Sub: Physics

Standard: 12th (Science) **Date: 31/01/2019**
Time : 3 Hours **Total Marks: 70**

General Instructions:

1) All questions are compulsory.
2) **Section A** contains Q. No. 1 to 4 of multiple choice type of questions carrying one mark each. Q. No. 5 to 8 are very short answer type of questions carrying **one** mark each.
3) **Section B** contains Q. No. 9 to 15 of short answer type of questions carrying **two** marks each. Internal choice is provided to only one question.
4) **Section C** contains Q. NO. 16 to 26 of short answer type of questions carrying **three** marks each. Internal choice is provided to only one question.
5) **Section D** contains Q.No.27 to 29 of long answer type of questions carrying **five** marks each. Internal choice is provided to each question.
6) Use Log-Table if necessary is allowed. Use of a calculator is not allowed.

SECTION-A (8 Marks)

Q.1 In a semiconductor acceptor. Impurity is

(a) antimony (b) indium (c) phosphorous (d) arsenic

Q.2 In Young's double slit experiment 5th dark fringe is formed opposite to one of the slits. If D is the distance between slits and the screen, and d is the separation between the slits then the wavelength of light used is

(a) $\frac{d^2}{6D}$ (b) $\frac{d^2}{5D}$ (c) $\frac{d^2}{15D}$ (d) $\frac{d^2}{9D}$

Q.3 A body of mass 1 kg is moving in a vertical circular path of radius 1m. The difference between the kinetic energies at the highest and lowest point is

(a) 20 J (b) 10 J (c) $4\sqrt{5}$ J (d) $10\left(\sqrt{5}-1\right)$ J

Q.4 If both the length and the radius of a wire are halved, the modulus of elasticity

(a) becomes half the initial modulus (b) becomes one-fourth the initial modulus

(c) becomes double the initial modulus (d) remains unchanged

Q.5 What is the ration of the accelerations for a solid sphere of mass M and radius R rolling down and incline plane of angle θ without slipping and slipping down the plane without rolling?

Q.6 If critical angle of medium is sin^{-1} (3/5), find the polarizing angle.

Q.7 Water rise in a capillary tube to a height of 2 cm. In another capillary tube whose radius is one third of it, how much the water will rise in it?

Q.8 What is the total radiant energy per unit area, normal to the direction of incidence, received at a distance R from the centre of a star of radius r, whose outer surface radiates as a black body at a temperature T K?

SECTION-B (14 Marks)

Q. 9 Calculate the de Broglie wavelength of an electron moving with $\frac{1^{rd}}{3}$ of the speed of light in vacuum [neglect relastivistic effect] (Planck's constant h = 6.63 x 10^{-34} j: Mass of electron m = 9.11 x 10^{-28} g)

Q.10 What pressure is required to reduce the volume of a lead block by 1%? (Bulk modulus of lead is 6×10^9 N/m^2)

Q.11 (a)State SI unit and dimensions of coefficient of mutual induction.

(b) How sentivity of M.C.G. can be increased?

Q. 12 Draw a neat labeled diagram of reflection of light form a plane reflecting surface on the basis of Huygens wave theory of light.

Q.13 The moving coil galvanometer has a resistance of 50 Ω and gives full scale deflection for a current of 10 mA. How will you convert it into an ammeter with a range 0-50 A. Also calculate the equivalent resistance of ammeter.

OR

Q. 13 In cyclotron, magnetic field of 1.4 Wb/m^2 is used to accelerate protons. How rapidly should the electric field between the Dees be reversed?

$Given: q = e = 1.6 \times 10^{-19} C, m = 1.67 \times 10^{-27}\ kg$

Q. 14 Draw a neat labeled circuit diagram for NPN transistor as an amplifier in common emitter mode.

Q. 15 Write a note on Sky wave propagation or ionosphere wave propagation.

SECTION-C (33 Marks)

Q.16 A particle of mass m, just completes the vertical circular motion. Derive an expression for the difference in tensions at highest position and at lowest positions.

Q.17 Define critical velocity of a satellite. Obtain an expression for critical velocity of an orbiting satellite. State the factors upon which critical velocity depend on

Q.18 Wavelengths of two notes in air are $\frac{83}{170}$ m and $\frac{83}{172}$ m. Each of these produce 4 beats per second with the third note of fixed frequency. Calculate the velocity of sound in air.

Q.19 State an expression for the moment of inertia of solid uniform disc, rotating about an axis passing through, its centre perpendicular to its plane. Hence derive an expression for the moment of inertia and radius of gyration.

(i) about a tangent in the plane of the disc and

(ii) about a tangent perpendicular to the plane of the disc.

OR

Q.19 Deduce an expression for kinetic energy when a body is rolling on a horizontal plane surface without slipping. Hence find the kinetic energy for solid sphere and disc.

Q.20 What is surface energy? Obtain the relation between surface tension and surface energy.

Q.21 State and prove Kirchhoffs law of radiation.

Q.22 Explain the resolving power of a telescope with the help of a neat diagram. On what factors does it depend?

Q.23 Obtain an expression for the electric intensity at a point outside a charged conducting sphere.

Q.24 What is Whetstone's bridge? Obtain balance condition in case of Wheatstone network.

Q.25 If the work function for certain metal is 1.8 eV.

(a) What is the stopping potential for electrons ejected from metal when light of 4000Å shines on the metal?

(b) What is the maximum speed of the ejected electrons?

Q.26 The magnetic field B and the magnetic intensity H in a material are found to be 1.6 T and 1000 A/m respectively. Calculate the relative permeability and the susceptibility and the susceptibility of the material.

SECTION-D (15 Marks)

Q.27 What is an ideal simple pendulum? Obtain an expression for period of simple pendulum. On what factors it depends? When length of simple pendulum is increased by 22 cm, the period changes by 20%. Find the original length of simple pendulum.

OR

Q.27 Define phase of S.H.M. show variation of displacement, velocity and acceleration with phase for a particle performing linear S.H.M graphically. When it starts from extreme position.

A body describes linear S.H.M along a path length 0.12 m long. Its velocity at the centre of its path is 0.12 m/s. Find the period and velocity at a distance $\sqrt{3} \times 10^{-2}$m from the central position.

Q.28 What are stationary waves? Explain the formation of stationary waves by analytical method. What are nodes and antinodes?

Show that the distance between two successive nodes is $\lambda/2$.

The length of air column for fundamental mode in resonance tube is 16 cm and that for the second resonance further 50.25 cm. Find the end correction and inner diameter of tube.

OR

Q.28 State the laws of vibrating string. Hence show that frequency of vibrating wire is inversely proportional to radius of wire and inversely proportional to square root of density of wire.

In Melde's experiment, number of loops on a string changes from 7 to 5 by addition of 0.015 kg-wt. Find the initial tension applied to the string.

Q.29 Prove theoretically, the relation between e.m.f. induced and rate of change of magnetic flux in a coil moving in a uniform magnetic field.

Calculate the radius of the first Bohr orbit from given data and hence find radius of 3rd Bohr orbit

DATA: $m = 9 \times 10^{-31}\ kg$

$e = 1.6 \times 10^{-19}\ C$

$h = 6.63 \times 10^{-34}\ Js$

$\epsilon_0 = 8.85 \times 10^{-12} C^2/Nm^2$

OR

Q.29 State the principle of transformer. Explain its working with construction. Derive an expression for e.m.f., current in terms of number of turns in primary and secondary coil.

The series limit for Lyman series is 912 Å. Find series limit for Paschen and Brackett series.