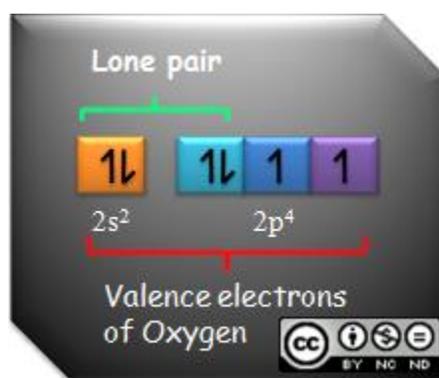
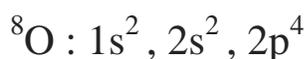


VALENCE ELECTRONS AND VALENCY OF AN ELEMENT

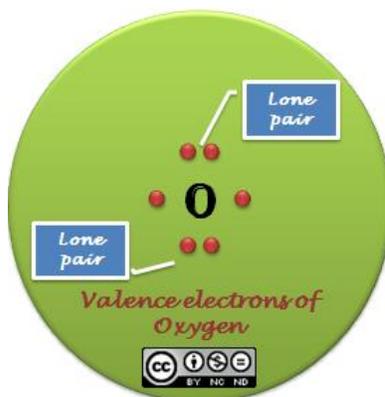
Valence electrons play an important role in an atom's life. When an atom wants to make a bond with another atom, these Valence electrons make it possible. Valence electrons are placed in the outer most orbit of the atom and that orbit (shell) is called the valence shell. Let's take an example to identify them. Write the configuration of Oxygen



Oxygen has 6 electrons in its outer most orbit (2+4) that means it has 6 valence electrons and orbit 2 is called the valence shell. Now place these electrons in orbitals of their respective sub-shell.

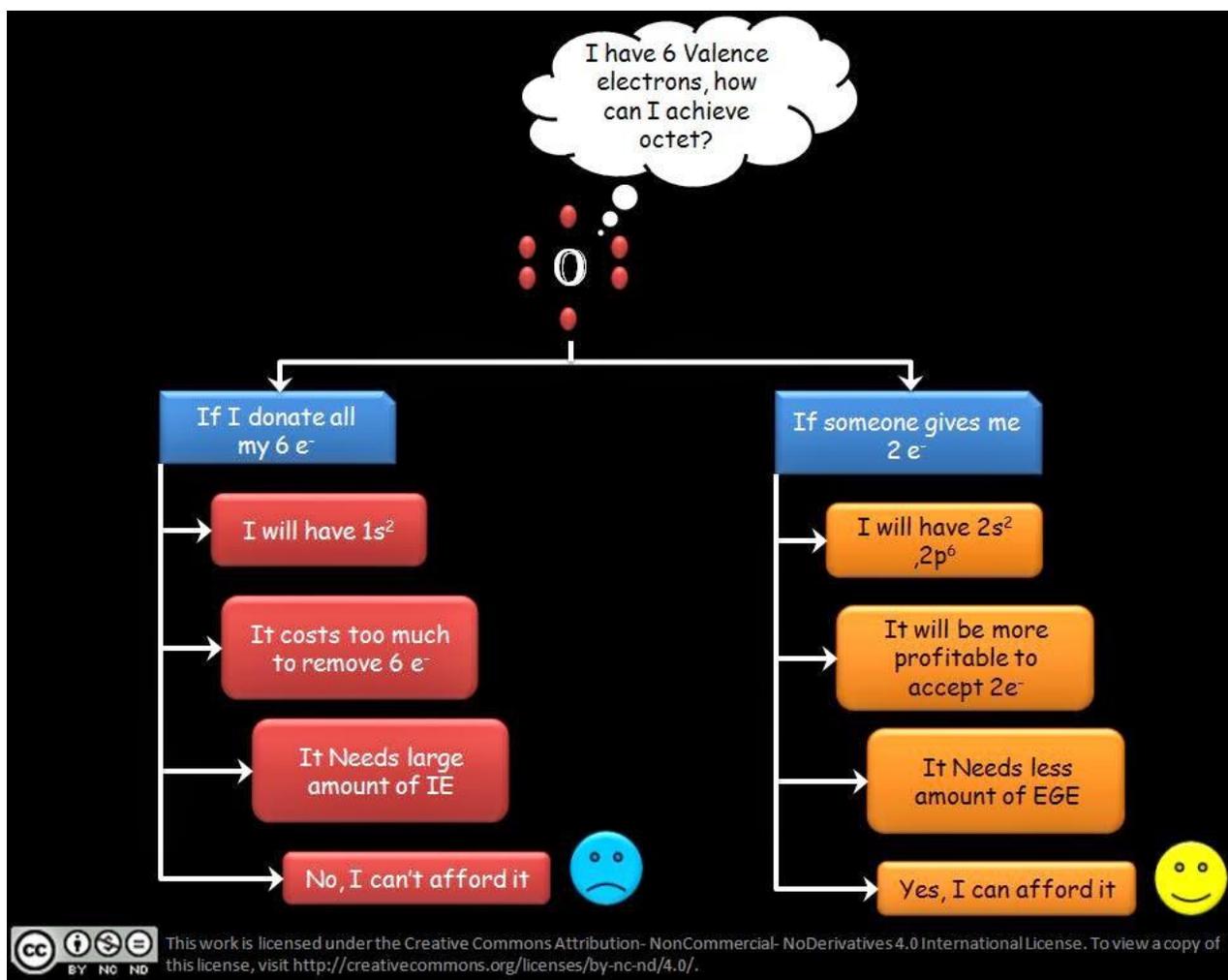
You can see, here 2 sets of paired electron and 2 single electrons are present. Paired electrons are called the **lone pair**. In **Lewis dot structure** these lone pairs are drawn as paired dots while other valence electrons as single dots.

