BOSTON PUBLIC SCHOOL

CLASS-XII

SUBJECT-PHYSICS (042)

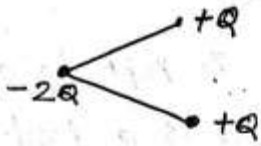
WORKSHEET 2024-25

CHAPTER-1.
ELECTRIC CHARGE AND FIELD

SHORT ANSWER TYPE QUESTION [2 MARKS QUESTIONS]

Q.1 Two point charges of unknown magnitude and signs are placed at a distance d apart. The electric field is zero at a point not between the charges, but on the line joining them. write two essential conditions for this to happen.

Q.2 Sketch the electric field lines for the following system of charges



Q.3 Derive an expression for the torque acting on an electric dipole placed in uniform electric field.

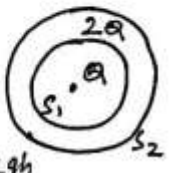
Q.4 An electron moves a distance of 6.0 cm when accelerated from rest by an electric field of strength $2 \times 10^4\ N C^{-1}$. Calculate the time of travel.

Q.5 Show experimentaly & Diagram set up of a dipole in the field for which the torque is (i) maximum (ii) half the max. value.

Q.6 State and Prove Gauss' law.

Q.7 A point charge +Q is kept in the vicinity of uncharged conducting plate. Sketch electric field lines between the charge and the plates.

Q.8 S_1 and S_2 are two hollow concentric spheres enclosing charge Q and 2Q as shown in figure.



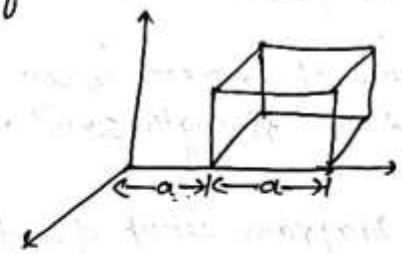
what is the electric flux through S_1 and S_2.

Short Answer type Question [3 Marks Each]

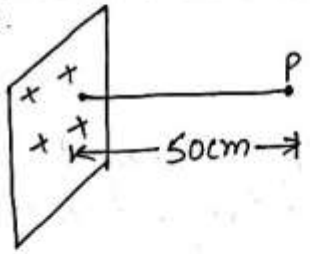
Q.9 The electric field induced in a dielectric when placed in an external field is 1/10 times to the external field. Calculate relative permittivity of the dielectric.

Q.10 An electric dipole of length 4cm, when placed with its axis making an angle of 60° with a uniform electric field experiences a torque of $4\sqrt{3}$ N×m. Calculate the p.e. of the dipole, if it has charge ±8nC.

Q.11 A cube with each side 'a' is kept in an electric field given by $\vec{E} = Cx\hat{i}$, where 'C' is a positive constant. Find out Net charge inside the cube.



Q.12



Given $\sigma = 2\times10^{-7}\ C/m^2$

find Electric field at point P.

Q.13 Derive an expression for electric field due to any (i) infinite long wire (ii) infinitely large plate.

CHAPTER-2

ELECTRIC POTENTIAL AND CAPACITANCE

Short answer Type Questions. [2 Marks Questions]

Q.1 How does electric potential vary from point to point due to a thin charged spherical shell? Draw a Graph showing variation of potential with distance.

Q.2 Derive the expression for the electric potential at any point along the axial line of an electric dipole.

Q.3. Derive an expression for the P.E. of an electric dipole of dipole moment $\vec{p}$ in an electric field $\vec{E}$.

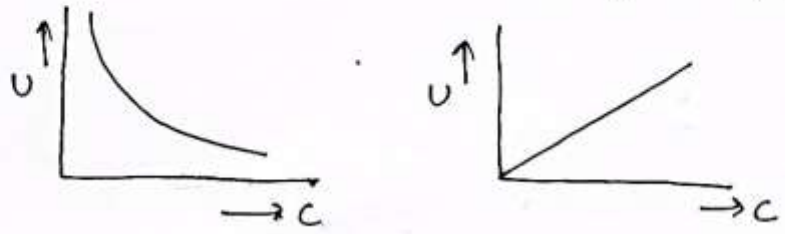
Q.4 Draw equipotential surfaces due to a point charge $Q>0$.

Q.5 Derive the expression for the capacitance of a parallel plate capacitor having plate area A and plate separation d.

Q.6 if one of the plates of a parallel plate capacitor is given $-Q$ charge, then depict the charge appearing on all the surfaces of a parallel plate capacitor.

