

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 ?