PHYSICS QUESTION PAPER
CLASS-XII

Time : 3.00 Hours] *[Maximum Marks : 100*

Instructions :

(1) There are *four* sections and total **60** questions in this question paper.
(2) Symbols used in this question paper have their usual meanings.
(3) Log table or Simple calculator can be used.
(4) Begin new section on a new page. Write answers in sequence.

SECTION - A

*Questions from **1** to **16** are multiple choice questions, each carries **one** mark. Choose the correct answer (A/B/C/D) from the given alternative responses and write it.* **16**

1. An electric dipole of dipole moment $\vec{p}$ is placed in a uniform electric field of intensity $\vec{E}$ parallel to the field. The work required to rotate it through an angle θ is .....

(A) $\vec{p} \times \vec{E}$ (B) $\vec{p} . E$

(C) $pE(1 - \cos\theta)$ (D) $pE(1 - \sin\theta)$

2. A point electrical charge Q is at the centre of a circle of radius r. The line integration of the electric field of charge Q along the circumference of the circle will be .....

(A) $\frac{1}{4\pi\varepsilon_0}\frac{Q}{r}$ (B) $\frac{2\pi Q}{4\pi\varepsilon_0 r^2}$

(C) Zero (D) $2\pi Q r$

3. If $5.0 \times 10^4\ \Omega$ is the resistance of a person's wet hand, then ..... potential difference will generate a fatal current of 1.0 mA.

(A) 50V (B) 110 V

(C) 230 V (D) 220 V

4. Temperature of a conductor increases by 5°C on passing electric current for some time. The increase in its temperature when double current is passed through the same conductor for the same time is ..... °C .

(A) 10 (B) 12

(C) 16 (D) 20

5. If the speed of a particle moving through a magnetic field is decreased, then the radius of curvature of its trajectory will .....

(A) Decrease (B) Increase

(C) Not change (D) Become half

6. With reference to the earth, the angle of dip is $\frac{\pi}{2}$ rad. at .....

(A) Equator. (B) 45° North latitude.

(C) Magnetic poles of the Earth. (D) Geographic poles of the Earth.

7. The distance between two extreme points of two wings of an aeroplane is 25 m. It is flying at a speed of 360 kmh^{-1} in horizontal direction. If the vertical component of earth's magnetic field at that place is 2×10^{-4} $Wb.m^{-2}$, then the induced emf between these two end points is ..... V.

(A) 0.1 (B) 1.0

(C) 0.5 (D) 0.01

8. Which of the following combinations of L, C and R has the dimension of time ?

(A) $\frac{R}{L}$ (B) $\frac{1}{\sqrt{LC}}$

(C) $\frac{C}{L}$ (D) RC

9. If the relative permeability and dielectric constant of a given medium are equal to μ_r and K respectively, then the refractive index of the medium is equal to .....

(A) $\frac{1}{\sqrt{\mu_r K}}$ (B) $\sqrt{\mu_r \varepsilon_0}$

(C) $\sqrt{\mu_0 \varepsilon_0}$ (D) $\sqrt{\mu_r K}$

10. A ray of light is incident normally on the surface of an equilateral Prism made of material of refractive index 1.5, so angle of deviation is .....

(A) 30° (B) 45°

(C) 60° (D) 75°

11. In Young's experiment, the distance between two slits is halved and the distance between the screen and the slit is doubled. The width of the fringe .....

(A) remain the same (B) becomes half

(C) becomes double (D) becomes four times

12. Wavelengths λ_A and λ_B are incident on two identical metal plates and photo electrons are emitted. If $\lambda_A = 2\lambda_B$, then relation between maximum Kinetic energy K_A and K_B of Photoelectron is .....

(A) $2K_A < K_B$ (B) $2K_B = K_A$

(C) $2K_A > K_B$ (D) $K_B = 2K_A$

13. The wavelength of the first line of Lyman series is λ. The wavelength of the first line in Balmer series is .....

(A) $\frac{27}{5}\lambda$ (B) $\frac{5}{27}\lambda$

(C) $\frac{9}{2}\lambda$ (D) $\frac{2}{5}\lambda$

14. If r_1 and r_2 are the characteristic average radii of two nuclei of atomic numbers 64 and 27 respectively, then $\frac{r_1}{r_2}$ = ...

