PHYSICS QUESTION PAPER
CLASS-XII

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

Instructions :

1. There are A, B, C and D sections, containing **60** questions in this question paper.
2. Symbols used in this question paper have their usual meanings.
3. Log table and simple electronic calculator can be used.
4. Write new section on a new page. Follow the sequence.

SECTION - A

*Question Nos. from **1** to **16** are multiple choice questions. Each question carries **ONE** mark. Choose the correct answer (A, B, C, D) from the given alternative and write it.* **16**

1. There exists an electric field of 200 N/C along Z-direction. The flux passing through a square of 10 cm sides placed on XY plane inside the electric field is .....Nm^2C^{-1} .

(A) $\frac{1}{4}$ (B) 4

(C) $\frac{1}{2}$ (D) 2

2. A 4 μF capacitor is charged up to 100 V. The plates of the capacitor are then connected with a conducting wire. How much heat will be generated in the above situation ?

(A) 0.2 J (B) 0.02 J

(C) 0.002 J (D) 2 J

3. The rating of a car battery of 12 V is 60 A, which means that 60 A of current will flow when the battery is connected to a conducting wire. The internal resistance of the battery will be ..... Ω.

(A) 0.2 (B) 0.02

(C) 0.015 (D) 0.15

4. If hot junction is made cold and the cold junction is made hot the .....

(A) direction of e.m.f. does not change.

(B) direction of current gets reversed.

(C) direction of current does not change.

(D) current is not obtained.

5. The speed of charged particle in a Cyclotron is independent of .....

(A) its mass. (B) its charge.

(C) its linear speed. (D) magnetic field

6. With reference to the earth, the angle of dip at magnetic poles of the earth is ..... rad.

(A) π (B) 2π

(C) $\pi/4$ (D) $\pi/2$

7. Magnetic flux linked with a coil is $\phi = 9t^2 + 2t - 3$, where t is in second and ϕ is in Wb. At $t = 1$ sec., the induced emf = ... V.

(A) 14 (B) 20

(C) 16 (D) 18

8. The real power in an A.C. circuit containing only inductor is equal to ..... W.

(A) $\frac{1}{2}LI^2$ (B) $\frac{1}{2}LI$

(C) $2LI^2$ (D) Zero

9. If λ_v, λ_x and λ_m represent the wave-length of Visible light, X-rays and Microwaves respectively, then .....

(A) $\lambda_m > \lambda_v > \lambda_x$ (B) $\lambda_m < \lambda_v < \lambda_x$

(C) $\lambda_m = \lambda_v = \lambda_x$ (D) None of the above

10. Focal length of a thin lens made of the material of refractive index 1.5 is 10 cm. Its focal length, when it is kept in a medium of refractive index $4/3$ would be ..... cm.

(A) 30 (B) 40

(C) 50 (D) 60

11. Which of the following phenomenon is not possible for Sound ?

(A) Interference (B) Diffraction

(C) Polarization (D) Reflection

12. If the momentum of an electron is required to be same as that of wave of 5200 Å wave-length, its velocity should be ..... ms^{-1} .

($h = 6.62 \times 10^{-34}$ Js and $m = 9.1 \times 10^{-31}$ Kg)

(A) 10^3 (B) 1.2×10^3

(C) 2.8×10^3 (D) 1.4×10^3

13. During which of the following transitions, will the radiation of maximum frequency be emitted in hydrogen atom ?

(A) $n = 2$ to $n = 1$ (B) $n = 1$ to $n = 2$

(C) $n = 2$ to $n = 6$ (D) $n = 6$ to $n = 2$

14. 1 mCi = ... Becquerel.

(A) 3.7×10^4 (B) 3.7×10^7

(C) 3.7 (D) 3.7×10^{-7}

15. ${}_7N^{14} + {}_2He^4 \rightarrow$ ..... + ${}_1H^1 + Q$

(A) ${}_0n^1$ (B) ${}_6C^{12}$

(C) ${}_8O^{17}$ (D) ${}_{-1}e^0$

16. The Boolean equation of NOT gate is ....

(A) $Y = A$ (B) $Y = A.B$

(C) $Y = \overline{A}$ (D) $Y = \overline{A.B}$

SECTION - B

*Question Nos. from **17** to **32** are very short answer type questions.*
*Each question carries **ONE** mark.* **16**

17. The total electric charge on an electric dipole is zero, but its electric field is not zero. Why ?

18. State Gauss's theorem.

19. What is called Polar dielectric ?

20. Define Mobility.

21. State Kirchoff's First Law.

22. State Joule's Law.

23. Write SI unit of Gyro - magnetic ratio.

OR

State the principle of Moving Coil Galvanometer.

24. What is called Bound current ?

25. What is called series resonance in L-C-R A.C. circuit ?

OR

Draw a circuit symbol of Step - down transformer.

26. Write the dimensional formula for Power of a Lens.

27. Which light was used instead of monochromatic light in Young's historical experiment ?

OR

Define Unpolarized light .

28. What is called Field Emission ?

29. What is called Metastable state ?

30. Draw the circuit symbol of Zener diode.

31. Write the Boolean equation of NOR gate.

OR

Show the truth table of OR gate .

32. What is called Modulation ?

OR

Define Critical Frequency (f_c) .

SECTION - C

Question Nos. from ***33*** *to* ***48*** *are short answer type questions.*
Each question carries ***TWO*** *marks.* **32**

33. Obtain the formula of force on a point charge q due to uniform surface charge distribution.

OR

Obtain the formula of torque on an electric dipole suspended in a uniform electric field.

34. Using $U_E = \frac{1}{2} CV^2$, obtain the formula for energy density in terms of electric field between plates of charged capacitor.

