

NAME: _____

Cover Sheets for Final Exam

Some direction:

No phones or other device that connects to the internet.

You may use a calculator, please **plug in numerical answers** and keep three sig figs regardless of the correct number of sig figs in the problem.

Present clear and complete answers:

Explain your answers clearly but briefly. You want to aim for a level of solution that someone taking this class would be able to understand. A diagram and a few words may help.

Start calculations with first principles: things like definitions ($\vec{E} \equiv \frac{\vec{F}}{Q}$) or empirical laws (like Coulomb's Law or Newton's Laws) or conservation laws.

Check time:

The point values for each problem are shown next to the question number. Time yourself accordingly. The total value of the exam is 100 points. **Good luck!**

Some constants:

$$K = k = \frac{1}{4\pi\epsilon_0} = 8.99 \times 10^9 Nm^2/C^2 \approx 9 \times 10^9 Nm^2/C^2$$

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

$$\mu_0 = 4\pi \times 10^{-7} Tm/A$$

$$e = 1.6 \times 10^{-19} C$$

New Equations for Final:

$$n = c/v$$

$$\theta_i = \theta_r$$

$$n_i \sin \theta_i = n_t \sin \theta_t$$

$$\frac{1}{f} = \frac{1}{d_o} + \frac{1}{d_i}$$

$$M = \frac{h_i}{h_o} = -\frac{d_i}{d_o}$$

$$d \sin \theta = m\lambda = d \frac{y_m}{L}$$

$$d \sin \theta = (m + \frac{1}{2})\lambda = d \frac{y_m}{L}$$

$$a \sin \theta_p = p\lambda = a \frac{y_p}{L}$$

Helpful Equations:

$$E_i = E_f$$

$$E = K + U$$

Definitions	Point charges	Uniform \vec{E}
	$ \vec{F} = k \frac{ qQ }{r^2}$	$\vec{F} = Q\vec{E}$
$\vec{E} \equiv \frac{\vec{F}}{Q}$	$ \vec{E} = k \frac{ q }{r^2}$	$\vec{E} = \text{const}$
$\Delta U \equiv -W$	$U = k \frac{qQ}{r}$	$\Delta U = QEs$
$V \equiv \frac{U}{Q}$	$V = k \frac{q}{r}$	$\Delta V = Es$

$$dq = \lambda dl$$

$$dq = \sigma da = \eta da$$

$$dq = \rho dV$$

$$\Phi = \int \vec{E} \cdot d\vec{A}$$

$$\int \vec{E} \cdot d\vec{A} = \frac{q_{enc}}{\epsilon_0}$$

$$C \equiv \frac{|Q|}{|V|}$$

$$C = \epsilon_0 \frac{A}{d}$$

$$W = \frac{1}{2} CV^2$$

$$I = \frac{dQ}{dt} = \frac{\Delta Q}{\Delta t}$$

$$V = IR$$

$$R_{eq} = R_1 + R_2 + \dots$$

$$\frac{1}{R_{eq}} = \frac{1}{R_1} + \frac{1}{R_2} + \dots$$

$$q(t) = Q_{max}(1 - e^{-\frac{t}{RC}})$$

$$q(t) = Q_{max} e^{-\frac{t}{RC}}$$

$$P = IV$$

$$\frac{1}{C_{eq}} = \frac{1}{C_1} + \frac{1}{C_2} + \dots$$

$$C_{eq} = C_1 + C_2 + \dots$$

$$\vec{B} = \frac{\mu_0 I}{4\pi} \int \frac{d\vec{\ell} \times \hat{r}}{r^2}$$

$$\oint \vec{B} \cdot d\vec{\ell} = \mu_0 I_{enc}$$

$$B = \frac{\mu_0 I}{2\pi r}$$

$$I = \int \vec{J} \cdot d\vec{A}$$

$$\vec{F} = \int I d\vec{\ell} \times \vec{B}$$

$$\vec{F} = q\vec{v} \times \vec{B}$$

$$\Phi_B = \int \vec{B} \cdot d\vec{A} = \int B dA \cos \theta$$

$$\mathcal{E} = -N \frac{d\Phi_B}{dt}$$