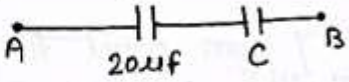
Q.7 Why is the dielectric constant of conductors are taken as ∞.

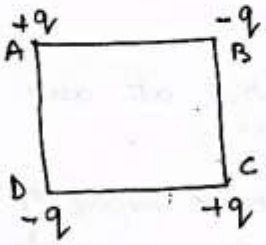
Q.8 The energy of a capacitor varying with its capacitance is shown by two Graphs :- (a) Charge is constant (b) potential difference is constant.. indentify the Graphs.



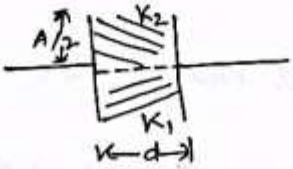
Short answer Type Question [3 Marks Question]

Q·9 The equivalent capacitance of the combination between A & B in the given figure is 4μf. calculate charge on each capacitor if a 12V battery is connected across terminals A and B.



Q·10 

Find the work required to put together this arrangement.

Q·11 

Find net capacitance of the capacitor.

Q·12 Derive the expression for potential energy of a system of two charges placed at distance 'r'.

Q·13 Derive an expression for the potential at a point due to a point charge Q.

CHAPTER-3

CURRENT ELECTRICITY

SHORT ANSWER TYPE QUESTION. [2 MARKS Questions]

Q.1 Why a conductor heats up when electric current passed through it?

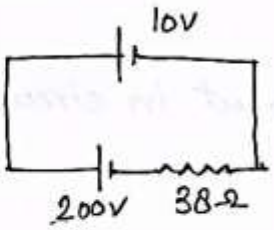
Q.2 For two nichrome wires connected in series with a battery, how does the ratio of drift velocity of electrons in them depend on their lengths and diameters.

Q.3 Distinguish between the emf and potential difference across a cell.

Q.4 An emf of a cell is 1.5V and its internal resistance is 1Ω. For what current drawn from the cell will its terminal potential difference be half of its Emf.?

Q.5 Current in a circuit is Given By $I = (2t+4)$ A Find amount of charge flowing through the wire in t=0 to t=2 sec.

Q.6



find current in the circuit

Q.7 Name two factors on which resistivity of a Given material depends.

Q.8 Define drift velocity and derive an expression for it.

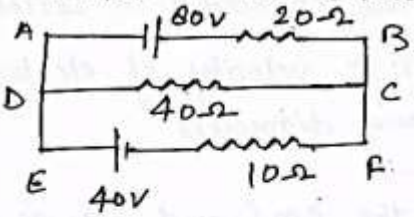
Short answer Type Question [3 Marks Question]

Q.9 State and prove OHM's Law.

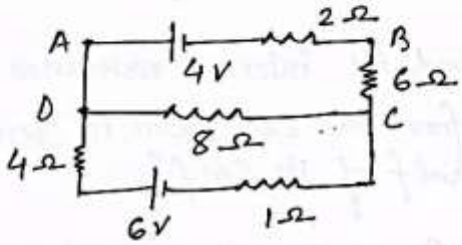
Q.10 Two cells of emfs E_1, E_2 and internal resistances r_1 and r_2 respectively are connected in parallel as shown Find equivalent Emf of the combination.

Q.11 Using Kirchhoff's rule, Calculate the current through 40Ω & 20Ω resistor in the circuit Given.

Q4

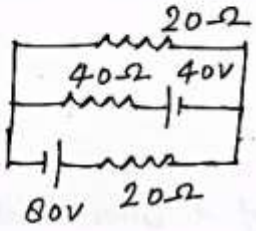


Q.12 Calculate P.D. across 8Ω resistor



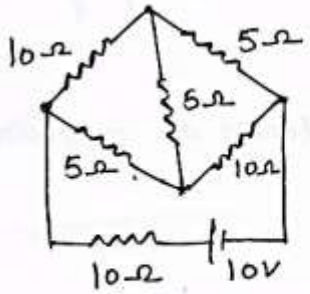
Q.13 Derive an expression for Balanced condition of Wheat stone Bridge

Q.14



find current in circuit.

Q.15



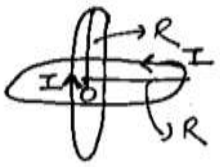
CHAPTER-4

MOVING CHARGES AND MAGNETISM

SHORT ANSWER TYPE QUESTIONS [2 Marks Question]

Q.1 Write the expression for Lorentz magnetic force on a particle of charge 'q' moving with velocity $\vec{v}$ in a magnetic field.