35. What is Shunt ? Derive necessary formula of Shunt.

36. Explain Peltier effect and define Peltier *emf*.

37. Using $dB(x) = \frac{\mu_0 I dl}{4\pi r^2} \cos\phi$, prove that the magnetic intensity at any point on the axis of ring (at a distance x from the centre of the ring) carrying current is

$$B(x) = \frac{\mu_0 I a^2}{2\left(a^2 + x^2\right)^{3/2}} .$$

38. Write both the definitions of Mutual inductance.

39. Define Motional emf and derive $\varepsilon = -Bvl$ with necessary figure.

40. Draw a neat diagram of an A.C. Dynamo. Derive the formula of magnetic flux linked with the coil, at instant t, $\Phi_t = NAB \cos \omega t$.

OR

A.C. voltage $V = V_m \cos \omega t$ is applied to a series L-C-R circuit. Derive the differential equation form of the charge Q.

41. Using $n = \frac{c}{v}$, derive the general form of Snell's Law.

OR

Derive the formula for the equivalent focal length of a close combination of two thin convex lenses.

42. Accepting the expression for path difference $r_2 - r_1 = \frac{xd}{D}$ in Young's experiment, obtain the formula for the distance between two consecutive bright fringes.

43. Write four properties of Photon.

44. Draw a labelled circuit diagrams of Half-wave rectifier and Full-wave rectifier.

45. Draw a circuit diagram and symbol diagram of NAND gate. Write its Boolean equation and give its truth table.

46. What is Thermo-nuclear Fusion Reaction ? Write the equations of proton-proton cycle alongwith energy released in the process.

OR

Define Half-life time and derive $\tau_{1/2} = \frac{0.693}{\lambda}$.

47. Derive the formula $d = \sqrt{2hr}$ for Space Wave Transmission.

48. Write four advantages of Optical Fibre Communication.

SECTION - D

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

49. A 40 μC of electric charge is placed at the origin of the Cartesian co-ordinate system. Calculate the electric potential at a point (0.5, 0.8, 0.6) m.
$k = 9 \times 10^9$ SI.

OR

The co-ordinates of two electric charges $q_A = 2.5 \times 10^{-7}$ C and $q_B = -2.5 \times 10^{-7}$ C are (0, 0, –15) cm and (0, 0, 15) cm. Calculate the total electric charge and dipole

moment of this system.

50. An electric kettle has two heating coils. When one of this coil is switched on, a given quantity of water in the kettle starts boiling in t_1 minutes. When the other coil only is switched on, then the same amount of water starts boiling in t_2 minutes. If the two coils are switched on in parallel, prove that the same amount of water will take time $t = \frac{t_1 t_2}{t_1 + t_2}$ to boil. Each time the voltage applied is the same.

51. Write the equation of magnetic force acting on a particle moving through a magnetic field. Using it, obtain Newton's equation of motion and show that Kinetic Energy of the particle remains constant with time.

52. There are 1.5×10^4 turns in the winding of a toroidal ring. The radius of circular axis of the ring is 10 cm. The radius of cross-section of ring is 2.0 cm. Find inductance of the ring. $\left(\mu_0 = 4\pi \times 10^{-7} \text{ SI}\right)$.

53. An inductor L = 8.1 mH is connected in series with a capacitor C = 12.5 μF and a resistor is R = 10 Ω. The series combination of R-L-C is connected to an A.C. voltage of 100 V and 500 Hz frequency. Calculate the voltage developed between the two ends of the resistor.

54. 3% 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 1 m from the bulb. Consider the bulb to be a point source and let the medium be isotropic.

55. An object is placed at a distance of 25 cm. on the axis of a concave mirror having focal length of 20 cm. Find the image distance, type of the image and its lateral magnification.

OR

Depth of a well is 5.5 m and it is completely filled with water. The refractive index of water is 1.33. If viewed from the top, by how much height would the bottom of the well appear to be shifted up.

56. In Fraunhoffer diffraction by a single slit, a position where first order minimum is formed by the wave-length of 6000 Å, first order maximum is formed due to an unknown wave-length λ'. Find λ' .

57. In potassium, Photo electric effect can be produced with maximum wave-length 564 nm. Find its work function in eV.

[$1\,eV = 1.6\times10^{-19}$ J ; $h = 6.63\times10^{-34}$ Js ; $C = 3.0\times10^{8}\,ms^{-1}$]

OR

Power produced by Sun is 4×10^{26} W. If the average wave-length of the emitted radiation is considered to be 500 nm, find the number of photons emitted in one second.

58. Find the ground state (n =1) energy (in MeV) of an electron inside a one dimensional box of length 1.2×10^{-15} m.

[Mass of an electron = 9.1×10^{-31} Kg, $h = 6.62\times10^{-34}$ Js ; $e = 1.6\times10^{-19}$ C] .

OR

If in an X-ray tube, the p.d. between the anode and the cathode is 12.4 kV and current flowing is 2 mA, then find :

(i) the speed of electrons while striking the anode.

(ii) minimum wave-length (λ_{min}) emitted.

[$e = 1.6\times10^{-19}$ C, $m = 9.1\times10^{-31}$ Kg, $h = 6.62\times10^{-34}$ Js]

59. A nucleus has an average radius of 6.6 fm. If the average mass of a nucleon is 1.0088 u, calculate its density.

[R_0 = 1.1 fm, 1u = 1.66×10^{-27} Kg.]

60. A change of 0.02 V takes place between the base and emitter when an input signal is connected to the CE transistor amplifier. As a result, 20μA change takes place in the base current and a change of 2 mA takes place in the collector current. Calculate the

(i) Input resistance.

(ii) A.C. current gain.

(iii) Trans-conductance.