01   What is electric dipole?

02   How do you calculate the electric field intensity due to an electric dipole?

03   Find the potential energy of an electric dipole placed in a uniform external electric field.

04   Derive an expressions for the electric field at a point on the axial line due to an electric dipole.

05   A neutral water molecule in its vapor state has an electric dipole moment of magnitude 6.2×10^{-30} c.m. (i) How far apart are the molecules center's of positive and negative charge? (ii) If the molecule is placed in an electric field of 1.5×10^4 N/C, what maximum torque can the field exert on it?

06   An electric dipole of moment 2×10^{-8} cm is placed in a uniform field intensity $1.5\times10^5 NC^{-1}$ (i) What maximum torque does the field exert on the dipole? (ii) How much work is done on turning the dipole end to end?

07   State and prove Gauss's law in electro statistics.

08   Write-down the few applications of Gauss law.

09   Applying Gauss's law to calculate the electric field intensity due to a uniformly charged sphere (non-conducting) at points (i) outside the sphere, (ii) at the surface of the sphere, (iii) inside the sphere.

10   Prove that, for a point charge, Gauss's law is equivalent to Coulomb's law.

11   Apply Gauss's law to calculate the electric field for cylindrical symmetry.

12   A long cylinder of radius α is uniformly charged with charge density λ per unit length. Find the field E at points inside and outside the cylinder.

13   An electric dipole consist of two opposite charges of magnitude $q = 2.0 \times 10^{-6}$ C separated by 2.0 cm. The dipole is placed in an external field of 2.0×10^{-6} $Nt/Count$. Calculate the maximum torque on the dipole.

14   Define capacitor. Classify the capacitors. Write down the major used of capacitor.

15   Derive an expression for the energy stored by a charged capacitor.

16   A parallel plate capacitor consists of two square metal plates with 5.0 cm of side separated by 1.0 cm. A Sulphur slab of 6.0 mm thick and with k = 4 is placed on the lower plate, calculate the capacitance.

17   A storage capacitor on a Random Access Memory (RAM) chip has a capacitance of 55 μF. If the capacitor is charged to 5.3 V, how many excess electrons are on its negative plate?

17a A metal rod of length 25 cm has resistance $7.5 \times 10^{-6}\Omega$. The diameter of the rod is 0.40 cm. Calculate the resistivity of the metal.

18   The parallel plates of an air-filled capacitor are 1 cm apart. What will be the area A of each plate if capacitance is to be 0.25μF?

19   Explain the following terms (i) insulator, (ii) semiconductor and (iii) conductor using the band-gap.

20   State and explain Faraday's law of electromagnetic induction.

21   Calculate the magnetic field inside a long straight wire with current.

22   A solenoid has length 1.23 m and inner diameter 3.55 cm it carries a current 5.57 A. It consists of five closed packed layers, each with 850 turns along. What is the B at its enter?

23   What are the coefficients of self-inductance and mutual inductance? Find an expression for the self inductance of a solenoid.

24   What is mutual inductance? Calculate the mutual inductance between two coaxial solenoids.

25   A solenoid of length 30 cm and area of cross-section 10 cm^2 has 1000 turns wound over a core of constant permeability 600. Another coil of 500 turns is wound over the same coil at its middle. Calculate the mutual inductance between them.

26   State and prove Ampere's law. Apply it to calculate the magnetic field due to a solenoid.

27   A solenoid is *1.0 m* long and *3.0 cm* in mean diameter. It has 5 layers of windings of *850 turns* each and carries a current of 5*A*. Calculate *B* at its center.