TOPPER SAMPLE PAPER I
Class XII - Physics

Time: Three Hours **Maximum Marks: 70**

General Instructions

(a) All questions are compulsory.

(b) There are 30 questions in total. Questions 1 to 8 carry one mark each, questions 9 to 18 carry two marks each, questions 19 to 27 carry three marks each and questions 28 to 30 carry five marks each.

(c) There is no overall choice. However internal choice is provided in few questions.

(d) Use of calculations is not permitted.

(e) You may use the following physical constants wherever necessary.

$$e = 1.6\times10^{-19} C$$
$$c = 3\times10^{8} ms^{-1}$$
$$h = 6.6\times10^{-34} JS$$
$$\mu_o = 4\pi\times10^{-7} TmA^{-1}$$
$$K_B = 1.38\times10^{23} JK^{-1}$$
$$N_A = 6.023\times10^{23} / mole$$
$$m_n = 1.6\times10^{-27} kg$$

Q1. Define the electric dipole moment. What is the direction of this vector? (1)

Q2. What is the SI unit of electric flux and electric field? (1)

Q3. The number of turns in the secondary of a transformer is 100 times the number of turns in the primary. If 1kW of power is supplied to the primary, how much power is obtained at the secondary? (1)

Q4. Arrange these in decreasing order of frequency: microwaves, infrared, x-ray, visible rays. (1)

Q5. Which of these quantities remains unchanged when light is refracted: wavelength, frequency and velocity? (1)

Q6. Does the frequency of incident radiation affect the stopping potential or saturation current or both? (1)

Q7. In an unbiased p-n junction why do holes diffuse from the p region to the n region? (1)

Q8. What is noise in a communication system? (1)

Q9. An electron, alpha particle and proton have the same kinetic energy. Which of these particles has the shortest de Broglie wavelength? (2)

Q10. Is it correct to say that a potentiometer is equivalent to an ideal voltmeter? (2)

Q11. A magician during a magic show makes a glass lens with n = 1.47 disappear in a trough of liquid. What is the refractive index of the liquid? What is the focal length of the glass lens in the liquid? (2)

Q12. A short bar magnet placed with its axis at 60 degrees with a uniform external magnetic field of 1.0T experiences a torque of magnitude $5x10^2$ J. What is the magnitude of magnetic moment of the magnet? (2)

Q13. Why does a paramagnetic sample display greater magnetism when cooled? Why is diamagnetism, in contrast, almost independent of temperature? (2)

Q14. What is power factor? Why does a low power factor imply large power loss in transmission? (2)

Q15. How does the resolving power of a compound microscope change on
- i) decreasing the wavelength of light used
- ii) decreasing the diameter of the objective lens? (2)

Q16. Find the maximum frequency and minimum wavelength of X-rays produced by 30keV electrons. (2)

Q17. Nuclear density of hydrogen is $2.3x10^{17}$ kg/ m 3. Given A = 56 for iron find its nuclear density. (2)

Q18. Why are sky waves not used for transmission of TV signals? State two factors that can increase the range of transmission. (2)

Q19. Define the term electric potential. Give the dependence of electric potential due to a small electric dipole at a far off point lying on
- i) the axial line and
- ii) equatorial line (3)

Q20. The electron drift arises due to the force experienced by electrons in the electric field inside the conductor. A force causes acceleration in accordance with Newton's second law. Why then do the electrons acquire a steady average drift speed but no acceleration?

What is the path of electrons along a straight line between successive collisions in the presence of an electric field? (3)

Q21. With the help of a labeled diagram, briefly describe the construction of a coaxial cable. What is the upper limit of frequency upto which a coaxial cable can be used? (3)

Q22. Two devices A and B are connected independently to a variable frequency alternating voltage source. The current in A leads the applied voltage whereas the current in A lags the applied voltage.

i) Identify the circuit element A and B.

ii) How will the current in these circuit elements change if the applied frequency is decreased? (3)

Q23. In a dark night, a thief was climbing up on a wall of the building with the help of a pipeline attached to that building. A man on the roof of the adjacent building saw him and to stop him he focused the torch to the pond at the ground floor lying between both the buildings, so that the reflected light reaches the eyes of the thief. As the same happened, the thief got afraid and lost his control over the pipe and fell in the pond.
(a) What is the interesting matter in this event?
(b) Explain reflection and its laws with suitable ray diagram. (3)

Q24. Briefly explain the principle of working of an ac generator. What is the maximum emf produced by it? (3)

Q25: Explain, with the help of a labelled diagram, the principle and construction of a cyclotron. (3)

Q26: An ac voltage $E = E_0 \sin \omega t$ is applied across a pure inductor of inductance L. Show mathematically that the current flowing through it lags behind the applied voltage by a phase angle of $\pi / 2$. (3)

Q27: A semiconductor has equal electron and hole concentrations of 2 x 10^8 /m^3. On doping with a certain impurity, the hole concentration increases to 4 x 10^{10} /m^3.

(i) What type of semiconductor is obtained on doping?

(ii) Calculate the new electron hole concentration of the semiconductor.

(iii) How does the energy gap vary with doping? (3)

Q28: a. State the essential condition for diffraction of light to take place.
b. Use Huygen's principle to explain diffraction of light due to a narrow single slit and the formation of a pattern of fringes obtained on the screen.
c. Sketch the pattern of fringes formed due to diffraction at a single slit showing variation of intensity with angle θ.

OR

a. What are the coherent sources of light? Why are coherent sources required to obtain sustained interference pattern?
b. State three characteristic features which distinguish the interference pattern due to two coherently illuminated sources as compared to that observed in a diffraction pattern due to a single slit. (5)

Q29. State Biot-Savart law. Use it to obtain the magnetic field at an axial point at a distance x from the centre of a circular coil of radius a carrying a current I. Compare the magnitude of the magnetic field at the centre of the coil and at an axial point for which $x = \sqrt{3}a$.

OR

Distinguish between the magnetic properties of para, diamagnetic and ferromagnetic substances in terms of

i) susceptibility
ii) permeability
iii) coercivity

Give one example of each of these materials. Draw magnetic field lines near a diamagnetic and paramagnetic substance. (5)

Q30: A transistor is used in common emitter mode in an amplifier circuit. When a signal of 20 mV is added to the base-emitter voltage, the base current changes by 20 μA and the collector current changes by 2 mA. The load resistance is $5\,k\Omega$. Calculate (a) the factor β, (b) the input resistance R_{BE}, (c) the transconductance and (d) the voltage gain. (5)