(A) $\frac{64}{27}$ (B) $\frac{27}{64}$

(C) $\frac{4}{3}$ (D) $\frac{3}{4}$

15. The Boolean expression for NOR gate is .....

(A) $y = \overline{A} + \overline{B}$ (B) $y = \overline{A \cdot B}$

(C) $y = \overline{A + B}$ (D) $y = A + B$

16. If the height of transmission tower is halved, then the region covered by this transmitter .....

(A) becomes four times (B) becomes one fourth

(C) becomes halved (D) becomes double

SECTION - B

*Question Nos. from **17** to **32** are Very short answer type.*
*Each carries **one** mark.* **16**

17. State the law of conservation of electric charge.

OR

State the superposition principle for forces between more than two charges.

18. Write the unit of Temperature Coefficient of Resistivity (α).

19. What is Thermopile ?

20. What is a Solenoid ?

21. What are hard ferromagnetic substances ?

22. What is "Back emf"?

OR

Write the use of Eddy current.

23. Which type of defect in vision is called Farsightedness (Hypermetropia) ?

24. What is the angle between Plane of Vibration and Plane of Polarization ?

OR

Write the Malus Law.

25. On what factor does the Threshold Frequency of a metal depend ?

26. Define the power of a Lens.

27. What is the Optical pumping ?

28. What is Multiplication factor ?

OR

Define Curie, a unit of Radioactivity.

29. What is called Reverse bias connection ?

30. Give the Boolean expression of NAND gate.

31. What is 'infinite line' in a two-wire transmission line ?

32. Which type of communication is done by a Modem ?

OR

What is the main function of Transponder ?

SECTION - C

*Question Nos. from **33** to **48** are Short answer type. Each carries **two** marks.* **32**

33. A dipole coincides with Z axis and its origin is at the mid-point of dipole. Obtain an equation for electric field intensity of such electric dipole at the equator of a dipole for a point $y = y$.

34. Derive equation of potential energy of an electric dipole in a uniform electric field.

35. Explain series combination of Capacitors and derive equation for the Resultant Capacitance in series combination.

36. Explain Wheatstone Bridge. Show that in a balanced condition of Wheatstone Bridge $\frac{P}{Q} = \frac{R}{S}$.

OR

Write Faraday's First Law of Electrolysis and explain it. By using it, define electro-chemical equivalent of that substance. Give its unit.

37. Using Amperes Circuital law, derive the equation for magnetic field $B = \frac{\mu_0 I}{2\pi y}$ due to a very long straight conductor carrying electric current.

OR

By accepting the equation of torque $\vec{\tau} = \vec{M} \times \vec{B}$, acting on magnetic dipole placed in a uniform magnetic field, derive the equation of its frequency, $f = \frac{1}{2\pi}\sqrt{\frac{MB}{I}}$.

38. By using $L = \frac{N\phi}{I}$, derive that $\varepsilon = -L\frac{dI}{dt}$. Define the Self inductance and also define unit of self inductance.

39. In L-C-R series, A.C. circuit voltage $V = V_m \cos \omega t$ is applied. Derive the differential equation of charge Q for this circuit.

40. Define real power for A.C. circuit and hence obtain formula for real power $P = V_{rms} \cdot I_{rms} \cos \delta$ for L-C-R a.c. series circuit.

41. For thin lens, prove that $\frac{1}{v} - \frac{1}{u} = \frac{(n_2 - n_1)}{n_1}\left(\frac{1}{R_1} - \frac{1}{R_2}\right)$.

42. Take the equation $\delta = i + e - A$ for refraction of light due to a Prism, then derive equation for refractive index of the material of Prism.

43. By taking the equation for path difference $r_2 - r_1 = \frac{xd}{D}$ in Young's experiment, derive equation for the distance between two consecutive bright fringes.

OR

For Fraunhoffer diffraction by a single slit, explain first maximum and derive the condition for first maximum.

44. Give Einstein's explanation for Photoelectric effect and also derive necessary equations.

45. Name the series that appear in the visible region and infrared region of Hydrogen Spectra and write their corresponding equations.

