MODEL QUESTION PAPER

PHYSICS
XII – STANDARD (CBSE)

Time Allowed: 3 Hours **Maximum Marks: 70**

General Instructions

1. There are 33 questions in all. All questions are compulsory.
2. This question paper has five sections: Section A, Section B, Section C, Section D and Section E.
3. All the sections are compulsory.
4. Section A contains sixteen questions, twelve MCQ and four Assertion Reasoning based of 1 mark each, Section B contains five questions of two marks each, Section C contains seven questions of three marks each, Section D contains two case study based questions of four marks each and Section E contains three long answer questions of five marks each.
5. There is no overall choice. However, an internal choice has been provided in one question in Section B, one question in Section C, one question in each CBQ in Section D and all three questions in Section E. You have to attempt only one of the choices in such questions.
6. Use of calculators is not allowed.
7. You may use the following values of physical constants where ever necessary

   i. c = 3 x 108 m/s

   ii. m_e = 9.1 x10-^{31} kg

   iii. e = 1.6 x 10-19 C

   iv. μ_0 = 4π x 10-7 Tm$\boldsymbol{A^{-1}}$

   v. h = 6.63 x10^{-34}Js

   vi. ε_0 = 8.854 x10-12 $\boldsymbol{C^2N^{-1}m^{-2}}$

   vii. Avogadro's number = 6.023 X $\mathbf{10^{23}}$ per gram mole

SECTION-A

Answer all the questions **16×1=16**

S.No.	Questions	Marks
1	In Huygen's wave theory, the locus of all points oscillating in the same phase is called a (a) ray (b) Vibrator (c) Wave fort (d) half period zone	1
2	If a glass rod is immersed in a liquid of the same refractive index, then it will (a) disappear (b) look bent (c) look longer (d) look shorter	1
3	Most of the substance shows which of the following magnetic property? (a) diamagnetism (b) paramagnetism (c) ferromagnetism(d) both b and c	1
4	When alpha particles are sent through a thin gold foil, most of them go straight through the foil, because (a) alpha particles are positively charged (b) the mass of an alpha particle is more than the mass of an electron (c) most of the part of an atom is empty space (d) alpha particles move with high velocity	1
5	The wavelength and intensity of light emitted by an LED depend upon − (a) Forward bias and energy gap of the semiconductor. (b) Energy gap of the semiconductor and reverse bias. (c) Energy gap only. (d) Forward bias only	1
6	In photoelectric effect the maximum kinetic energy of emitted electron depends on (a) Wave length (b) frequency (c) intensity (d) work function	1
7	The number of Photons of frequency 10^{14} Hz in radiation of 6.62 J will be (a) 10^{10} (b) 10^{15} (c) 10^{20} (d) 10^{25}	1
8	What is the resistance of a 40 W lamp which is lighted as full brilliance by a current of 1/3 A (a) 120 ohm (b) 240 ohm (c) 360 ohm (d) 480 ohm	1
9	The power factor of a series LCR circuit at resonance will be (a) 1 (b) 0 (c) ½ (d) $1/\sqrt{2}$	1
10	Which of the following does not obey the phenomenon of mutual induction? (a) dynamo (b) transformer (c) induction coil (d) electric heater	1
11	Two solenoids of the same length having number of turns in the ratio of 2:3 are connected inseries. The ratio of magnetic fields at their centers is (a) 2;1 (b) 3;1 (c) 2;3 (d) 3;2	1

