

Work each of the following problems. SHOW ALL WORK.

1. List four similarities between the electromagnetic and gravitational forces. What are two differences?

2. You hold in your hand a block of material with 3×10^{27} protons, 3×10^{37} neutrons, and 3.1×10^{27} electrons. What is the mass of the block, and what is its charge?

3. A proton is placed 100 micrometers from a helium nucleus. Gravity pulls the proton and nucleus together, while the electric force pushes them apart. Which is stronger, and by how much?

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4. How far apart are a proton and electron if they exert an attractive force of 3 N on one another?
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 (choose one.)
- a. Positively-charged
 - b. Negatively-charged
 - c. Electrically neutral
 - d. Unstable
6. An object with charge 4.3×10^{-5} C pushes another object 0.31 micrometers 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, initially neutral, is rubbed with fur until it acquires a net charge of -0.40nC .

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 3000 m . What is the magnitude of the electric force between them?