

Answer on Question #68932, Physics / Atomic and Nuclear Physics

What is the % of Fe^{2+} in $\text{Fe}_{0.93}\text{O}_{1.00}$?

Solution:

We know that the compound contains a mixture of Fe^{3+} and Fe^{2+} ions, but you don't know how many of each you have.

This is where the charge of the compound comes into play. The compound must be neutral, so the (2-) charge of the oxygen must be balanced by the overall charge of the iron cations.

To make the calculations as simple as possible, let's say that you have 100 moles of the compound, which will contain

- 93 iron(II) and iron(III) ions
- 100 ions of oxygen

Let's say that you have x iron(II) ions and y iron(III) ions. You can say that

$$x + y = 93$$

Now focus on the charge. You have 100 moles of O^{2-} , which means that you must have

$$x(2+) + y(3+) = |100(2-)|$$

Use the first equation to get $y=93-x$, then replace x in the second equation

$$2x + 3(93 - x) = 200$$

$$2x + 279 - 3x = 200$$

$$x = 79$$

Therefore, we have 79 iron(II) ions and the percent composition of iron(II) ions in the total ions is

$$\frac{79}{193} \times 100 = 40.93 \%$$

The percentage of Fe^{2+} in the total ions of iron

$$\frac{79}{93} \times 100 = 84.95 \%$$

Answer: 40.93 % of total ions in the compound and **84.95 %** in the total ions of iron.

Source: Comprehensive Chemistry: JEE Advanced 2016 by McGraw Hill Education

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