizontal. Describe addition of these vectors by rectangular component method also derive formula for magnitude of resultant vector and its direction.

3. b) Define simple Harmonic motion, "A particle is moving in a circle with constant speed, prove that its projection execute simple harmonic motion on one of the diameter of the circle.

4. a) What is an electric dipole? Derive the expression for electric field intensity due to an electric dipole at a point which is at a perpendicular distance 'y' from the centre of the dipole.

b) What is stationary waves? Stationary waves are established in the stretched string, derive the expressions for the frequencies if the string is vibrating in:

i) one loop ii) two loops iii) three loops iv) n loops

5. a) Two smooth, rigid and non-rotating spheres of masses and , moving with initial velocities and , collide elastically in one dimension. Derive the expressions for the final velocities of the spheres after the collision.

b) What are Newton's rings? Explain the process of their formation? Derive the expressions for the radius of bright and dark rings.