12	The radius of the inner most electronorbitofahydrogenatomis5.3×10^{-11}m. The radius of then =3orbitis (a) $1.01\text{x}10^{-10}$m (b)$1.59\text{X}10^{-10}$m (c)$2.12\ \text{x}10^{-10}$m (d)$4.77\ \text{X}10^{-10}$m	1
For Questions 13 to 16, two statements are given –one labelled Assertion (A) and other labelled Reason (R). Select the correct answer to these questions from the options as given below. **a) If both Assertion and Reason are true and Reason is correct explanation of Assertion.** **b) If both Assertion and Reason are true but Reason is not the correct explanation of Assertion.** **c) If Assertion is true but Reason is false.** **d) If both Assertion and Reason are false.**		
13	**Assertion:** In Young's experiment, the fringe width for dark fringes is different from that forwhite fringes. **Reason :** In Young's double slit experiment the fringes are performed with a source of whitelight, then only black and bright fringes are observed. (a) Both Assertion and Reason are correct and Reason is the correct explanation of Assertion (b) Both Assertion and Reason are correct, but Reason is not the correct explanation ofAssertion. (c) Assertion is correct but Reason is incorrect. (d) Assertion is incorrect but Reason is correct.	1
14	**Assertion :** We cannot think of a magnetic field configuration with three poles. **Reason :** A bar magnet does exert a torque on itself due to its own field. (a) Both Assertion and Reason are correct and Reason is the correct explanation of Assertion (b) Both Assertion and Reason are correct, but Reason is not the correct explanation ofAssertion. (c) Assertion is correct but Reason is incorrect. (d) Assertion is incorrect but Reason is correct	1
15	**Assertion (A):** Diamond behaves like an insulator. **Reason (R):** There is a large energy gap between valence band and conduction band of diamond. (a) Both Assertion and Reason are correct and Reason is the correct explanation of Assertion (b) Both Assertion and Reason are correct, but Reason is not the correct explanation ofAssertion. (c) Assertion is correct but Reason is incorrect (d) Assertion is incorrect but Reason is correct .	1

16	**Assertion:** The setting sum appears to be red. **Reason:** Scattering of light is directly proportional to the wavelength. (a) Both Assertion and Reason are correct and Reason is the correct explanation of Assertion. (b) Both Assertion and Reason are correct, but Reason is not the correct explanation ofAssertion. (c) Assertion is correct but Reason is incorrect. (d) Assertion is incorrect but Reason is correct	1

SECTION-B

Answer all the questions **5×2=10**

17	In which situation is there a displacement current but no conduction current ?	2
18	Define conductivity of a material. Give its SI unit	2
19	How does a circular loop carrying current behaves as a magnet?	2
20	The current flowing through a pure inductance 2 mH is $I = (15\cos 300t)A$. What is the (i) r.m.s. and (ii) Average value of current for a complete cycle?	2
21	State the criteria for the phenomenon of total internal reflection of light to take place. OR What is the difference between Magnification and Magnifying power?	2

SECTION-C

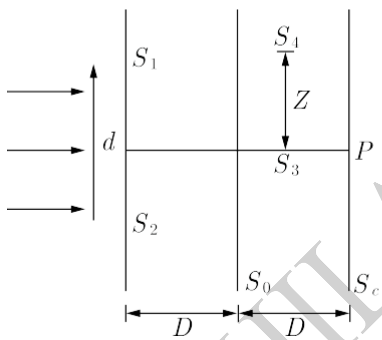
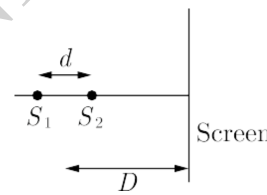
Answer all the questions **7×3=21**

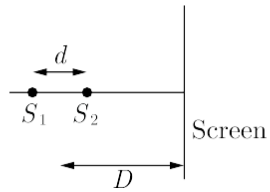
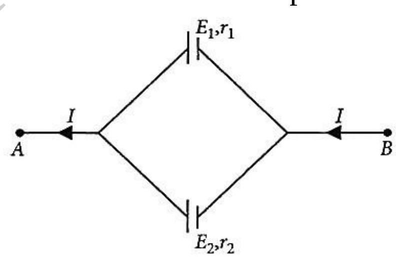
22	In the Rutherford scattering experiment, the distance of closest approach for an α-particle is d_0. If α-particle is replaced by a proton, then how much kinetic energy in comparison to α-particle will be required to have the same distance of closest approach d_0?	3
23	Give two advantages of LED's over the conventional incandescent lamps.	3
24	Two equal balls having equal positive charge q coulombs are suspended by two insulatingstrings of equal length. What would be the effect on the force when a plastic sheet is inserted between the two?	3
25	State the Bio-Savart law for the magnetic field due to a current carrying element. Use this lawto obtain a formula for magnetic field at the centre of a circular loop of radius R carrying a steady current I. Indicate the direction of the magnetic field.	3
26	Explain with reason, why 1. Sun appears reddish at sun-set or sun-rise 2. Sun is observed earlier to actual sun-rise.	3

