

PHYSICS 1020

Homework #4

(Due March 13, 2017)

1. A solid copper sphere of diameter 1.0 cm has a charge of -20.0 nC. What fraction of the copper atoms have gained an extra electron? (Hint: you will need to compute how many electrons are in -20.0 nC, and how many *moles* of copper atoms are present. See the discussion of moles in section 2.2 of the class handouts.)
2. (KJF 20-11) A small plastic sphere with a charge of -5.0 nC is near another small plastic sphere with a charge of -12 nC. If the spheres repel one another with a force of magnitude 8.2×10^{-4} N, what is the distance between the spheres?
3. (KJF 20-19) What are the strength and direction of the electric field 2.0 cm from a small glass bead that has been charged to $+6.0$ nC?
4. (KJF 20-26) What are the strength and direction of an electric field that will balance the weight of (a) a proton and (b) an electron?
5. (KJF 21-19)
 - a. What is the potential difference between the terminals of an ordinary AA or AAA battery? (If you're not sure, find one and look at the label.)
 - b. An AA battery is connected to a parallel-plate capacitor having 4.0-cm-diameter plates spaced 2 mm apart. How much charge does the battery move from one plate to the other?
6. (KJF 21-35) A science-fair radio uses a homemade capacitor made of two 35 cm \times 35 cm sheets of aluminum foil separated by a 0.25-mm-thick sheet of paper. What is its capacitance?
7.
 - a. How long must a 0.60-mm-diameter copper wire be to carry a 0.50 A current when connected to the terminals of a 1.5 V flashlight battery?
 - b. What is the current if the wire is half this length?
8. (KJF 22-61) A wire is 2.3 m long and has a diameter of 0.38 mm. When connected to a 1.2 V battery, there is a current of 0.61 A. What material is the wire most likely made of?