Name: ________________________________

Physics 272. Midterm II

Show your work.

Problem 1: 25 points

Two parallel plate capacitors, each having a capacitance of $C_1 = C_2 = 2\mu F$ are connected in parallel across a 12-V battery.

a) Find the total energy stored in the capacitors.

The capacitors are then disconnected from the battery and a dielectric of constant $\kappa = 2.5$ is inserted between the plates of $C_2$.

b) Find the total energy that is now stored in the capacitors. (Hint: what quantity is constant?)
Problem 2: 25 points

Consider the circuit shown below. The batteries in the circuit have negligible internal resistance.

a) Write down Kirchoff’s laws for this circuit.

b) Find the current in each resistor

c) Find the voltage drop from b to e.
Problem 3: 25 points

A uniform magnetic field of magnitude 1.48 T is in the positive z direction.

a) Find the force on an electron if the electron's velocity is $\vec{v} = (4.0 \times 10^3 \text{m/s}) \hat{i} + (3.0 \times 10^3 \text{m/s}) \hat{j}$.

b) Suppose we add an electric field. What electric field is required for the net force on the electron to be zero?
Problem 4: 25 points

(a) A charged particle enters a uniform magnetic field with a velocity which is not completely perpendicular to B, describe the shape of the path it will follow.

(b) Two wires of the same material with the same length have different diameters. Wire A has three times the diameter of wire B. If the resistance of wire B is R, what is the resistance of wire A?

(c) Half the charge is removed from a capacitor without changing its capacitance. What fraction of the stored energy is removed along with the charge?

(d) If a magnetic field vector is directed towards the north and an electron is moving towards the east, what is the direction of the magnetic force on the particle?

(e) What is the Hall effect? Why is it useful?