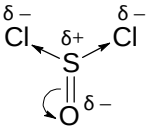
Answer on Question#38361-Chemistry-Organic Chemistry

Question

Why sulphur is electophilic in thionyl chloride while it is nucleophilic in case of sodium thiosulphate?

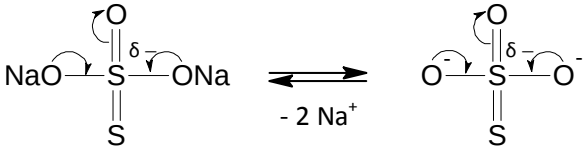
Answer

Let us consider the structure of thionyl chloride:



Sulfur in thionyl chloride is bound with two chlorine atoms and one oxygen atom. Since both oxygen and two chlorine atoms have higher electronegativity than sulfur, the electron density is drawn from the sulfur to chlorines and oxygen due to the induction effect (shown by arrows) and mesomeric effect (shown by bow-shaped arrow). As a result, sulfur becomes partially positively charged and thus electrophilic.

Now let us consider the structure of sodium thiosulphate and take into account that in a solution it is almost completely dissociated:



Despite the oxygen bound to the sulfur by double bond proves negative mesomeric effect, the central atom of sulfur is partially negatively charged, because two other oxygen atoms prove positive mesomeric effect, especially in dissociated state of the substance. That is why the sulfur atom in sodium thiosulphate is nucleophilic.