BOARD QUESTION PAPER : FEBRUARY 2020

PHYSICS

Time: 3 Hours **Total Marks: 70**

General Instructions :

The question paper is divided into FOUR sections.

1. **Section A :** Q. No.1 contains Ten multiple choice type of questions carrying One mark each.
   Q. No. 2 contains Eight very short answer type of questions carrying One mark each.
2. **Section B :** Q. No.3 to Q. No. 14 contain Twelve short answer type of questions carrying Two marks each.
   (Attempt any Eight).
3. **Section C :** Q. No. 15 to Q. No.26 contain Twelve short answer type of questions carrying Three marks each.
   (Attempt any Eight).
4. **Section D :** Q. No. 27 to Q. No. 31 contain Five long answer type of questions carrying Four marks each.
   (Attempt any Three).
5. Use of log table is allowed. Use of calculator is **not** allowed.
6. Figures to the right indicate full marks.
7. For each MCQ, correct answer must be written alongwith its alphabet.
   e.g., (a)…… / (b) …….. / (c) …….. / (d) …….. etc.
8. **Physical Constants:**

   i. $h = 6.63 \times 10^{-34}$ Js ii. $c = 3 \times 10^{8}$ m/s iii. $\pi = 3.142$

   iv. $g = 9.8\ m/s^2$ v. $\epsilon_0 = 8.85 \times 10^{-12}\ \frac{c^2}{Nm^2}$ vi. $\mu_0 = 4\pi \times 10^{-7}\ \frac{Wb}{A-m}$

Section-A

Q.1. Select and write correct answers of the following questions : **[10]**

i. If the length of a potentiometer wire is increased by keeping constant potential difference across the wire, then _____.

(A) null point is obtained at larger distance (B) there is no change in the null point
(C) potential gradient is increased (D) null point is obtained at shorter distance

ii. If a coil of metal wire is kept stationary in a uniform magnetic field, then_____.

(A) an e.m.f. is induced in the coil (B) a current is induced in the coil
(C) neither e.m.f. nor current is induced (D) both current and e.m.f. are induced

iii. In rotational motion of a rigid body, all particles move with _____.

(A) same linear velocity and same angular velocity
(B) same linear velocity and different angular velocity
(C) different linear velocities and same angular velocities
(D) different linear velocities and different angular velocities

iv. A standing wave is produced on a string fixed at one end and free at other. The length of string must be an _____.

(A) odd integral multiple of $\frac{\lambda}{4}$ (B) integral multiple of $\frac{\lambda}{2}$
(C) integral multiple of λ (D) integral multiple of $\frac{\lambda}{4}$

v. Herapathite (iodo sulphate of quinine) is used in the production of _____.

(A) achromatic prism (B) polaroid (C) biprism (D) solar cell

vi. A diffraction pattern is obtained by making blue light incident on a narrow slit. If blue light is replaced by red light, then the diffraction bands _____.
(A) disappear (B) become broader (C) become narrower (D) remain same

vii. Two droplets coalesce in a single drop. In this process _____.
(A) energy is liberated (B) energy is obsorbed
(C) energy does not change (D) some mass is converted into energy

viii. In hydrogen atom, electron jumps from the 3^{rd} orbit to the 1^{st} orbit. The change in angular momentum is _____.
(A) 1.05×10^{-34} Js (B) 2.11×10^{-34} Js (C) 3.16×10^{-34} Js (D) 4.22×10^{-34} Js

ix. A fixed volume of iron is drawn into a wire of length 'L'. The extension 'x' produced in the wire by a constant force 'F' is proportional to _____.
(A) $\frac{1}{L^2}$ (B) $\frac{1}{L}$ (C) L^2 (D) L

x. Two tuning forks have frequencies 450 Hz and 454 Hz respectively. On sounding these forks together, the time interval between two successive maximum intensities will be _____.
(A) $\frac{1}{4}$s (B) $\frac{1}{2}$s (C) 1s (D) 4s

Q.2. Answer the following questions : **[8]**

i. What is attenuation in communication system?
ii. What is isothermal process?
iii. What does the negative sign indicate in Lenz's law?
iv. Define uniform circular motion.
v. At which position, the total energy of a particle executing linear S.H.M. is purely potential?
vi. State the name of the visible series in hydrogen spectrum.
vii. At what height the acceleration due to gravity is 25% of that at the surface of the Earth, in terms of radius of the Earth.
viii. Capacity of a parallel capacitor with dielectric constant 5 is 40 μF. Calculate the capacity of the same capacitor when dielectric material is removed.