Q.2 Write Biot-Savart law and using it derive an expression for magnetic field due to a current carrying circularcal loop at its centre.

Q.3 

find $'B'_{net}$ at 'O'.

Q.4 A circular coil of N turns and radius R carries a current I It is unwound and rewound to make another coil of radius R/2, current I remaining the same. Calculate the ratio of magnetic moment of new and original coil.

Q.5 Explain. Giving reasons. The basic difference in converting a Galvanometer into (a) a voltmeter (b) an ammeter.

Q.6 A galvanometer having a coil resistance of 100Ω gives full scale deflection when a current of 1mA passes through it. Calculate the value of resis. to be added with it to convert it into an ammeter of range 0-1A.

Q.7 An electron revolves around the nucleus in an orbit of radius 0.53Å. Calculate equivalent magnetic moment if the frequency of revolution of e^- is 6.8×10^9 MHz.

Short answer Types Question [3 Marks Questions]

Q·8 A straight wire of length $\frac{\pi}{2}$ m, is bent into a circular shape. if the wire were to carry a current of 5A. Calculate the magnetic field, due to it. at its centre.

Q·9 Using ampere's circuital law, deduce an expression for magnetic field within a solenoid.

Q·10 A proton and an α-particle move $\perp$ to a magnetic field find the ratio of radii of circular path described By them when Both have (i) equal velocities (ii) equal Kinetic Energy.

Q·11 An e^- revolves around a proton in a H-atom at a speed of 2.18×10^6 m/s in an orbit of radius 0·53Å. what magnetic field does it produce at the centre of its circular orbit?

Q·12 A circular coil of wire consisting of 100 turns, each of radius 8·0cm carries a current of 0·40A. what is the mangnitude of magnetic field at the centre of coil.

Q·13 A straight wire of mass 200g and length 1·5m carries a current of 2A.. it is suspended in mid air by a uniform magnetic field B. What is the magnitude of magnetic field.

CHAPTER-6

ELECTRO MAGNETIC INDUCTION.

Q.1 Obtain a relationship between the charge flowing through the circuit and the change in magnetic flux.

Q.2 State Lenz's Law? does it violate the principle of conservation of energy. Justify your Answer.

Q.3. The magnetic flux through a coil perpendicular to its plane is varying according to the relation $\phi = (5t^3 + 4t^2 + 2t - 5)$ wb. Calculate the induced current through the coil at 2 sec if the resistance is 5Ω.

Q.4 The magnetic flux threading a coil changes from 12×10^{-3} wb to 6×10^{-3} wb in 0.01 s. Calculate the induced Emf.

Q.5 Calculate Self-inductance for a long solenoid of length I, number of turns N and radius r.

Q.6 Current in a circuit falls from 5.0A to 0.0A in 0.1s if an average emf of 200V induced, Give an estimate of the self inductance of the circuit.

Q.7 A pair of adjacent coils has a mutual inductance of 1.5H. if the current in one coil changes from 0 to 20A in 0.5s, what is the change in flux with other coil.

Q.8 Differentiate between magnetic permeability and intensity of magnetization.

Q.9 Two circular loops have their radii in the ratio of 2:3 if the ratio of currents flowing in those is 3:5 find ratio of their magnetic moment.

Q.10 Deduce an expression for the torque acting on a magnetic needle kept in a uniform magnetic field.

CHAPTER-6

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Short answer type Question [3 Marks Questions]

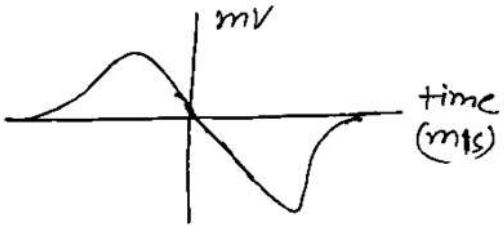
Q.8 A square of side L lies in X-Y plane in a region, where the magnetic field is Given by $B = B_0(2\hat{i}+3\hat{j}+4\hat{k})$ T, where B_0 is constant. The magnitude of flux passing through it will be?

Q.9 Define the term 'self inductance', write its S.I. unit Give two factors on which self induction of an iron core coil depends.

Q.10 A bar magnet is dropped so that it falls vertically through the coil. The graph obtained for voltage produced across the coil v/s time is shown

(i) Explain the shape of Graph.

(ii) Why -ve peak is longer than +ve peak.



Q.11 Solenoid with an iron core and a bulb is connected to an DC source. How does the brightness of the bulb change, when the iron core is removed from solenoid.