OR

By using Exponential law of Radioactive Decay, derive equations for Mean lifetime and Half life.

46. Explain N-type semi-conductor.

47. Explain for transistor:

(i) Input resistance (r_i) *(ii)* Output resistance (r_0)

(iii) Current gain (β) *(iv)* Transconductance (g_m)

48. Explain Ground Wave Propagation.

SECTION - D

*Question Nos. from **49** to **60** are Short answer type questions.*
*Each carries **three** marks.* **36**

49. An electric dipole of moment $\vec{p}$ is placed in a uniform electric field $(\vec{E})$. The dipole is rotated through a very small angle θ from equilibrium and is released. Prove that it executes simple harmonic oscillations with periodic time $T = 2\pi\sqrt{\frac{I}{pE}}$, where I = Moment of Inertia of the dipole.

OR

Prove that the force acting on one plate due to the other in a parallel plate capacitor is given by $F = \frac{1}{2}\frac{CV^2}{d}$.

50. 0.291 A current is obtained, when a 5 Ω resistor is connected with an unknown battery having r as internal resistance. 0.147 A current is obtained, if the above battery is connected to 10 Ω resistor. Calculate the emf and the internal resistance of the battery.

51. On passing some current through a Silver voltameter for 10^3 sec., 1.118 gm. Silver collects on its cathode. An ammeter connected in series shows 0.9 amp. If the electro-chemical equivalent of Silver is 1.118×10^{-6} Kg C^{-1}, find the error in the ammeter.

52. A solenoid of length 0.4 m and diameter 0.6 m has only one layer of winding, containing 1000 turns. If the current passing through the solenoid is 5.0×10^{-3} A, find magnetic induction at the end of the axis.

53. A magnetic pole with pole strength 100 Am is at 20 cm from a bar magnet has pole strength of 200 Am and has a length of 5 cm. If the magnetic pole is on the axis of the bar magnet, find the force on the magnetic pole.

54. Find equivalent inductance of two inductors connected in parallel with the help of an appropriate d.c. circuit.

OR

In an a.c. circuit, calculate the resultant inductance of two inductors L_1 and L_2 when they are connected in parallel.

55. 10% of the total energy of a 100 W bulb is converted into visible light. Calculate the average intensity at a spherical surface which is at a distance of 2 m. from the bulb. Consider the bulb to be a point source and let the medium be isotropic.

56. An object is placed at a distance of 5 cm from the pole of a mirror on the principal axis of a concave mirror having 15 cm radius of curvature –
Find the following :
(i) Image distance *(ii)* Type of image *(iii)* Lateral magnification

OR

In Young's experiment, the distance between two slits is 1 mm. and the distance between two consecutive bright fringes is 0.03 cm. Now on displacing the screen by 50 cm. away from the slits, the distance between two consecutive bright fringes is doubled. Find the wavelength of light.

57. Human eye can experience minimum 25 photons per second. Light of 660 nm wavelength is required for it. What is the minimum power necessary to excite optic nerves ? ($c = 3 \times 10^8\ ms^{-1}$; $h = 6.62 \times 10^{-34}$ Js.)

58. How much energy (in eV) should be given to an electron in the level $n = 2$ of Hydrogen atom, so that it can emit the H_β line of the Balmer series ?
($R = 1.097 \times 10^7\ m^{-1}$; $c = 3 \times 10^8\ ms^{-1}$; $h = 6.625 \times 10^{-34}$ Js.)

59. A radioactive substance emits both α and β radiations. Its mean life for α-emission is 1620 yrs. and for β-emission is 405 yrs. If both emissions occur simultaneously, find the time elapsed during which $\frac{3}{4}$ th part of the substance has decayed.

60. The width of a depletion region is equal to 400 nm. The impurity of the electric field at the depletion region is equal to 5×10^5 V/m. Then calculate the following quantities : *(i)* The value of the potential barrier. *(ii)* The minimum energy required by an electron to move from the N type to the P type region of the diode.

OR

The collector supply voltage in a CE transistor amplifier is equal to 10 V. The base current is equal to 10 μA in the absence of the signal voltage and the voltage between the collector and the emitter is equal to 4 V. The current gain β of the transistor is equal to 300. Calculate the value of the load resistance R_L.