

Final Exam (Fall 2024)

PHYS 205B: UNIVERSITY PHYSICS

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

Date: 2024 Dec 10

(Name)

(Signature)

Instructions

1. Seating direction: On even-numbered seats in alternate rows A, C, E,
2. Total time = 120 minutes.
3. There are 4 short questions and 3 homework-style problems in this exam.
4. Equation sheet is provided separately.
5. To be considered 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. Restroom breaks are allowed. Under questionable circumstances this might lead up to a Makeup Exam.
9. Academic misconduct will lead to a failing grade in the course.

1. **(5 points.)** A conductor with no net charge on it is placed in a uniform electric field. Using a diagram describe the redistribution of the charges inside the conductor.

2. (5 points.) Given R is resistance and C is capacitance, deduce the dimension of the quantity represented by the product

$$RC. \tag{1}$$

3. (**5 points.**) A current of what shape and configuration creates a uniform magnetic field. That is, how will you create a uniform magnetic field.

4. (5 points.) Figure 1 shows two rays originating from a point object o . Qualitatively, draw the trajectories of the two rays when they pass through two thin prisms placed as shown in Figure 1.

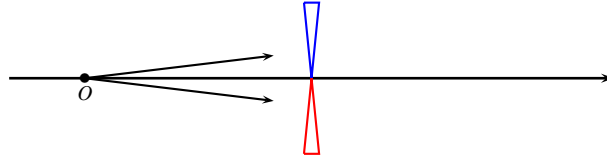


Figure 1: Problem 4

5. (10 points.) Two charges, $q_1 = +1.00 \mu\text{C}$ and $q_2 = -4.00 \mu\text{C}$ are a distance D apart. Refer Figure 2. As a multiple of distance D , at what coordinate x on the line connecting the two charges is the total electric field zero? Caution: This point need not be in between the charges.

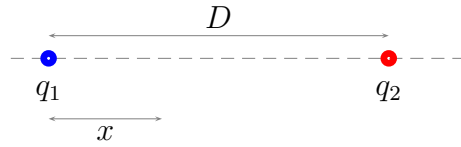


Figure 2: Problem 5

6. (10 points.) A 1.0 cm object is placed upright at a distance 30.0 cm away from a convex mirror. The mirror's focal length is 10.0 cm.
- (a) What is the radius of curvature of the mirror?
 - (b) Calculate the image distance. Is the image real or virtual?
 - (c) What is the magnification? Determine the height of the image.
 - (d) Is the image upright or inverted?
 - (e) Confirm your results by drawing a ray diagram for the above case. Choose the scale for the two relevant directions appropriately so that the relevant features are illustrated well. Points will be awarded for clarity and accuracy.

7. (10 points.) A 1.0 cm object is placed upright at a distance 30.0 cm away from a convex lens. The focal length of the lens is 10.0 cm.
- (a) Calculate the image distance. Is the image real or virtual?
 - (b) What is the magnification? Determine the height of the image.
 - (c) Is the image upright or inverted?
 - (d) Confirm your results by drawing a ray diagram for the above case. Choose the scale for the two relevant directions appropriately so that the relevant features are illustrated well. Points will be awarded for clarity and accuracy.