II PUC - PHYSICS
IMPORTANT NUMERICALS

Chapter 2: Electrostatic Potential and Capacitance

1. Two charges 30nC and -20nC are located 15 cm apart. At what points on the line joining the two charges is the electric potential zero? Take the potential at infinity to be zero. **(x=6cm, 30cm from smaller charge)**

2. Two point charges +1 nC and –4 nC are 1m apart in air. Find the positions along the line joining the two charges at which resultant potential is zero. **(x=0.2cm, 0.33cm from smaller charge)**

3. Charges 2μC, 4μC and 6μC are placed at the three corners A, B and C of a square ABCD of side x metre. Find what charge must be placed at the fourth corner so that net potential at the centre of the square becomes zero. **(q=-12μC)**

4. ABCD is a square of side 2m. Point charges of 5nC, 10nC and -5nC are placed at corners A, B, C respectively. Calculate the work done in transferring a charge of 5μC from D to the point of intersection of diagonals. **(W=15.9mJ)**

5. In a parallel plate capacitor with air between the plates, each plate has an area of 6×10^{-3} m^2 and the distance between the plates is 3 mm. Calculate the capacitance of the capacitor. If this capacitor is connected to a 100 V supply, what is the charge on each plate of the capacitor? **(q=1.77nC)**

6. In a parallel plate capacitor with air between the plates, each plate has an area of 8×10^{-3} m^2 and the distance between the plates is 2 mm. Calculate the capacitance of the capacitor. If this capacitor is connected to a 50 V supply, what is the charge on each plate of the capacitor? (Absolute permittivity of free space = 8.85×10^{-12} Fm^{-1}) **(C=35.4pF, q=1770pC)**

7. When the two capacitors are connected in series and connected across 4kV line, the Energy stored in a system 8J The same capacitor is connected in parallel across the same line, energy stored is 36J. Find the capacitance of the capacitors. **(C_1=3μF, C_2=1.5μF)**

8. Two capacitors of capacitance 600pF & 900pF are connected in series across a 200V supply. Calculate (i) the effective capacitance of the combination, (ii)the pd across each capacitor and (iii) the total charge stored in the system. **(C_s=4.5μF, V_1=120V, V_2=80V, q=0.072μC)**

Chapter 3: Electric Current

1. (a) Three resistors 2Ω , 3Ω, and 4Ω are combined in series. What is the total resistance of the combination?
(b) If the combination is connected to a battery of emf 10 V and negligible internal resistance,obtain the potential drop across each resistor. **(R_s=9Ω, V_1=2.22V, V_2=3.33V, V_3=4,44V)**

2. (a) Three resistors 4Ω, 6Ω and 8Ω are combined in parallel. What is the total resistance of the combination? (b) If the combination is connected to a battery of emf 25 V and negligible internal resistance, determine the current through each resistor, and the total current drawn from the battery. **(R_p=1.8Ω, I=13.5A, I_1=6.25A, I_2=4.166A, I_3=3.125A)**

3. Two resistors of resistance 12Ω and 6Ω are connected in parallel to a battery of 12V. (a) Calculate the equivalent resistance of the network. (b) Obtain the current in 12Ω and 6Ω resistors. **(R_p=4Ω, I_1=1A, I_2=2A)**

4. A battery of internal resistance 3Ω is connected to 20Ω resistor and potential difference across the resistor is 10V. If another resistor of 30 Ω is connected in series with the first resistor and battery is again connected to the combination, calculate the emf and terminal p.d across the combination. **(E=11.5V, pd=10.84V)**

5. When two resistances are connected in series with a cell of emf 2V and negligible internal resistance, a current of (2/5)A flows in the circuit. When the resistances are connected in parallel, the main current is 5/3A. Calculate the resistances.(**R_s=5Ω, R_p=1.2Ω, R_1=3Ω, R_2=2Ω)**

6. A wire of length 2m, diameter 1mm and resistivity 1.963×10^{-8} Ωm is connected in series with a battery of emf 3V and internal resistance 1Ω. Calculate the resistance of the wire and the current in the circuit. **(A=078 x 10^{-6} m^2, R = 5Ω, I=0.5A)**

7. Two identical cells either in series or in parallel combination, gives the same current of 0.5A through external resistance of 4Ω. Find the emf and internal resistance of each cell. **(E=3V, r=4Ω)**

8. Two cells of emf 2V and 4V and internal resistance 1 Ω and 2Ω respectively are connected in parallel so as to send the current in the same direction through an external resistance of 10Ω. Find the potential difference across 10 Ω resistor. **(V=2.5V)**

9. The number density of free electrons in a copper conductor is 8.5 x 10^{28} m^{-3}. How long does an electron take to drift from one end of a wire to its other end? The area of cross section of the wire is 2.0 x 10^{-6} m^2 and it is carrying a current of 3.0A.**(v_d=0.00011 m/s, t=27200 s)**

10. Resistances in cyclic order in a Whetstone's network are 2Ω, 3 Ω, 1 Ω and 2 Ω. Resistance of the galvanometer is 10 Ω. Emf of the cell is 1.2V and its internal resistance is negligible. What is the current through the galvanometer?**(I_g=0.026A)**

Chapter 7: Alternating Current

1. A pure inductor of 25.0 mH is connected to a source of 220 V & 50Hz. Find the inductive reactance and rms current and peak current in the circuit **(X_L=7.85Ω, I_{rms}=39.6A).**

2. An inductor and bulb are connected in series to an AC source of 220V, 50 Hz ac source. A current of 11A flows in the circuit and phase angle between voltage and current is π/4 radian. Calculate the impedance and inductance of the circuit. **(Z=20Ω, L=0.045H)**