Q.12 A magnetic field of flux density 10T acts normal to a coil of 50 turns having 100 cm^2 area. Find Emf induced, if the coil is removed from the field in 0.1s

Chapter 7 & 8.

Alternating current + Electromagnetic wave.

Short Answer Type Questions.

Q.1. In a series LCR circuit $V_L = V_C \neq V_R$, what is the value of power factor.

Q.2 In a series LCR circuit obtain the condition under which (i) the impedance of the circuit is minimum (ii) Wattless current flows in the circuit

Q.3. Three AC circuits containing resistor, inductor, capacitor carry equal currents. If the frequency of emf be increased, then what will be the increased, then what will be its effect on the current flowing in them? Explain with reason

Q.4 A 60μF capacitor is connected to a 110V, 60Hz ac supply. Determine the rms value of current in the circuit

Q.5 A capacitor 1 pF is connected to 220V, 50 Hz ac source. Calculate the reactance of the capacitor.

Q.6 An AC source of 100V rms, 50Hz is connected across a 2Ω resistor and 0.2 mH inductor in series. Calculate (a) impedance of circuit (b) rms current in the circuit.

Q.7 A charged 30μF capacitor is connected to a 27mH inductor. What is the angular frequency of free oscillations of the circuit?

Q.8 A series combination contains a resistor of 10Ω. a capacitor and an ammeter of negligible resistance. It is connected to a source of 220V, 50Hz. If ammeter reads 2A. Find X_C.

Short answer Type Question [3 marks each]

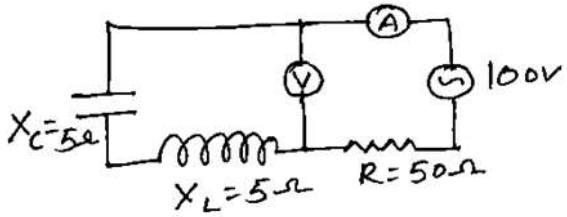
Q.9 Prepare a chart showing origin, frequency range, wavelength range, uses & Detection of electromagnetic waves.

Q.10 Define Root mean Square current also find a derivation for that.

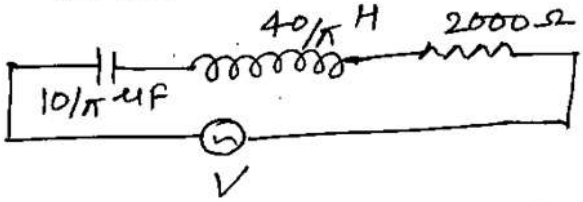
Q.11 Show that in an AC circuit containing a pure inductor, current leads in phase by $\pi/2$

Q.12 Show that in full wave cycle, average value of AC is zero.

Q.13 Find reading of voltmeter and ammeter in the circuit shown in figure.



Q.14 The equation of Emf 'V' is $V=282 \sin 100\pi t$. connected in circuit as shown



find

(i) Peak voltage (ii) Inductive reactance

(iii) Capacitive reactance (iv) Impedance of the circuit.

Chapter-9

Ray optics

Short answer Type Question [2 Marks Question]

Q.1 Derive mirror formula for any convex mirror.

Q.2 Derive lens formula for convex lens, when image is Virtual.

Q.3 In the case of a concave mirror, the distances of the objects and its image from the focus are x_1 & x_2, Show that $f = \sqrt{x_1 \times x_2}$

Q.4 A 4 times magnified image of an object formed by a mirror of focal length $f = 20\,cm$. find position of object and image.

Q.5 Using mirror equation show that an object placed between f and 2f of a concave mirror produces a real image beyond 2f.

Q.6 A ray of light passes symmetrical through a prism of refractive index 1.60 and suffers a deviation of 30°. find the value of angle of prism.

Q.7 Show that if the angle of prism is Greater then twice the critical angle of the material of prism, there is no emergent ray.

Q.8 The focal length of a equiconvex lens is equal to the radius of curvature of either face. what is the refractive index of material of prism.

Q.9 What is critical angle? Give one application of total internal reflection.

Q.10 Obtain an expression for magnifying power of a simple microscope.

Q.11 Derive Lens Maker's formula for any convex Lens.

