

Physics 2135 Test Preparation Homework #2, Spring 2017

These problems are intended to help you verify your level of preparation for Test 2. **They are not intended to cover every topic you could be tested on. Make sure you attend the review lecture!**

Multiple Choice (including short problems)

_____ 1. An air-filled parallel-plate capacitor is charged by a battery. After it is fully charged it is *disconnected* from the battery and a dielectric is inserted between the plates. Which of the following is true?

- [A] The electric field between the plates increases and the energy stored increases.
- [B] The electric field between the plates is constant and the energy stored increases.
- [C] The electric field between the plates decreases and the energy stored decreases.
- [D] The electric field between the plates is constant and the energy stored decreases.

Problems

2. A $2.0 \mu\text{F}$ parallel-plate air-filled capacitor is connected across a 10 V battery.

(a) Determine the charge on the capacitor and the energy stored in the capacitor.

(b) An identical $2.0 \mu\text{F}$ parallel-plate air-filled capacitor is connected across a 5 V battery, and a dielectric slab with dielectric constant κ is inserted between the plates of the capacitor, completely filling the region between the plates, while the battery remains connected. The energy stored in this capacitor is four times that found in part (a). Determine the dielectric constant κ and the charge on the capacitor after the dielectric is inserted.

3. A copper wire having resistivity ρ_{Cu} at a temperature T_0 (measured in $^{\circ}\text{C}$) is in the shape of a cylindrical shell of length L , inner radius a , and outer radius $2a$.

(a) Calculate the resistance R of this wire. Express your answer in terms of ρ_{Cu} , L , and a .

(b) If copper has a temperature coefficient α_{Cu} , what is the resistance of the wire after it has been heated to a temperature of $6T_0$?

4. A $4.60 \mu\text{F}$ capacitor is initially uncharged. It is connected in series with a switch of negligible resistance, a $7.50 \text{ k}\Omega$ resistor, and an emf of 125 volts and negligible internal resistance.

(a) Just after the switch is closed, what are the voltage drop across the capacitor, the voltage drop across the resistor, and the current through the resistor? At what time after the switch is closed will the current in the resistor be 10.0 mA ? Draw a qualitative sketch of the voltage drop as a function of time across the capacitor.

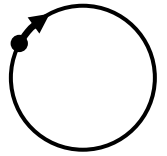
(b) The capacitor is allowed to fully charge. The switch is then opened and the emf removed. Then the switch is closed. How long after the switch is closed will the capacitor voltage be 12.5 V ?

5. An electron with kinetic energy 1.20 keV moves in a circle in a plane perpendicular to a uniform magnetic field. The radius of the circular orbit is 25.0 cm.

(a) Determine the speed, v , of the electron, and the period, T , of its motion.

(b) Determine the magnitude of the magnetic field.

(c) The figure illustrates a possible electron orbit. What magnetic field direction would give this orbit?

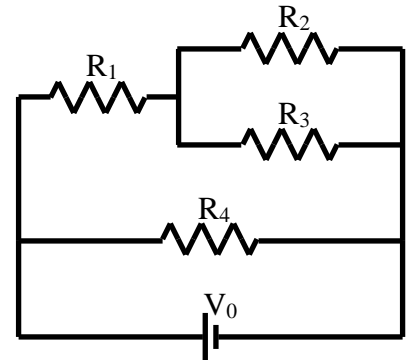


(d) If the electron's kinetic energy were increased by a factor of 4, what would be the dimensions of the smallest region that could completely hold the orbiting electron?

6. For the resistor circuit shown, $R_1 = 1.0 \Omega$, $R_2 = 2.0 \Omega$, $R_3 = 2.0 \Omega$, and $R_4 = 2.0 \Omega$.

(a) Find the equivalent resistance.

(b) The power supply provides a potential difference of $V_0 = 6 \text{ V}$. Determine the power dissipated by each of the four resistors.



Physics 2135 Spring 2017 Exam Rooms
February 14, March 21, April 18
5:00 – 6:00 PM

Instructor	Sections	Room
Dr. Hale	F, H	104 Physics
Dr. Kurter	B, N	125 BCH
Dr. Madison	K, M	199 Toomey
Dr. Parris	J, L	B-10 Bertelsmeyer
Mr. Upshaw	A, C, E, G	G-3 Schrenk
Dr. Waddill	D	120 BCH

Special Accommodations Testing Center

Know the exam time (5:00 pm to 6:00 PM)!
Find your room ahead of time!

These room assignments will be posted on the doors to
104 Physics.

BCH = Butler-Carlton Hall (Civil Engineering)
EECH = Emerson Electric Company Hall

B-10 Bertelsmeyer for March 21 and April 18 exams