

**PHYSICS 2426 Fall 2019**  
**Equation Sheet Exam 2**

$$\epsilon_0 = 8.85 \times 10^{-12} \text{ C}^2/\text{N}\cdot\text{m}^2$$

$$K = \frac{E_0}{E}$$

$$\epsilon = K\epsilon_0$$

**Electrostatics Basics**

$$\vec{E}_{\text{pt.}} = \frac{1}{4\pi\epsilon_0} \frac{q}{r^2} \hat{r}$$

$$\vec{F}_E = q_0 \vec{E}$$

$$\oint \vec{E} \cdot d\vec{A} = \frac{Q_{\text{encl}}}{\epsilon_0}$$

$$V_a - V_b = - \int_b^a \vec{E} \cdot d\vec{l}$$

$$\vec{E} = -\vec{\nabla}V \quad \text{or} \quad \vec{E} = -\frac{dV}{dr} \hat{r}$$

$$V_{\text{point}} = \frac{1}{4\pi\epsilon_0} \frac{q}{r}$$

$$K = \frac{1}{2}mv^2$$

$$U_{\text{elec}} = q_0V$$

$$W_{\text{ext}} = \Delta U + \Delta K$$

**Capacitors, Capacitance and Stored Energy**

$$C \equiv Q/V$$

$$U = \frac{Q^2}{2C}$$

$$u = \frac{1}{2}\epsilon_0 E^2$$

$$C_{\text{par plates}} = \frac{\epsilon_0 A}{d}$$

$$C_{\text{eq,par}} = C_1 + C_2 + C_3 + \dots$$

$$\frac{1}{C_{\text{eq,ser}}} = \frac{1}{C_1} + \frac{1}{C_2} + \frac{1}{C_3} + \dots$$

**Current, Resistance and Emf**

$$I \equiv \frac{dQ}{dt} = n|q|v_d A$$

$$\vec{J} = nq\vec{v}_d$$

$$E = \rho J$$

$$V = IR \quad \text{with} \quad R \equiv \rho \frac{L}{A}$$

$$R_{\text{eq,ser}} = R_1 + R_2 + R_3 + \dots$$

$$\frac{1}{R_{\text{eq,par}}} = \frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_3} + \dots$$

$$I_{\text{in}} = I_{\text{out}}$$

$$\sum V_{\text{loop}} = 0$$

**RC Circuits**

$$q(t) = \epsilon C \left(1 - e^{-t/RC}\right)$$

$$q(t) = Q_0 e^{-t/RC}$$

$$i(t) = \frac{\epsilon}{R} e^{-t/RC}$$

$$i(t) = I_0 e^{-t/RC}$$