

Work each of the following problems. SHOW ALL WORK.

1. What are four similarities between electrostatic and gravitational forces? What are two differences?

2. Determine both the mass and the charge of a block of material consisting of 3×10^{27} protons, 3×10^{37} neutrons, and 3.1×10^{27} electrons.

3. A proton is placed $100 \mu\text{m}$ from a helium nucleus. The gravitational force pulls the proton and nucleus together, while the electric force pushes them apart. Which force is stronger and by how much?

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4. How far apart are a proton and an electron if they exert an attractive force of 3 N on each other?
5. If the total charge of an atom's nucleus is +3 and the total charge of the surrounding electrons is -3, the atom is which one of the following:
- a. positively charged
 - b. negatively charged
 - c. electrically neutral
 - d. unstable
6. An object with charge $4.3 \times 10^{-5} \text{ C}$ pushes another object $0.31 \mu\text{m}$ away with a force of 7 N. What is the total charge of the second object?

Work each of the following problems. SHOW ALL WORK.

7. A balloon, which is initially neutral, is rubbed with fur until it acquires a net charge of -0.40 nC .

a. Assuming that only electrons are transferred, were electrons removed from the balloon or added to it?

b. How many electrons were transferred?

8. Two $+1 \text{ C}$ charges are separated by $3,000 \text{ m}$. What is the magnitude of the electric force between them?