3. A sinusoidal voltage of peak value 283 V and frequency 50 Hz is applied to a series LCR circuitin which R = 3Ω, L = 25.48 mH, and C = 796 μF. Find (a) the impendence of the circuit; (b) the phase difference between the voltage across the source and the current (c) the power factor (d) Average power dissipated in the circuit. **(Z=5Ω, ϕ=53.1°, cosϕ=0.6)**

4. A sinusoidal voltage of peak value 285 V is applied to a series LCR circuit in which R = 5Ω, L =28.5 mH, and C = 800 μF. Find (a) resonant frequency (b) Calculate the impedance, current and power dissipated at resonance. **(f_r=33.32Hz, Z=5Ω, I=57A, P=16.2kW)**

5. A resistor 100Ω, a pure inductance coil of L = 0.5 H and capacitor are in series in a circuit containing an ac of 200V, 50 Hz. In the circuit current is ahead of the voltage by 30°. Find the value of the capacitance. **(C=14.82μF)**

6. Obtain the resonant frequency of a series LCR circuit with L = 4.0 H, C = 27 μF and R = 8.4 Ω. What is the Q-value of this circuit? Also find the band width. **(f_r=15.3Hz, Q=45, B_w=0.34Hz)**

7. A source of alternating emf of 220V, 50 Hz is connected in series with a resistance of 200Ω,inductance of 100mH and capacitance of 30μF. Does the current lead or lag the voltage and by what angle? **(X_L=31.42Ω, X_C=106.1Ω, ϕ=20.5°).**

8. A charged 30μF capacitor is connected to a 27mH inductor. What is the angular frequency of free oscillation of the circuit? Suppose the initial charge on the capacitor is 6mC. What is the total energy stored in the circuit initially? What is the total energy at later time?**(ω_r=1111.1 rad/sec, U_i=U_f=0.6J)**

Chapter 10: Wave optics

1. In young's double slit experiment while using a source of wavelength 4500Å, the fringe width obtained is 5mm. If the distance between the screen and plane of the slits is reduced to half, what should be the wavelength of the light required to get fringes of width 4mm? **(λ_2=7200A^0)**

2. In young's double slit experiment while using a source of wavelength 6000Å, the fringe width obtained is 6mm. If the distance between the screen and plane of the slits is reduced to half, what should be the wavelength of the light required to get fringes of width 4mm? **(λ_2=8000A^0)**

3. A beam of light consisting of two wavelengths 420 nm and 560 nm is used to obtain interference fringes in Young's double slit experiment. The distance between the slits is 0.3 mm and the distance between the slits and the screen is 1.5 m. Compute the least distance of the point from the central maximum, where the bright fringes due to both the wavelengths coincide. **(x=8.4mm)**

4. In Young's double slit experiment, fringes of certain width are produced on the screen kept at a certain distance from the slits. When the screen is moved away from the slits by 0.1 m, fringe width increases by 60μm. The separation between the slits is 1 mm. Calculate wavelength of light used. **(λ=6000A^0)**

5. In Young's double-slit experiment distance between the slits is 1 mm. The fringe width is found to be 0.6 mm. When the screen is moved through a distance of 0.25 m the fringe width becomes 0.75 mm. Find the wavelength of the light used. **(λ=6000A^0)**

6. In Young's double slit experiment distance between the slits is 0.5 mm. When the screen is keptat a distance of 100 cm from the slits the distance of 9th bright fringe from the central fringe system is 8.835 mm. Find the wavelength of light used. **(λ=4908A^0)**

7. In YDSE the slits are separated by 0.28mm and screen is place at a distance of 1.4m away from the slits. The distance between the central bright fringe and the fifth dark fringe is measured to be 1.35cm. Calculate the wavelength of light used. Also find the fringe width if the screen is moved 0.4m towards the slits for the same experimental set up. **(λ=6000A^0, β=2.14mm)**

8. In an oil immersion microscope, oil of RI 1.414 is used. The wavelength of light used is 4850A^0 and semi vertical angle is 45^0. Calculate the limit of resolution and resolving power. **(dx=2959A^0, RP=3.37x 10^6 m^{-1})**

9. In a telescope, the diameter of the aperture of the objective is 0.25m. Assuming the mean wavelength of light to be 580nm, find the limit of resolution and resolving power of the telescope. **(dθ=2830x 10^{-9}rad, RP=3.533 x 10^{5}rad^{-1})**

Chapter 13: Nuclei

1. Calculate the mass defect and specific binding energy of $_7N^{14}$, given that the rest mass of nitrogen nucleus is 14.00307 u, m_P = 1.00783 u and m_n = 1.00867 u. **(Δm=0.11243 u, SBE=7.48 MeV)**

2. Calculate binding energy and binding energy per nucleon of an oxygen nucleus $_8O^{16}$. Rest mass of oxygen nucleus is 15.995 u, mass of proton = 1.007825 u and mass of neutron = 1.008665u. **(BE=127.54 MeV, SBE=7.97 MeV)**

3. The activity of a radioactive substance is 4700 per minute. Five minutes later the activity reduces to 2700 per minute. Find (a) decay constant (b) half-life of the radioactive substance. **(λ=0.11 m^{-1}, T=6.25 min)**

4. Determine the mass of Na^{22} which has an activity of 5 mCi. Half life of Na^{22} is 2.6 years. Avogadro number = 6.023 × 10^{23} atoms **(m=7.68 10^{-10}kg)**

5. Calculate the half life and mean life of Radium 226 of activity 1Ci. Given mass of Radium 226 is 1g. 226 g of radium consists of 6.023 × 10^{23} atoms. **(T=4.98 x 10^{10}s, T$_m$=7.189 x 10^{10}s)**

Numericals