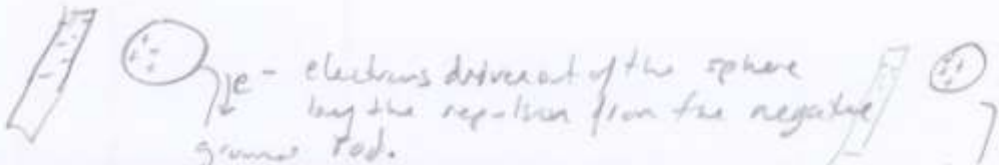
HW 20 additional Problems

1. Workbook items 7-14 found in sections **20.1 Charges and Forces** and **20.2 Charges, Atoms, and Molecules**

2. If a metal object receives a positive charge, does its mass increase, decrease, or stay the same? What happens to its mass if the object receives a negative charge? Include diagrams to support your answer.

Its mass will decrease. Negative charge (electrons) are what moves when something becomes charged. So electrons had to leave the object for it to gain a negative charge



3. A 27-g piece of aluminum that was originally electrically neutral is given a charge of +1.6 μC. (a) How many electrons were removed from the aluminum in the charging process? (b) What fraction of the electrons originally in the aluminum were involved in the charging process? (answers: a. 1×10^{13}, b. 1.28×10^{-12})

a) $q = 1.6 \times 10^{-6}$ C 1.6×10^{-19} C = 1 electron

1.6×10^{-6} C $\left(\frac{1 \text{ electron}}{1.6 \times 10^{-19} \text{ C}}\right) = 1 \times 10^{13}$ electrons

b) Find the # of electrons in this 27 g piece of Al first. Then you can find the fraction that were removed.

Al has 13 protons so it also has 13 electrons.

Al has a mass of 27 g per mole (how convenient!)

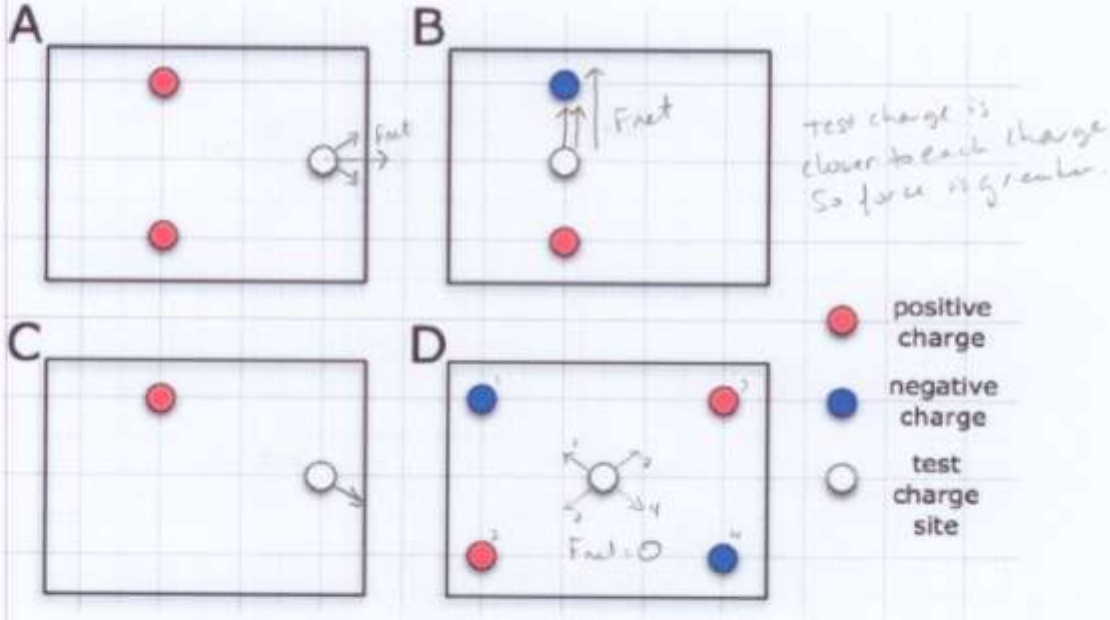
Since we have 1 mole of Al we have 6.022×10^{23} atoms each with 13 electrons.

$6.022 \times 10^{23} \cdot 13 = 7.83 \times 10^{24}$ electrons to start with

$\frac{1 \times 10^{13} \text{ removed}}{7.83 \times 10^{24} \text{ original}} = 1.28 \times 10^{-12}$

A positive and negative test

In the figure below are shown four situations in which charges have been placed. Each of the positive and negative charges has the same magnitude. The positive and negative charges are fixed in their position. Each situation is independent and you do not need to be concerned about any charges that might be outside the boxes.



A. If in each situation, we put a small positive test charge, q, at the indicated positions. Rank the magnitude of the force that the test charge would feel. Use a ranking such as E>F=G>H=0, that is, only use greater than signs, indicate if any two situations produce equal forces, and indicate if any of the forces are zero.

B > A > C > D

B. Instead of using a positive test charge, we use a negative test charge of the same magnitude. How would the forces felt by the test charge in the four situations change?

The magnitude will be the same, it will just be in the opposite direction.