Name: Key

Practice - 18.2 Conductors and Insulators

1. A 50.0 g ball of copper has a net charge of 2.00 μC. What fraction of the copper's electrons has been removed? (Each copper atom has 29 protons, and copper has an atomic mass of 63.5.) For a neutral atom, $\#e^- = \#p^+$

$$\#e^- = \left(\frac{50.0\text{ g}}{63.5\ \frac{\text{g}}{\text{mole}}}\right)\left(\frac{6.02\times10^{23}\text{ atoms}}{1\text{ mole}}\right)\left(\frac{29\ e^-}{\text{Cu atom}}\right) = 1.375\times10^{25}\ e^-$$

$$\frac{\#\text{ removed}}{\text{Total } e^-} = \frac{(2.00\times10^{-6}\text{ C})\left(\frac{1\ e^-}{1.60\times10^{-19}\text{ C}}\right)}{1.375\times10^{25}\ e^-} = \boxed{9.09\times10^{-13}}$$

2. What net charge would you place on a 100 g piece of sulfur if you put an extra electron on 1 in 10^{12} of its atoms? (Sulfur has an atomic mass of 32.1.)

$$\#\text{ sulfur atoms in 100 g} = \left(\frac{100\text{ g}}{32.1\ \frac{\text{g}}{\text{mole}}}\right)\left(\frac{6.02\times10^{23}\text{ atoms}}{1\text{ mole}}\right) = 1.875\times10^{24}\text{ sulfur atoms}$$

$$Q = \left(\frac{1\ e^-}{10^{12}\text{ atoms}}\right)\left(1.875\times10^{24}\text{ atoms}\right)\left(\frac{1.60\times10^{-19}\text{ C}}{1\ e^-}\right) = \boxed{3.00\times10^{-7}\text{ C}}$$

3. How many coulombs of positive charge are there in 4.00 kg of plutonium, given its atomic mass is 244 and that each plutonium atom has 94 protons?

$$Q = (4.00\,\text{kg})\left(\frac{1\,\text{mole}}{0.244\,\text{kg}}\right)\left(\frac{6.02\times10^{23}\,\text{atoms}}{1\,\text{mole}}\right)\left(\frac{94\,p^+}{\text{atom}}\right)\left(\frac{1.60\times10^{-19}\,\text{C}}{1\,p^+}\right)$$

$$= \boxed{1.48\times10^{8}\,\text{C}}$$