Equations to Know

Chapter 24

Capacitance	$Q = CV_{ab}$
Capacitance of a parallel plate	$C = \varepsilon_0 \frac{A}{d}$
Capacitance of a cylindrical capacitor	$C = \frac{2\pi\varepsilon_0 L}{\ln\left(R_a / R_b\right)}$
Capacitance of a spherical capacitor	$C = 4\pi\varepsilon_0 \left(\frac{R_a R_b}{R_a - R_b}\right)$
*Potential of a single conducting sphere	$V = \frac{Q}{4\pi\varepsilon_0}\left(\frac{1}{R_b} - \underbrace{\frac{1}{R_a}}_{=\infty}\right) = \frac{1}{4\pi\varepsilon_0}\frac{Q}{R_b}$
*Capacitance of a single conducting sphere	$C = 4\pi\varepsilon_0 R_b$
Capacitors in parallel	$C_{eq} = C_1 + C_2 + C_3 \ldots$
Capacitors in series	$\frac{1}{C_{eq}} = \frac{1}{C_1} + \frac{1}{C_2} + \frac{1}{C_3} \ldots$
*Work needed to store a total charge Q	$W = \int_0^Q V\,dq = \frac{1}{C}\int_0^Q q\,dq = \frac{1}{2}\frac{Q^2}{C}$
Energy stored in a capacitor	$U = \frac{1}{2}\frac{Q^2}{C}$
Energy stored in a parallel plate capacitor	$U = \frac{1}{2}\varepsilon_0 E^2 Ad$
Energy density, energy stored per volume in **E**	$u = \frac{1}{2}\varepsilon_0 E^2$
Dielectric constant	$C = KC_0$
Permittivity of a material	$\varepsilon = K\varepsilon_0$