Section-B

Attempt any EIGHT questions of the following : **[16]**

Q.3. Define ;
(a) Threshold frequency (b) Photoelectric work function

Q.4. Distinguish between step-up and step-down transformer.

Q.5. Write a short note on sky wave propagation.

Q.6. Obtain the relation between the magnitude of linear acceleration and angular acceleration in circular motion.

Q.7. Deduce Boyle's law using the expression for pressure exerted by the gas.

Q.8. State any two postulates of Bohr's theory of hydrogen atom.

Q.9. State the factors on which resolving power of microscope depends. How can it be increased?

Q.10. The photoelectric work function for a metal surface is 3.84×10^{-19} J. If the light of wavelength 5000 Å is incident on the surface of the metal, will there be photoelectric emission?

Q.11. A parallel L-C circuit comprises of a 5H inductor and 5μF capacitor. Calculate the resonant frequency of the circuit.

Q.12. A wire length 1 m and mass 2 g is in unison with a tuning fork of frequency 300 Hz. Calculate the tension produced in the wire.

Q.13. Energy of 1000 J is spent to increase the angular speed of a wheel from 20 rad/s to 30 rad/s. Calculate the moment of inertia of the wheel.

Q.14. Energy of an electron in the second Bohr orbit is –3.4 eV. Calculate the energy of an electron in the third Bohr orbit.

Section-C

Attempt any EIGHT questions of the following : **[24]**

Q.15. State Newton's law of gravitation. Obtain the relation between universal gravitational constant and gravitational acceleration on the surface of the earth.

Q.16. Define linear S.H.M. Obtain differential equation of linear S.H.M.

Q.17. Explain Doppler effect in sound. State any two applications of Doppler effect.

Q.18. State and prove the principle of parallel axes in rotational motion.

Q.19. Explain the concept of a parallel plate capacitor. State its any 'two' applications.

Q.20. Define :
(a) Young's modulus (b) Bulk modulus (c) Poisson's ratio

Q.21. Explain energy distribution spectrum of a black body radiation in terms of wavelength.

Q.22. In a biprism experiment, light of wavelength 5200 Å is used to obtain an interference pattern on the screen. The fringewidth changes by 1·3 mm when the screen is moved towards the biprism by 50 cm. Calculate the distance between the two virtual images of the slit.

Q.23. A simple pendulum of length 1 m has mass 10 g and oscillates freely with amplitude of 5 cm. Calculate its potential energy at extreme position.

Q.24. If the difference in the velocities of light in glass and water is 0.25×10^8 m/s, calculate the velocity of light in air. Given that refractive index of glass and water with respect to air are 1·5 and $\frac{4}{3}$ respectively.

Q.25. In a Circus, a motor-cyclist having mass of 50 kg moves in a spherical cage of radius 3 m. Calculate the least velocity with which he must pass the highest point without losing contact. Also calculate his angular speed at the highest point.

Q.26. Two resistances X and Y in the two gaps of a meter-bridge gives a null point dividing the wire in the ratio 2:3. If each resistance is increased by 30 Ω, the null point divides the wire in the ratio 5:6, calculate the value of X and Y.

Section-D

Attempt any THREE questions of the following : **[12]**

Q.27. Show that all harmonics are present in case of an air column vibrating in a pipe open at both ends.

Q.28. What is a rectifier? With the help of a neat circuit diagram explain the working of a null wave rectifier.

Q.29. What is capillarity? Give any two applications of capillarity. Calculate the work done in blowing a soap bubble of radius 0.1 m. (Surface tension of soap solution = $30 \frac{\text{dyne}}{\text{cm}}$)

Q.30. State the advantages and disadvantages of a moving coil galvanometer.
A moving coil galvanometer (M.C.G.) has 10 turns each of length 12 cm and breadth 8 cm. The coil of M.C.G. carries a current of 125 μA and is kept perpendicular to the uniform magnetic field of induction 10^{-2} T. The twist constant of phosphor bronze fibre is 12×10^{-9} Nm/degree. Calculate the deflection produced.

Q.31. Derive an expression for magnitude of magnetic dipole moment of a revolving electron.
A circular coil of 300 turns and diameter 14 cm carries a current of 15 A. Calculate the magnitude of the magnetic dipole moment associated with the coil.