Higher Secondary School Main Exam – 2024

Subject – Physics

Class – XII

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

Instructions:

1. All questions are compulsory. Internal options are given in each question from 6 to 20.

2. Question Nos. 1, 2 and 4 each carries 6 marks and each sub-question carries 1 mark.

3. Question Nos. 3 to 5 carries 5 marks and each sub-question carries 1 mark.

4. Each question from 6 to 12 carries 2 marks and word limit for each answer is approx. 30 words.

5. Each question from 13 to 16 carries 3 marks and word limit for each answer is approx. 75 words.

6. Each question from 17 to 20 carries 4 marks and word limit for each answer is approx. 120 words.

7. Draw neat and labeled diagrams wherever necessary.

SECTION – A

1. Select and write the correct option from the options given in each question. **(1 × 6 = 6)**

(a) The electric dipole moment per unit volume of a substance is called -

(i) Electric field (ii) Polarisation

(iii) Potential (iv) Electric capacitance

(b) The specific resistance of a wire depends on which of the following factors?

(i) Material of wire (ii) Diameter of wire

(iii) Length of wire (iv) Mass of wire

(c) Who discovered the magnetic effect of current?

(i) Ampere (ii) Lorentz

(iii) Faraday (iv) Oersted

(d) The correct relationship between the radius of curvature (R) and focal length (f) of a spherical mirror is _____ .

(i) R = 2f (ii) f = 2R

(iii) $R = \frac{f}{2}$ (iv) $R = \frac{1}{f}$

(e) ${}^{3}_{1}H$ and ${}^{3}_{2}He$ atoms are examples of which of the following concept?

(i) Isotope (ii) Isotone

(iii) Isobar (iv) Radioactivity

(f) In depletion layer of p-n junction diode, there are -

(i) Electron (ii) Protons

(iii) Mobile ions (iv) Immobile ions

2. Fill in the blanks with appropriate word and write : **(1 × 6 = 6)**

(i) Potential ____ on moving along the direction of electric field.

(ii) The substances which have negative magnetic tendency are called ____ substances.

(iii) Variable electric field produce ____ current.

(iv) In reflective telescope a concave mirror is used as an ____ .

(v) The energy band above the valence band is called ____ band.

(vi) In a p-type semiconductor, the concentration of ____ is more than the concentration of electron.

(vii) The ____ of the galvanometer is reduced by the use of shunt.

3. Write True and False : **(1 × 5 = 5)**

(i) The electric field inside the cavity is always zero.

(ii) Resistivity of semiconductors increases with increase in temperature.

(iii) The Lorentz force on a stationary charge in any magnetic field is zero.

(iv) Electromagnetic waves cannot propagate through any physical medium other than vacuum.

(v) Silicon and Germanium both are examples of compound semiconductor.

4. Match the column 'A' with column 'B' and write the correct pair : **(1 × 6 = 6)**

	Column 'A'		**Column 'B'**
(i)	Electrostatic force	(a)	De-Broglie
(ii)	Direction of induced current	(b)	Maxwell
(iii)	Electromagnetic wave	(c)	Ohm
(iv)	Double-slit experiment of interference	(d)	Einstein
(v)	Dual nature of matter	(e)	Coulomb
(vi)	Mass-energy equivalence relation	(f)	Lenz
		(g)	Young

5. Write answer of each question in one sentence : **(1 × 5 = 5)**

(a) Write the value of total electric flux emanating from a unit positive charge in air.

(b) Write the name of instrument that measures current in an electric circuit.

(c) Which type of extrinsic semiconductor is obtained when pure semiconductor is doped with trivalent impurities?

6. Write two characteristics of electric field lines. **(2)**

OR

Write two characteristics of equipotential surface.

7. Write two difference between self induction and mutual induction. **(2)**

OR

Write two differences between step-up transformer and step-down transformer.

8. Write the statement and mathematical form of Ampere's circuital law. **(2)**

OR

Write the statement and mathematical form of Gauss's law of magnetism.

9. Which waves are also called heat waves? In which effect do these waves play an important role in maintaining the average temperature on earth? **(2)**

OR

Write the name and one use of the highest frequency electromagnetic wave.

10. If the lower half of the reflecting surface of a concave mirror is covered with an opaque material, what will it have on the image formed by the mirror of an object placed in front of the mirror? Write. **(2)**

OR

If a ray of light enters obliquely from an optically rarer medium to an optically denser medium, what will be the effect on the velocity and frequency of the light ray? Write.

11. Write two conclusions obtained from the alpha particle scattering experiment. **(2)**

OR

Write two features of nuclear force.

12. Draw labeled circuit diagram of forward bias of p-n junction diode. **(2)**

OR

Draw labeled circuit diagram of half-wave rectifier.

13. Establish the relation between EMF, terminal voltage and internal resistance of a cell. **(3)**

OR

Draw the labeled diagram of wheatstone bridge and write the necessary condition for the balance of wheatstone bridge.

14. A solenoid of length 2 meter and 100 turns carries a current 10A. Calculate the magnitude of the magnetic field inside the solenoid. ($\mu_0 = 4\pi \times 10^{-7}$) **(3)**

OR

A long straight wire carries a current of 30A. Calculate the magnitude of magnetic field at a point 30 cm from the wire.

15. Describe total internal reflection of light on the basis of following points : **(3)**

(i) Labelled ray diagram

(ii) Definition

(iii) An application

OR

Describe Huygen's principle on the basis of following points :

(i) Definition of wave front.

(ii) Ray diagram of spherical wave emanating from point source.

(iii) Emanation of secondary wavelets.

16. Write three experimental observations of photoelectric effect. **(3)**

OR

Write three characteristics of photon.

17. Two point charges $q_A = 2\mu C$ and $q_B = -2\mu C$ are located 40 cm apart in vacuum. Find the intensity of the electric field at the mid point of the line joining these two charges. $\left(\frac{1}{4\pi\varepsilon_0} = 9\times10^9\ Nm^2c^{-2}\right)$ **(4)**

OR

Three capacitors of capacitance 3 pF, 4 pF and 5 pF are connected in parallel to a 120V battery. Find the total capacitance of the combination and charge on each capacitor.

18. Deduce an expression for motional electromotive force induced across a straight conductor moving in any uniform magnetic field. **(4)**

OR

Find the expression of resultant voltage, impedance and phase difference between current and voltage with the help of phaser diagram in series LCR circuit.

19. Establish the expression for the net power of combination of two thin lenses kept in contact. **(4)**

OR

Draw a labelled ray diagram for formation of image from simple microscope and establish an expression for the magnification of a simple microscope when image is formed at (a) infinity and (b) least distance of distinct vision.

20. Write two shortcomings of Rutherford's nuclear model and explain how Bohr's model of hydrogen atom overcome these shortcomings? **(4)**

OR

Explain the nuclear fusion and fission with the help of one example each.

***** End *****