Question #80727

To determine the concentration of iron in an unknown sample, a chemist analyzed the sample 5 times, and obtained the following results: 339.276 ppm, 127.533 ppm, 220.031 ppm, 132.825 ppm and 415.818 if the accepted value for the concentration of iron in this sample is 230.476 determine standard deviation for the set of analysis.

Answer:

The standard derivation for set of analysis is equal to 127.5245 (128.8712*).

According to the equation [1], the standard derivation for set of analysis is equal to:

$$s = \sqrt{\frac{\sum_{i=1}^{N}(x_i - \overline{x})^2}{N-1}}$$

As I understood, the accepted value for the concentration of iron in this sample means the same as the value for concentration of iron in an unknown sample. Therefore, the standard derivation for set of analysis is equal to:

$$\overline{x} = \frac{339.276 + 127.533 + 220.031 + 132.825 + 415.818}{5} = 247.097$$

$$s = \sqrt{\frac{(339.276 - 247.097)^2 + (127.533 - 247.097)^2 + (220.031 - 247.097)^2 + (132.825 - 247.097)^2 + (415.818 - 247.097)^2}{4}} = 127.5245$$

But, if I am mistaken and the accepted value for the concentration of iron in this sample is equal to the average concentration of iron in that sample*, the standard derivation for set of analysis is equal to:

$$s = \sqrt{\frac{(339.276 - 230.476)^2 + (127.533 - 230.476)^2 + (220.031 - 230.476)^2 + (132.825 - 230.476)^2 + (415.818 - 230.476)^2}{4}} = 128.8712$$

So, the standard derivation for set of analysis is equal to 127.5245 (128.8712*).

* It depends on that, what you mean by the accepted value. Because, if you mean that analysis was carried out by the standard addition method [2], the 2nd, 3rd and 4th results could not be obtained. If you mean that the accepted value is the value for concentration of iron in unknown sample, the standard deviation is equal to 127.5245. Otherwise, the only meaning, which has sense, is that the accepted value for the concentration of iron in this sample is equal to the average concentration of iron in that sample.

References:

[1]   https://en.wikipedia.org/wiki/Standard_deviation

[2]   https://en.wikipedia.org/wiki/Standard_addition