

Midterm Exam No. 02 (Fall 2025)

PHYS 203B-001: COLLEGE PHYSICS

School of Physics and Applied Physics, Southern Illinois University–Carbondale

Date: 2025 Oct 23

(Name)

(Signature)

Instructions

1. Seating direction: In alternate rows, B, D, F, $\dots$, on even-numbered seats.
2. Total time = 75 minutes.
3. There are 4 short questions and 3 homework-style problems in this exam.
4. Equation sheet is provided separately.
5. For partial credit you need to present your work in detail and organize it clearly.
6. A simple calculator (with trigonometric functions) is allowed.
7. Use of smart devices, including smart watches, is strictly prohibited. They should stay out of reach during the exam.
8. Academic misconduct will lead to a failing grade in the course.

1. (**5 points.**) The electric potentials at the two ends of a $R = 1.5 \text{ k}\Omega$ resistor in a circuit is measured to be $V_a = 6.0 \text{ V}$ and $V_b = 1.5 \text{ V}$. Refer Figure 1. Determine the current passing through the resistor.

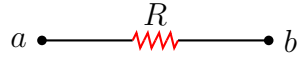


Figure 1: Problem 1

2. **(5 points.)** Watt is the unit of power. Watt-hour is a unit of energy. How much is kWh (kilo Watt-hour) in Joules? The average cost of electricity in the United States, for residential users, is about 0.15 USD/kWh (15 cents per kilo Watt-hour). At this rate your electricity bill for a month came out to be 50.00 USD. How much electric energy (in Joules) did you use in the month?

3. (**5 points.**) A charged particle initially moving with constant speed v enters a region of magnetic field $\mathbf{B}$ pointing into the page. It is deflected as shown in Fig. 2. What can you deduce about the sign of the charged particle? That is, is it a positive charge or a negative charge.

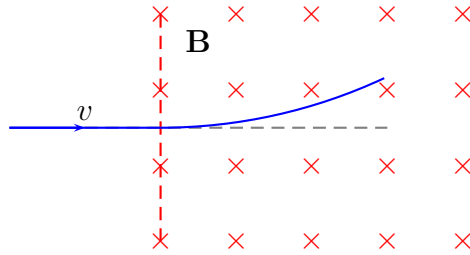


Figure 2: Problem 3

4. **(5 points.)** A bar magnet is hung from a ceiling such that it is free to rotate in the horizontal plane. What can you infer from the orientation of such a magnet after it settles down?

5. (10 points.) Determine the equivalent capacitance between points A and B in the circuit in Figure 3. Given $C_1 = 1.0 \text{ nF}$, $C_2 = 2.0 \text{ nF}$, $C_3 = 3.0 \text{ nF}$, $C_4 = 4.0 \text{ nF}$, and $C_5 = 5.0 \text{ nF}$.

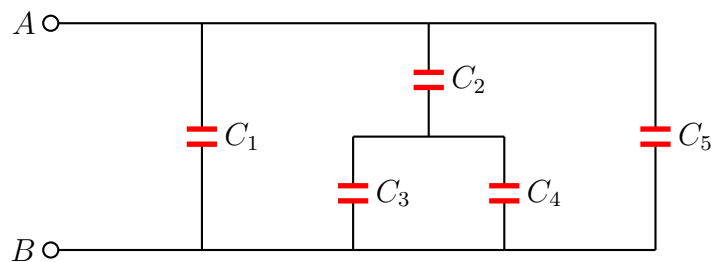


Figure 3: Problem 5

6. (10 points.) Figure 4 shows two resistors connected in series to a battery. The battery has a voltage of $V = 10. \text{ V}$, and the resistors have resistances $R_1 = 15. \Omega$ and $R_2 = 45. \Omega$. Find the ratio P_2/P_1 of the powers of the resistors.

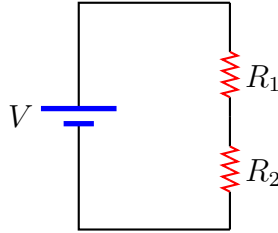


Figure 4: Problem 6

7. (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 uniform magnetic field of strength 0.30 T going into the page. See Figure 5. Determine the magnitude and direction of the force on side 1 of the triangle.

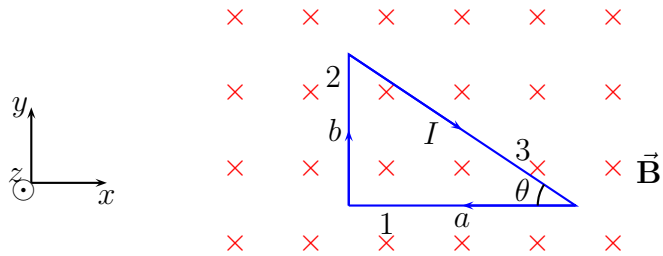


Figure 5: Problem 7.