27	How the size of a nucleus is experimentally determined? Write the relation between the radiusand mass number of the nucleus. Show that the density of nucleus is independent of its mass number.	3
28	Explain why we need coherent sources to produce interference of light. OR How does one demonstrate, using a suitable diagram, that unpolarized light when passedthrough a Polaroid gets polarized?	3

SECTION-D

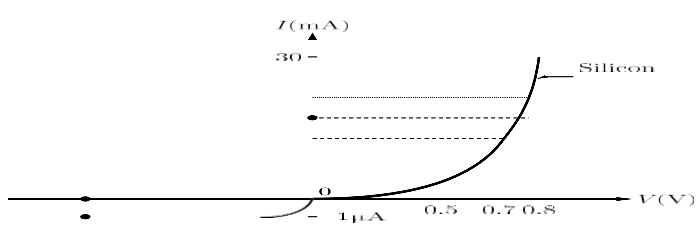
Answer all the questions **2×4=8**

29	Consider the situation shown in figure. The two slits S_1 and S_2 placed   symmetrically around thecentral line are illuminated by monochromatic light of wavelength λ. The separation betweenthe slits is d. The light transmitted by the slits falls on a screen S_0 place at a distance D from the slits. The slits S_3 is at the central line and the slit S_4 is at a distance from S_3. Another screenS_c, is placed a further distance D away from S_c. i) Find the path difference if z = $\frac{\lambda D}{2d}$ (a) λ (b) $\lambda/2$ (c) $3/2\lambda$ (c) 2λ ii) Find the ratio of the maximum to minimum intensity observed on S_c, if z = $\frac{\lambda D}{d}$ (a) 4 (b) 2 (c) 3 (d) 1 iii) Two coherent point sources S_1 and S_2 are separated by a small distance d as shown infigure. The fringes obtained on the screen will be	4

	 (a) Concentric Circle (b) Points (c) Straight Lines (d) Semi-circles iv) In the case of light waves from two coherent sources S_1 and S_2, there will be constructive interference at an arbitrary point P, if the path difference S_1P - S_2P is (a) $\left(n+\frac{1}{2}\right)\lambda$ (b) $n\lambda$ (c) $7A^2$ (d) $19A^2$ V) Two monochromatic light waves of amplitudes 3A and 2A interfering at a point have a phase difference of 60°. The intensity at that point will be proportional to (a) $5A^2$ (b) $13A^2$ (c) $7A^2$ (d) $19A^2$	
30	(a) Explain the term drift velocity of electrons in a conductor. Hence obtain the expression for the current through a conductor in terms of drift velocity. (b) Two cells of emfs $E1$ and $E2$ and internal resistances r_1 and r_2 respectively are connected in parallel as shown in the figure. Deduce the expression for the (i) Equivalent emf of the combination (ii) equivalent internal resistance of the combination (iii) potential difference between the points A and B.  **OR** (a) State the two Kirchhoff's rules used in the analysis of electric circuits and explain them. (b) Derive the equation of the balanced state in a Wheat stone bridge using Kirchhoff's laws.	4

SECTION-E

Answer all the questions **3×5=15**

31	Define mutual inductance between a pair of coils. Derive an expression for the mutual inductanceof two long coaxial solenoids of same length round one over the other. **OR** In a closed circuit of resistance 10 ohm, the linked flux varies with time according to relation $\varphi = 6t^2 - 5t + 1$. At $t = 0.25$ second, What is the current (in Ampere) flowing through the circuit?	5
32	Discuss the inconsistency in Ampere's circuital law. What modification was made my Maxwellin this law? **OR** A parallel plate capacitor is charged to 60 μC. Due to a radioactive source, the plate loses charge at the rate of 1.8×10^{-8} C-s^{-} What is the magnitude of displacement current?.	5
33	Considering the case of a parallel plate capacitor being charged, show how one is required togeneralise Ampere's circuital law to include the term due to displacement current. OR The V - I characteristic of a silicon diode is as shown in the figure. Calculate the resistance of the diode at a) I = 15 mA b) V =− 10 V. 	5