Physics 102 Formula Sheet (for Midterm #1)

Coulomb's law (16-2): $F = k\dfrac{Q_1 Q_2}{r^2} = \dfrac{1}{4\pi\varepsilon_0}\dfrac{Q_1 Q_2}{r^2}$ (magnitude) $\varepsilon_0 = 8.85\times10^{-12}\ C^2/N\cdot m^2$

Gauss's law (16-9): $\Phi_E == \sum_{\substack{closed\\surface}} \vec{E}\bullet\vec{A} = \sum_{\substack{closed\\surface}} F_\perp \Delta A = \dfrac{Q_{encl}}{\varepsilon_0}$

Electric potential due to a point charge (17-5): $V = \dfrac{1}{4\pi\varepsilon_0}\dfrac{Q}{r}$ (assuming $V = 0$ at $r = \infty$)

Capacitance (17-7): $Q = CV$

Parallel-plate capacitor (17-8): $C = \varepsilon_0\dfrac{A}{d}$

Capacitors in parallel (19-5): $C_{eq} = C_1 + C_2 + C_3$

Capacitors in series (19-6): $\dfrac{1}{C_{eq}} = \dfrac{1}{C_1} + \dfrac{1}{C_2} + \dfrac{1}{C_3}$

Energy stored in a capacitor (17-10): $U = \dfrac{1}{2}QV = \dfrac{1}{2}CV^2 = \dfrac{1}{2}\dfrac{Q^2}{C}$

Ohm's law (18-2): $I = \dfrac{V}{R},\quad V = IR$

Resistivity (18-3): $R = \rho\dfrac{l}{A}$

Electric power (18-5,6): $P = IV = I^2R = \dfrac{V^2}{R}$

Root-mean-square (rms) value (18-8): $I_{rms} = \dfrac{I_0}{\sqrt{2}},\quad V_{rms} = \dfrac{V_0}{\sqrt{2}}$

Resistors in series (19-3): $R_{eq} = R_1 + R_2 + R_3$

Resistors in parallel (19-4): $\dfrac{1}{R_{eq}} = \dfrac{1}{R_1} + \dfrac{1}{R_2} + \dfrac{1}{R_3}$

Time constant of RC circuits (19-7): $\tau = RC$

Charging and discharging: $V_C = \varepsilon\left(1 - e^{-t/RC}\right);\quad V_C = V_0 e^{-t/RC}$.

and more ….