Class : XII || Pre Board Examination , 2024-25
Subject :Physics ||Full marks : 70||Time : 3 hours|| Set -01

(The figures in the margin indicate full marks for the questions)

1:Answer any eight questions from the following as directed : 1x8=8

(a) Electrostatics deals with the study of forces, fields and potentials arising from _____ . (Fill in the blank)

(b) Sketch the electric field lines due to two unequal electric charges $+Q_1$ and $-Q_2$, $|Q_1| > |Q_2|$.

(c) What is the SI unit and the dimensional formula of the permitivity (ε) of a medium.

(d) Identify the set in which all the three materials are good conductors of electricity:
(i) Cu, Ag and Au (ii) Cu, Si and diamond
(iii) Cu, Hg and NaCl (iv) Cu, Ge and Hg

(e) If the magnetic monopole exists, then which of the Maxwell's equation to be modified?

(i) $\oint \vec{E}.\vec{dS} = q/\epsilon_o$ (iii) $\oint \vec{E}.\vec{dl} = -d\phi_B/dt$
(ii) $\oint \vec{B}.\vec{dS} = 0$ (iv) $\oint \vec{B}.\vec{dl} = \mu_o(I_c+I_d)$

(f) A convex lens of power 4D and a concave lens of power 3D are placed in contact.What is the equivalent power of the combination?
(i) 7 D (ii) 4 D (iii) 1 D (iv) 0.75 D

(g) What is the de Broglie's wavelength of an electron accelerated through a potential difference of 100V.

(h) The maximum kinetic energy with which an electron is emitted from a metal surface is _____ of the intensity of the light and _____ upon its frequency . (Fill up the blank)

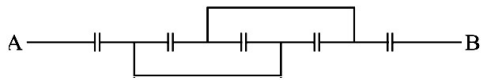
(i) The total energy of an electron in 1st excited state of hydrogen atom is about -3.4eV.What is the kinetic energy of electron in this state?
(Ii -3.4 eV (ii) 3.4 eV (iii) 0.34 eV (iv) -0.34 eV

(j) Binding energy per nucleon of a stable nucleus is about
(i) 8 eV (ii) 8 KeV (iii) 8 MeV (iv) 8 meV

2. **Answer the following questions as directed : 2x10 =20**

(a) Write down the properties of electric charge .What is quantisation of electric charge ? 2
Or
Two point charges + 0.01 μC and −0.01 μC are placed 20 cm apart in vacuum. Calculated the magnitude of electric field intensity at the middle point of the line joining the charges and mention its Direction . What will be the electric potential at that point ? 2

(b) Show that the electric field intensity at a point can be given as negative of potential gradient. 2
Or
Find equivalent capacitance between A and B , if capacitance of each capacitor is C



2

(c) Define mobility . How does mobility of electron changes with temperature ? 1+1=2
Or
The resistance of a platinum wire at 0^0 C is 5.0 Ω and its resistance at steam point is 5.4 Ω .When the wire is immersed in a hot oil bath, the resistance is 5.8 Ω . Calculate the temperature of the oil bath. 2

(d) Write any two important points of similarities and differences each between Coulomb's law for the electrostatic field and Biot-Savart's law for the magnetic field . 2
Or
Define 1 tesla . Obtain the relation between testa & gauss . 2

(e) Find the expression for the emf induced in a rod moving perpendicularly in a uniform magnetic field acting perpendicularly inward to the plane of paper . 2
Or
A long solenoid with 15 turns per cm has a small loop of area 2.0 cm^2 placed inside the solenoid normal to its axis. If the current carried by the solenoid changes steadily from 2.0 A to 4.0 A in 0.1 s, what is the induced emf in the loop while the current is changing? 2

(f) The electric field of an e.m. wave is given by , $E_y = 30 \cos(2\pi \times 10^8 t - 4\pi z)$, where E is in volts/meter, t in second and z in meter , Determine
(i) the wavelength and frequency
(ii) the magnetic field component . ½ + ½ +1 = 2
Or
How are infrared waves produced ? Write their uses . 1+1=2

(g) A plane electromagnetic wave of frequency 25 MHz travels in free space along the *x*-direction. At a point in space , E = 6.3 V/m , along Y direction .What is B at this point ? Find its wavelength . 2
Or
Show that the average energy density of the electric field equals the average energy density of the magnetic field. 2

(h) Give the properties of the electromagnetic waves . 2
Or
Write down the Einstein's photo electric equation. Draw the graph between stopping potential and frequency of the incident photon . From it obtain threshold frequency . 2

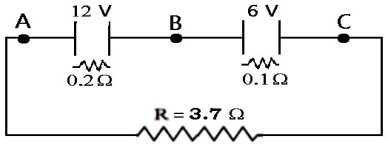
(i)State Huygen's principle . 2
Or
Give the advantages of the reflective type telescope over refracting telescope . 2

(j) State Bohr's postulates . 2
Or
Explain how the nuclear fusion can be explained with the help of the binding energy curve. 2

3.Answer the following questions as directed : 3x9 =27

(a) Find an expression for electric field due to an electric dipole at a point in its equitorial line . 3
Or
Find an expression for capacitance of a parallel plate capacitor with vacuum in between its plates . 3

(b) State the limitations of Ohm's law with proper graphs . 3
Or
In the circuit given below , find the potential difference between A and B and between A and C .



