THE UNIVERSITY OF MISSISSIPPI

PHYS 212, Honors Section – Review Material

Chapter 26: Capacitance and Dielectrics

- Capacitors: General concept and use; The capacitance is defined by

  $$C = q/V\,.$$

  The unit is the farad, 1 F = 1 C/V.

- Parallel plate capacitors: $C = \varepsilon_0 A/d$, where $\varepsilon_0 = 8.85 \times 10^{-12}\ \mathrm{C^2/N{\cdot}m^2}$ as usual is the permittivity constant, related to the coefficient in Coulomb's law by $k = 1/(4\pi\varepsilon_0)$.

- Capacitors in series: The capacitance equivalent to C_1, C_2, ... in series is obtained from

  $$C_{\mathrm{eq}}^{-1} = C_1^{-1} + C_2^{-1} + \ldots$$

- Capacitors in parallel: The capacitance equivalent to C_1, C_2, ... in parallel is

  $$C_{\mathrm{eq}} = C_1 + C_2 + \ldots$$

- Electric energy: In a charged capacitor, $U = \frac{1}{2}\,qV$ [same as $q^2/2C$ and $CV^2/2$]. This implies that in an electric field E in general, there is an energy density $u = U/\mathrm{volume} = \frac{1}{2}\,\varepsilon_0 E^2$.

- Dielectrics: Materials that become polarized in the presence of electric fields; They modify the values of the E fields and potentials produced by charges. As a result, effectively the permittivity of the vacuum gets replaced everywhere by $\varepsilon = \varepsilon_0\varkappa$, where $\varkappa$ is the dielectric constant. For example, the capacitance of a parallel plate capacitor becomes

  $$C = \varepsilon\, A/d = \varkappa\varepsilon_0\, A/d.$$

Note: You are not required to know the topics and equations inside square brackets.

Website by Luca Bombelli <bombelli"at"olemiss.edu>; Content of this page last modified on 7 may 2011