

Midterm Exam 02 (2022 Spring)

PHYS 203B-001: College Physics

Date: 2022 Mar 4

(Name)

(Signature)

Instructions

1. Seating direction: Please be seated on seats with seat numbers divisible by 4.
2. Total time = 50 minutes.
3. There are 8 questions in this exam.
4. Equation sheet is provided separately.
5. To be considered for partial credit you need to show your work in detail and organize it clearly.
6. A simple calculator (with trigonometric functions) is allowed.
7. Use of mobile phones is strictly prohibited. It should stay out of reach during the exam.

1. (**5 points.**) Consider a region of uniform electric field $\vec{E} = -E\hat{j}$ of magnitude $E = 1.0 \times 10^3 \text{ N/C}$ and direction vertically down. Distance between points '1' to '2' is $h = 5.0 \text{ cm}$, and the distance between points '2' to '3' is $d = 15 \text{ cm}$. Refer Fig. 1. What is the potential difference between points '2' and '3'?

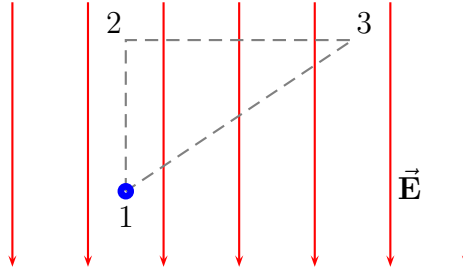


Figure 1: Problem 1

2. (5 points.) Determine the equivalent resistance in the circuit in Figure 2. Given $R_1 = 50.0 \Omega$ and $R_2 = R_3 = 25 \Omega$.

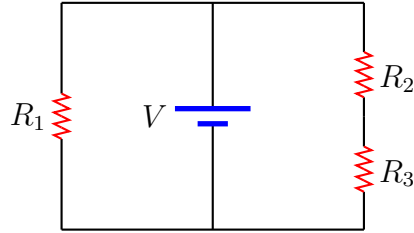


Figure 2: Problem 2

3. (5 points.) The illustration in Figure 3 shows a positive charged particle moving with velocity \mathbf{v} entering a region of magnetic field \mathbf{B} pointing into the page. Determine the direction of the magnetic force experienced by the charge and draw the resulting trajectory of the particle.

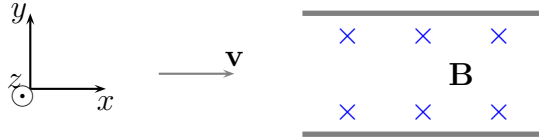


Figure 3: Problem 3

4. **(5 points.)** A current is maintained in a single circular loop of wire. Such a current carrying loop has a magnetic dipole moment and behaves like a refrigerator magnet. If this circular loop of wire and the associated magnetic dipole moment is free to rotate, in what direction will it orient when placed in the magnetic field generated by Earth?

5. (10 points.) Determine the total electric energy required to assemble three identical positive charges Q at the corners of an equilateral triangle of sidelength L . Assume that the charges are brought from infinity.

6. (10 points.) A potential difference $V = 10.0\text{ V}$ is applied across a capacitor arrangement with two capacitors connected in series, $C_1 = 10.0\ \mu\text{F}$ and $C_2 = 20.0\ \mu\text{F}$. Find the potential energies U_1 and U_2 stored inside each of the capacitors.

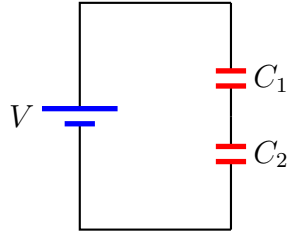


Figure 4: Problem 6

7. (10 points.) A battery pack of a pocket calculator has a voltage of 3.0 V and delivers a current of 0.17 mA. In one hour of operation, how much energy does the battery deliver to the circuit?

8. (10 points.) A loop in the shape of a right triangle of sides $a = 3.0$ cm and $b = 2.0$ cm, carrying a current $I = 2.0$ A, is placed in a magnetic field 0.30 T going into the page. See Figure 5. Determine the magnitude and direction of the force on side 2 of the triangle.

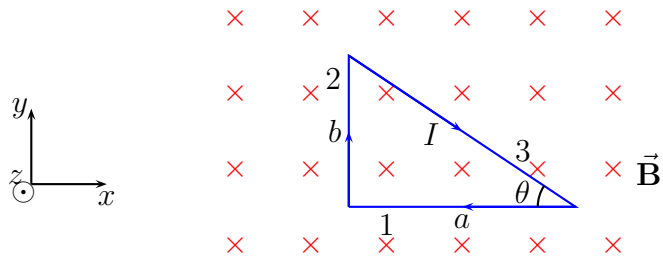


Figure 5: Problem 8.