

Homework No. 01 (Fall 2025)

PHYS 203B-001: COLLEGE PHYSICS

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

Due date: Thursday, 2025 Aug 28, 12:30 PM, on D2L

Instructions

- You are encouraged to use any of the resources to complete this homework. However, the extent to which you depend on resources while doing this homework is a measure of how much extra work you need to put in to master the associated concepts. Solutions should be the last resource.
- Links to solutions are provided.
- Variations of homework problems and additional problems are available in [Lecture Notes](#). These serve as practice problems.
- Describe your thought process in detail and organize it clearly. Make sure your answer has units and right number of significant digits.
- After completion, scan the pages as a single PDF file, and submit the file on D2L (under Assessments → Assignments). You can replace your PDF file as many times as you like, only the last file is graded. The deadline has an (undisclosed) buffer period, so do not hesitate to try submissions after the deadline.

Problems

1. (10 points.)

- (a) Determine the number of electrons in one nano-gram of electrons.
- (b) Calculate the total electric charge on one nano-gram of electrons.

Solution [Erratum: $0.11 \times 10^{-9+31-3} = 1.1 \times 10^{18}$ in part (a). This carries over to part (b) and the correct answer is 0.18 C.]

2. (10 points.) Two identical conducting spheres A and B carry equal charge. They are separated by a distance much larger than their diameters. A third identical conducting sphere C is uncharged. Sphere C is first touched to A , then to B , and finally removed.

- (a) As a result, what is the charge on A , if it was originally Q .
- (b) As a result, what is the charge on B , if it was originally Q .

(c) As a result, what is the electrostatic force between A and B , if it was originally F .

Solution

3. (10 points.) A pair of electric charges of equal magnitude q and opposite sign separated by distance a has an electric dipole moment

$$p = qa. \quad (1)$$

It has a direction going from the negative charge to the positive charge. Determine the magnitude of the electric dipole moment constituting of an electron and a proton separated by a distance of 0.30 \AA .

Solution

4. (10 points.) Four negative charges of equal magnitude $q = -3.00 \mu\text{C}$ are placed at the corners of a square of length $L = 10 \text{ cm}$. Determine the magnitude of the force on one of the negative charge.

Solution

5. (10 points.) Fig. 1 shows three point charges that lie in the x - y plane. Given $q_1 = -4.0 \mu\text{C}$, $q_2 = +6.0 \mu\text{C}$, $q_3 = +5.0 \mu\text{C}$, charges q_1 and q_2 are separated by a distance of 4.0 cm , and charges q_1 and q_3 are separated by a distance of 6.0 cm . Find the magnitude and direction of the net electrostatic force on charge q_3 .

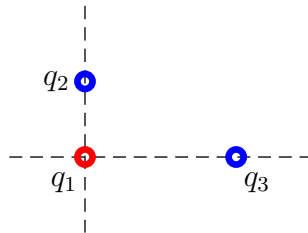


Figure 1: Problem 5

Solution

6. (10 points.) What is the magnitude and direction of the instantaneous acceleration of an electron that has a total force of $\hat{\mathbf{i}} 2.0 \times 10^{-19} \text{ N}$ acting on it. Here $\hat{\mathbf{i}}$ denotes the direction of the force along the positive x axis.

Solution