Oxygen has 6 valence electrons and it needs 2 more electrons to achieve octet. The number of electrons needed to complete octet is termed as the valency of an element. This value can be obtained by subtracting the number of valence electrons from octet (8). So, the valency of Oxygen is 2. That means Oxygen is ready to share its 2 valence electrons or ready to accept 2 more electrons in order to achieve octet.



To grasp the concept of valence electrons and valencies of elements let's work out a few examples. Before working on examples, I want to tell you one more thing about periodic table. Valence electrons and valencies are also periodic properties. All elements of a group have same number of valence electrons and valency. And you can call it as group valency. Let's figure out it for the first element of each group.

Every element has a right to choose which way it likes to achieve octet. It has always two choices either it can accept electrons from others or donate to others. It chooses between them as per its financial condition (in case of atom, it means energy required). If donation of electrons requires lesser energy (lower **IE**) it chooses to donate and if it can manage to take loan from others (lower **EGE**) it chooses to accept electrons.



Elements of group 1 have 1 electron in outer most orbit. They have two ways to achieve octet, either they can accept 7 electrons or donate 1 electron to another element. If you recall the trend of Ionisation enthalpy in periodic table, you will find that group 1 has lowest IE. That's why they choose to donate 1 electron

Group No	Group 1	Group 2	Group 13	Group 14	Group 15	Group 16	Group 17
Element	¹ H	⁴ Be	⁵ B	⁶ C	⁷ N	⁸ O	⁹ F
Electronic configuration	1s ¹	1s ² , 2s ²	1s ² , 2s ² , 2p ¹	1s ² , 2s ² , 2p ²	1s ² , 2s ² , 2p ³	1s ² , 2s ² , 2p ⁴	1s ² , 2s ² , 2p ⁵
Total No of Valence electrons	1	2	3	4	5	6	7
Lewis dot structure							
Possible ways to achieve octet	Either lose 1e ⁻ or Gain (8-1) = 7e ⁻	Either lose 2e ⁻ or Gain (8-2) = 6e ⁻	Either lose 3e ⁻ or Gain (8-3) = 5e ⁻	Either lose 4e ⁻ or Gain (8-4) = 4e ⁻	Either lose 5e ⁻ or Gain (8-5) = 3e ⁻	Either lose 6e ⁻ or Gain (8-6) = 2e ⁻	Either lose 7e ⁻ or Gain (8-7) = 1e ⁻
IE	Lowest 😊	Lower 😊	Low 😊	Moderate 😊	High	Higher	Highest
EGE	Highest	Higher	High	Moderate 😊	Low 😊	Lower 😊	Lowest 😊
Preferred to way to achieve octet	Donate 1e ⁻	Donate 2e ⁻	Donate 3e ⁻	Donate 4e ⁻ Or Demand 4 e ⁻	Demand 3 e ⁻	Demand 2 e ⁻	Demand 1 e ⁻
Valency of the Element and Group	1	2	3	4	3	2	1
Oxidation number	+1	+2	+3	+4, -4	-3	-2	-1



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and the valency of first group is 1. And for similar reason group 2 and 13 also choose to donate electrons and their respective valencies are 2 and 3.

Elements of group 14 have 4 electrons in outer orbit. For this group IE and EGE both have moderate values. That's why they can happily donate or accept electrons from others. This quality makes them special and because of this speciality carbon has capability to form bond with a large number of elements and is able to form a number of compounds. The list of carbon compounds is so long that scientists have to develop a whole branch of chemistry to study them. This branch is known as Organic Chemistry.

Elements of group 15, 16 and 17 have higher IE but lower EGE, that's why they prefer to accept electrons from other elements to achieve octet. And their respective group valencies are 3, 2 and 1. Elements of group 18 have complete octet that's why they have 0 valencies.

Do you notice that Group 1 prefers to donate 1 electron while group 17 prefers to accept 1 electron from others? And group 1 and group 17 both have group valencies of 1. How do you differentiate them?

Scientists also faced this problem and they developed a method to clear this confusion. They give plus (+) sign to the valency when electron is donated by the element and they give minus (-) sign to the valency when electron is accepted by the element. Now valency of group 1 gets '+' sign while valency of group 17 gets '-' sign. This new look of valency is known as "Oxidation Number"

Do you know that periodic table tells us which element is likely to bond with which element and also gives us a clue about the nature of bond? In the next post we will explore this quality of periodic table.

Source : <http://chemistrynotmystery.blogspot.in/2014/07/valence-electrons-and-valency-of-element.html>