. 1+2=3

(c) find an expression force acting between two straight conductors of infinite length carrying current I_1 and I_2 in the same direction , seperated by a distance r in vacuum . What is 1 ampere ? 2+1=3

Or

A long straight wire of a circular cross-sectional radius 'R', carrying steady current I , which is uniformly distributed across this cross-section. Using Ampere's circuital law calculate the magnetic field at a distance (r) (i) region $r < R$

(d)A short bar magnet placed with its axis at 30^0 with an external magnet field of 0.1 T experiences a torque of 0.02 Nm.
(i) What is the magnetic moment of the magnet.
(ii) Find work done in turning it from its most stable equilibrium to most unstable equilibrium position .
(iii) What is the magnetic field at a point , at a distance of 1 m from its mid point on its axial line ? 3

Or

State Lenz's law . Prove that it obeys the principle of conservation of mechanical energy . 1+2=3

(e) Establish the relation , $\frac{\mu_2}{v} - \frac{\mu_1}{u} = \frac{\mu_2 - \mu_1}{R}$,
where symbols are having usual meanings . 3

Or

Draw the ray diagram showing the formation of image of a distant object at the infinity by an astronomical telescope .

A small telescope has an objective lens of focal length 144cm and an eyepiece of focal length 6.0cm . What is the magnifying power of the telescope? 2+1=3

(f) Establish the law of reflection on the basis of Huygen's principle . 3

Or

(i) Two slits are made 1 mm apart and is placed 0.8 m away in Young's double slit experiment. What is the fringe separation when blue-green light of wavelength 500 nm is used ?

(ii) What is the distance of 8^{th} bright fringe from the central bright fringe .

(iii) What is the distance of the 5^{th} dark fringe from the central bright fringe . 1+1+1= 3

(g) Monochromatic light of frequency 6×10^{14} Hz is produced by a laser. The power emitted is 2×10^{-3} W.

(i) What is the energy of a photon in the light beam?

(ii) How many photons per second, on an average, are emitted by the source? 1 +2 = 3

Or

Draw the energy level diagram to show the different series of hydrogen spectra. Find the limit of Balmar series of Hydrogen spectrum . 1½+1½=3

(h) (i) State the properties of the nuclear force .

(ii) Calculate energy equivalent of 1 amu . 1½+1½=3

Or

Determine from the given data the *Q*-value of the following reaction 3

$_6C^{12} + _6C^{12} \rightarrow _{10}Ne^{20} + _2He^4$

Atomic masses are given to be

$m(_2He^4) = 4.002603$ u

$m(_6C^{12}) = 12.000000$ u

$m(_{10}Ne^{20}) = 19.992439$ u

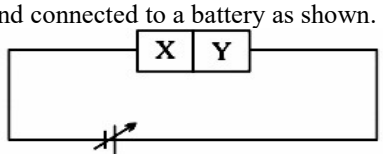
(i) An intrinsic semiconductor has equal electron and hole concentration of 6×10^{16} m^{-3}. On doping with certain impurity the electron concentration increases to 9×10^{22} m^{-3} .

(i) Identify the extrinsic semiconductor. (ii) Calculate the new hole concentration. 2+1 = 3

Or

(i) What is doping ? Write the name of the impurities used to fabricate P type & N type semiconductor.

(ii) Two semiconductor materials X and Y shown in the given figure, are made by doping germanium crystal with indium and arsenic respectively. The two are joined at lattice level and connected to a battery as shown.



Will the junction be forward biased or reversed biased ? Explain . 1+!+1=3

4. Answer any three of the following questions: 5 x 3 =15

(a) (i) What is electric dipole moment of an electric dipole ?
(ii) Derive the expression of intensity at a point on the axial line of an electric dipole .
(iii) An electric dipole is placed at an angle of 30^0 with an electric field of intensity 2×10^5 N/C. It experiences a torque equal to 4 Nm .What is the electric dipole moment of the electric dipole ? 1+3+1=5

(b) State Kirchoff's Laws of current electricity. Applying the same laws to establish the principle of a balanced Wheatstone's bridge. 2+3=5

(c) What is the basic principle of a moving coil galvanometer? Derive an expression for current flowing through the galvanometer in terms of steady angular deflection of its coil. Define voltage sensitivity of the galvanometer. 1+3+1 =5

(d) State the working principle of a transformer. What are the losses in transformer? Name them . 3+2=5

(e) What is diffraction of light ? Describe briefly how a diffraction pattern is obtained on a screen due to a single narrow slit illuminated by a monochromatic source of light.Obtain the conditions for the formation of central maxima , secondary maxima and secondary minima with the help of a neat diagram . 1+4=5

(f) (i) Give the difference between forward and reverse biasing of a PN junction diode
(ii)Identify the types of biasing done with the PN junction diode in the following diagram (a) , (b) , (c) and (d)
1½+1½+½+½+½+½=5