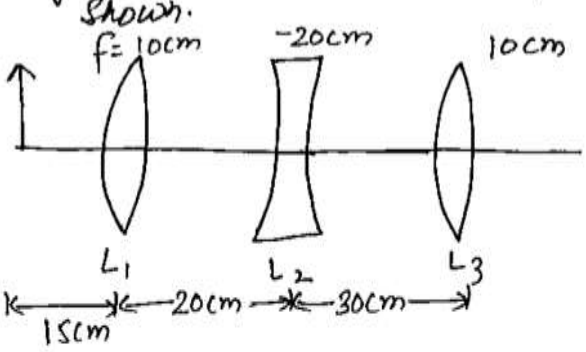
Q.12 for any prism deduce the relation

$$\mu = \frac{\sin\left(\frac{A+\delta_m}{2}\right)}{\sin\frac{A}{2}}$$

Q.13 Draw a ray diagram to show image formation by compound microscope in normal adjustment

Q.14 Draw a ray diagram to show image formation by telescope in normal adjustment.

Q.15 Find the position of the image of the object 'O' formed by the lens combination as shown.



Chapter-10

Wave Optics

Short answer Types Question [2 Marks Questions]

Q.1 What is meant by a wavefront? What is its shape of the wavefront for a beam of parallel rays?

Q.2 Use Huygen's principle to explain the action of a Glass prism when a plane wavefront is incident on it.

Q.3 What is co-harent sources of light

Q.4 Verify Snell's law for wave nature of light.

Q.5 Verify laws of reflection for wave nature of light.

Q.6 In YDSE, the slits are separated by 0.28 mm and the screen is placed 1.4m away. The distance between the central bright fringe and the fourth bright fringe is measured to be 1.2 cm. Determine the wavelength of light used.

Q.7 In YDSE, two slits 0.15mm apart, are illuminated by a monochromatic light of wavelength 450 nm. The screen is 1.0 m away from the slits, find the distance of second (a) bright (b) dark fringe from the central maximum.

Q.8 A double slit is illuminated by light of wavelength 6000Å. The slits are 0.1 cm apart and the screen is placed 1m away. Calculate

(i) the angular position of 10^{th} maximum in radian

(ii) Separation of two adjacent minimum.

Q.9 In YDSE Two slits are 1mm apart and screen is placed 1m away from the slits. Calculate the fringe width when light of wavelength 500 nm is used.

Q.10 In YDSE the slits are separated by 0.56mm and the screen is placed 2.8m away. The distance b/w the central bright fringe and the fourth fringe is 1.2cm. Find frequency of light used.

CHAPTER-11

DUAL NATURE OF RADIATION AND MATTER

Short answer Type Questions. [2 Marks Questions]

Q.1 Find the frequency of light which ejects electron from a metal surface fully stopped by a retarding potential of 3.3V. The photo electric emission begins in this metal at 8×10^{14} Hz. Also find ϕ_0 for the metal.

Q.2 Find the change in stopping potential when the wavelength of light incident on the cathode is reduce from 6000Å to 5000Å

Q.3 Light of frequency 7.21×10^{14} Hz is incident on a metal surface. Electrons with max. speed of 6×10^5 m/s are ejected from the surface. What is the threshold frequency of photoemission of the electrons.

Q.4 Calculate the threshold frequency of photon for photoelectric emission from a metal whose work function is 0.1eV

Q.5 Light of wavelength 5000Å falls on a plate of work function 1.9eV. Find the (i) energy of photon in eV (ii) Stopping potential.

Q.6 What is the energy anociated with a photon of wavelength 4000 Å

Q.7 Monochromatic light of frequency 6×10^{14} Hz is produced by a laser The power emitted is 2×10^{-3} w. Calculate the.
(i) Energy of photon
(ii) No. of photons emitted per sec.

Q.8 An electron, A proton and an α-particle have same K.E. Which will have shortest wavelength.

Q.9 Find the maximum (a) frequency (b) minimum wavelength of X-rays produced by 30 KV electrons.

Q.10 Calculate de-Broglie wavelength of the electron orbiting in $n=2$ state of Hydrogen atom.

Q.11 Show that for an electron acc. by a potential diff "V". de-Broglie wavelength is $\frac{12.27}{\sqrt{V}}$ Å.

Q.12 An electron and a proton have same de-Broglie wavelength. Which one of these has higher K.E. Which one is moving faster?

Q.13 Discuss the laws of photoelectric emission. How can these be explained on the basis of Einstein's photoelectric equation.

Q.14 Light of wavelength 2000Å falls on an aluminium surface of work function 4.2 eV. Calculate the
(a) K.E. of fastest emitted e^-
(b) cut-off wavelength of aluminium.

Q.15 In an experiment of P.E. emission, following observations were made.
(i) wavelength of incident light $= 1.98 \times 10^{-7}$ m
(ii) stopping potential $= 2.5$ V.
Find ν_0, ϕ_0 & K.E.max of emitted e^-