

Question

What is the octet rule? Why might this principle be considered the "driving force" that causes elements to react to form chemical bonds?

Answer

The octet rule is a chemical rule that states that atoms of low atomic number (< 20) tend to combine in such a way that they each have eight electrons in their valence shells, giving them the same electronic configuration as a noble gas.

Despite the octet rule is not the "driving force" in strict sense, it indicates the most stable electron configuration – completely filled s- and p-orbitals in an atom's outermost energy level. The deviation from such stable electron configuration determines reactivity of element, because elements always seek the most stable electron configuration, and when reaching it they form stable molecules. For example, sodium atom has a single electron in its outermost electron shell, the low-laying shells being full with two and eight electrons respectively. Thus sodium will form a compound in which it has lost a single electron and have a full outer shell of eight electrons, or octet. A chlorine atom has seven electrons in its outer electron shell, the first and second shells being filled with two and eight electrons respectively. That is why it has great electron affinity, i.e. tends to gain an electron to make an octet.