

Exam Title Page

The exam is closed book and closed notes. For each problem, choose your answers from among the available choices. Show your methods and calculations for partial credit.

Mark your answers with an X in the table below (see example).

	A	B	C	D	E
1					
2					
3					
4					
5					
6					
7					

	A	B	C	D	E
8					
9					
10					
11					
12					
13					
14					

Example:

	A	B	C	D	E
1				X	

Score

$$m_e = 9.1 \times 10^{-31} \text{ kg}, \quad m_p = 1.67 \times 10^{-27} \text{ kg}, \quad e = 1.60 \times 10^{-19} \text{ C}$$

$$\epsilon_0 = 8.854 \times 10^{-12} \frac{\text{C}^2}{\text{Nm}^2}, \quad k = 1/4\pi\epsilon_0 = 9.0 \times 10^9 \frac{\text{Nm}^2}{\text{C}^2}$$

$$m = \text{milli} = 10^{-3}, \quad \mu = \text{micro} = 10^{-6}, \quad n = \text{nano} = 10^{-9}, \quad p = \text{pico} = 10^{-12}$$

$$\Delta K = W, \quad W_{\text{field}} = -\Delta U, \quad \Delta U = q\Delta V, \quad \Delta V = -\vec{E} \cdot \Delta \vec{r}$$

$$\Delta V = kQ \left(\frac{1}{r_f} - \frac{1}{r_i} \right), \quad V = \frac{kQ}{r}$$

$$C = \frac{\epsilon A}{d}, \quad \epsilon = K\epsilon_0, \quad V = Ed$$

$$Q = CV, \quad U = \frac{CV^2}{2}, \quad P = \text{eff} \times \frac{U}{t}$$

$$u = \frac{U}{\text{vol}}, \quad u = \frac{\epsilon E^2}{2}$$

1. Rework the Mastering Physics exercises listed below with additional instructions:

Assignment	Exercise
5	Fate of an Electron
5	23.16
6	23.18, find ΔK and ΔU instead of speed
7	Capacitors in Parallel
7	Capacitors in Series
8	24.50, also find the energy density u

2. See Figure 23.23 on textbook page 772. Sketch and know the equipotential surfaces of simple point charge configurations: a single charge, and two charges. Compare two equipotential surfaces and determine which of the two is at higher potential, or if they are at the same potential.

3. a) Sketch the equipotential surfaces for a given uniform electric field \vec{E} . Given the distance between two equipotential surfaces, calculate the potential difference between them. Indicate which equipotential surfaces are at higher/lower potential.

b) Sketch two equipotential surfaces for a uniform field. Specify their voltages and the distance between them. Find the field \vec{E} , both magnitude and direction.

4. Textbook exercise 23.55. A particle of charge q moves under the influence of a known potential field and an unknown force. Given the displacement of the charge and change in kinetic energy, calculate

$$\Delta V, \quad \Delta U, \quad \Delta K, \quad W_{total}, \quad W_{field}, \quad W_{force}$$

5. a) Compare two capacitors having different permittivities. How do their capacitances, energies and energy densities differ?

b) Compare two capacitors having different plate separations. How do their capacitances, energies and energy densities differ?

c) Given a two capacitor circuit connected to a battery, envision the current flow during the charging process to determine whether the capacitors are in series or parallel.

d) Calculate the output power of a flash unit capacitor given one or more of the following quantities: its capacitance, flash time, voltage, charge and energy.