H. S. C. PHYSICS - I

Time : 2 Hours) **Question Paper : September 2009** (Max. Marks : 40

*** Note : Refer to Question Paper March 2008. ***

Q. 1. Select and write the most appropriate answer from the given alternatives for each sub-question. **[8]**

(i) A stone is tied to a string and rotated in horizontal circle with constant angular velocity. If the string is released, the stone flies ..... **(1)**

(a) radially inward. (b) radially outward.

(c) tangentially forward. (d) tangentially backward.

(ii) When a body of mass 'm' is taken from the surface of the earth to a height equal to the radius of the earth (R) then the change is its P.E. is ..... **(1)**

(a) $\frac{1}{4}$ mgR (b) $\frac{1}{2}$ mgR (c) mgR (d) 2mgR

(iii) The compressibility of a substance is the reciprocal of ..... **(1)**

(a) Young's modulus (b) Bulk modulus

(c) Modulus of rigidity (d) Poisson's ratio

(iv) The motion of a simple pendulum is ..... **(1)**

(a) oscillatory but not periodic (b) pariodic but not oscillatory

(c) neither periodic nor oscillatory (d) periodic as well as oscillatory

(v) The amount of energy radiated per second by a body does not depend upon ..... **(1)**

(a) nature of surface (b) area of surface

(c) mass of the body (d) temperature difference of the surface and surroundings.

(vi) A stretched string of length λ vibrates in third overtone, the wavelength of stationary wave formed is ..... **(1)**

(a) $\frac{\lambda}{2}$ (b) $\frac{\lambda}{4}$ (c) λ (d) 2λ

(vii) In a simple harmonic progressive wave of amplitude 10 cm, the maximum particle velocity is two times its wave velocity, then-wave length of the wave is ..... **(1)**

(a) 3.14 cm (b) 15.7 cm (c) 31.4 cm (d) 157 cm

(viii) The r.m.s. velocity of the molecules moving with velocities 2m/s, 4m/s and 6 m/s is ..... **(1)**

(a) 2.8 m/s (b) 3 m/s (c) 3.8 m/s (d) 4.33 m/s

Q. 2. (A) Attempt any ONE : **[8]**

(i) A torque of magnitude 1000 N m acting on a body, produces an angular acceleration of 2 rad/s². Calculate the moment of intertia of the body. **(2)**

(ii) If the r.m.s. velocity of oxygen molecules at N. T. P. is 460 m/s, determine the r. m. s. velocity of hydrogen molecules at N. T. P. Molecular weight of oxygen = 32; Molecular weight of hydrogen = 2. **(2)**

(B) Attempt any TWO :

(i) For a conical pendulum, prove that $\tan\theta = \frac{v^2}{rg}$ **(3)**

(ii) Prove that strain energy per unit volume of a wire = $\frac{1}{2}$ stress × strain. **(3)**

(iii) Define angle of contact. State the characteristics of angle of contact. **(3)**

Q. 3. (A) Attempt any ONE : **[8]**

(i) Obtain relation between linear velocity and angular velocity of a particle in U.C.M. **(2)**

(ii) Explain how law of length can be verified by using a sonometer. **(2)**

(B) Attempt any TWO :

(i) State Newton's law of net loss of heat, hence show that $\frac{d\theta}{4} \propto (\theta - \theta_0)$ **(3)**

(ii) Derive an expression for height of liquid column when a capillary is vertically dipped in a liquid. **(3)**

(iii) State any two assumptions of kinetic theory of gases. Deduce Boyle's law on the basis of kinetic theory of gases. **(3)**

Q. 4. (A) Attempt any TWO : **[8]**

(i) Give graphical representation of S.H.M. when particle starts from the positive extreme position. **(2)**

(ii) Draw a neat labelled diagram of experimental set up of determination of Young's modulus by Searle's method. **(2)**

(iii) Represent graphically energy distribution of a black body against wavelength at various temperatures. **(2)**

(B) Attempt any ONE :

(i) Derive an equation of a simple harmonic progressive wave and express it in different forms. **(4)**

(ii) Obtain an expression for the M.I. of a solid cylinder about an axis passing through its centre perpendicular to its length. **(4)**

Q. 5. Attempt any TWO : **[8]**

(i) A satellite is revolving round the earth in a circular orbit with the critical velocity 7 km/s. Find the radius of the orbit of the satellite and period of its revolutions

$[G = 6.67 \times 10^{-11}\ Nm^2/kg^2\ ;\ M = 5.98 \times 10^{24}\ kg]$ **(4)**

(ii) The period of a simple pendulum increases by 10% when its length is increased by 21 cm. Find the original length and period of the pendulum. $(g = 9.8\ m/s^2)$ **(4)**

(iii) The consecutive harmonics of an air column closed at one end are 405 Hz and 675 Hz respectively. Find the fundamental frequency of the similar air column but open at both ends. **(4)**

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