

Answer on Question #46402 – Chemistry – Organic Chemistry

Question:

Rank the following elements by effective nuclear charge, Z_{eff} , for a valence electron. Sb, Sn, Sr, In, and Rb. please rank from highest to lowest

Answer:

The effective nuclear charge (often symbolized as Z_{eff} or Z^*) is the net positive charge experienced by an electron in a multi-electron atom.

The effective nuclear charge on such an electron is given by the following equation:

$$Z_{\text{eff}} = Z - S$$

where

Z is the number of protons in the nucleus (atomic number), and

S is the average number of electrons between the nucleus and the given electron (the number of nonvalence electrons).

$$Z_{\text{eff}}(\text{Sb}) = 51 - 46 = 5+;$$

$$Z_{\text{eff}}(\text{Sn}) = 50 - 46 = 4+;$$

$$Z_{\text{eff}}(\text{Sr}) = 38 - 36 = 2+;$$

$$Z_{\text{eff}}(\text{In}) = 49 - 46 = 3+;$$

$$Z_{\text{eff}}(\text{Rb}) = 37 - 36 = 1+;$$

So the rank will be:

$$Z_{\text{eff}}(\text{Sb}) > Z_{\text{eff}}(\text{Sn}) > Z_{\text{eff}}(\text{In}) > Z_{\text{eff}}(\text{Sr}) > Z_{\text{eff}}(\text{Rb})$$

Answer: $Z_{\text{eff}}(\text{Sb}) > Z_{\text{eff}}(\text{Sn}) > Z_{\text{eff}}(\text{In}) > Z_{\text{eff}}(\text{Sr}) > Z_{\text{eff}}(\text{Rb})$