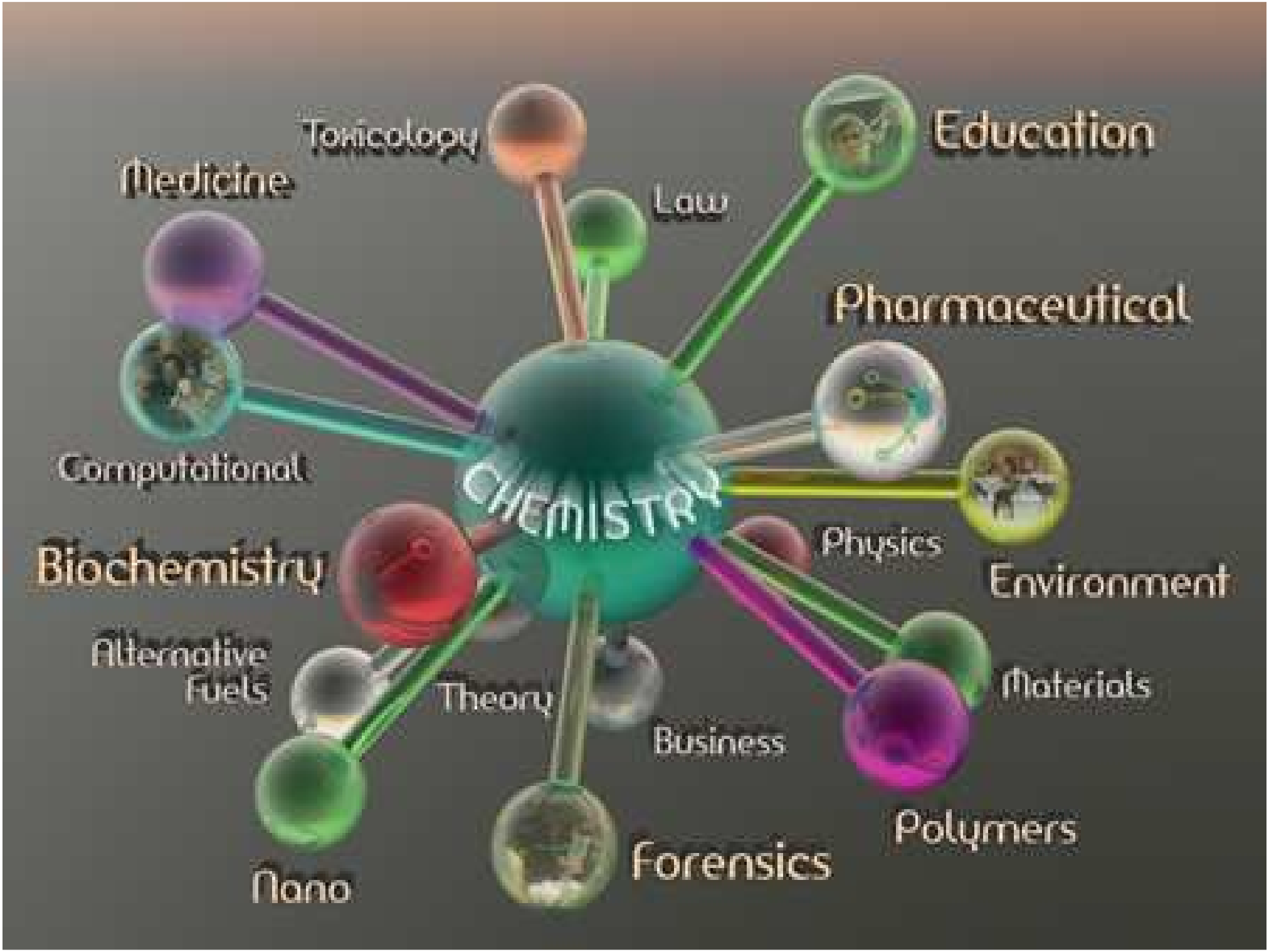
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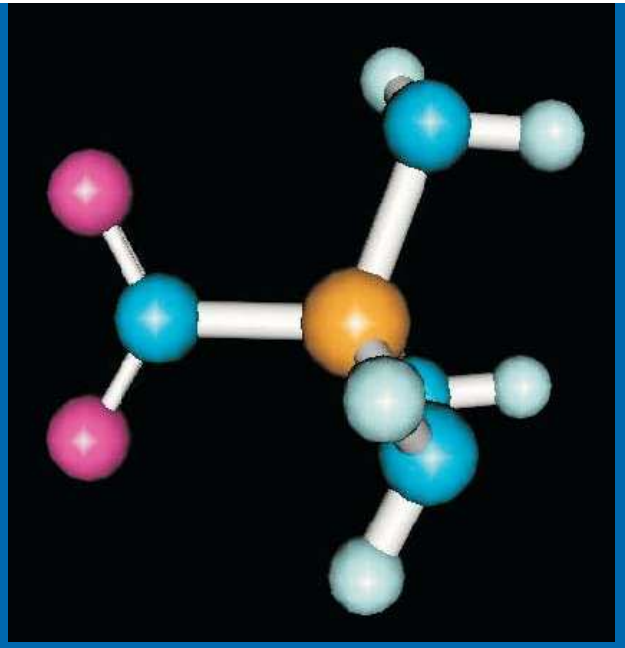
CHEMISTRY PROJECT



ON

CHEMICAL BONDING

BY :

- Anjali Rakhyani

- (11^{th} – S)

PREFACE

This project titled "Chemical Bonding" is based on the syllabus prescribed by the Council for Indian School Certificate Examination (ISC) Board for the students of class 11th, who are to appear in the annual examination of March 2011.

The main theme of our project is to give information about chemical bonding, its cause, types of chemical bonds – ionic, covalent etc. and their characteristics, factors influencing their formation; octet rule, fajan's rule and relation with the periodic table by collecting matters from books and internet.

The project has been done in a very simple style. The subject matter is both narrative and descriptive. Various illustrations are also added to make the project clear and easy. We have also tried to collect relevant photographs wherever possible as they give a very clear view of the matter and make the reader understand the project.

Acknowledgement

We express deep senses of gratitude to the Principal of our school, Sr. Theresa and to the subject teacher, Mr. Ashish Pandey, who gave us such a learning project to work on.

We are also thankful to our school Librarian who helped us a lot in providing books necessary in connection with the preparartion of this project.

We are also thankful to our friends for their immence help and kind efforts which helped us to prepare our project successfully.

This project is the outcome of the cooperation and precious time given by all of them above.

- Anjali Rakhyani

- Akansha Sharma

(11^{th} – Science)

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INTRODUCTION

A chemical bond is any force of attraction that holds two atoms or ions together. In most cases, that force of attraction is between one or more negatively charged electrons held by one of the atoms and the positively charged nucleus of the second atom. Chemical bonds vary widely in their strength, ranging from relatively strong covalent bonds (in which electrons are shared between atoms) to very weak hydrogen bonds. The term chemical bond also refers to the symbolism used to represent the force of attraction between two atoms or ions. For example, in the chemical formula H—O—H, the short dashed lines are known as chemical bonds.

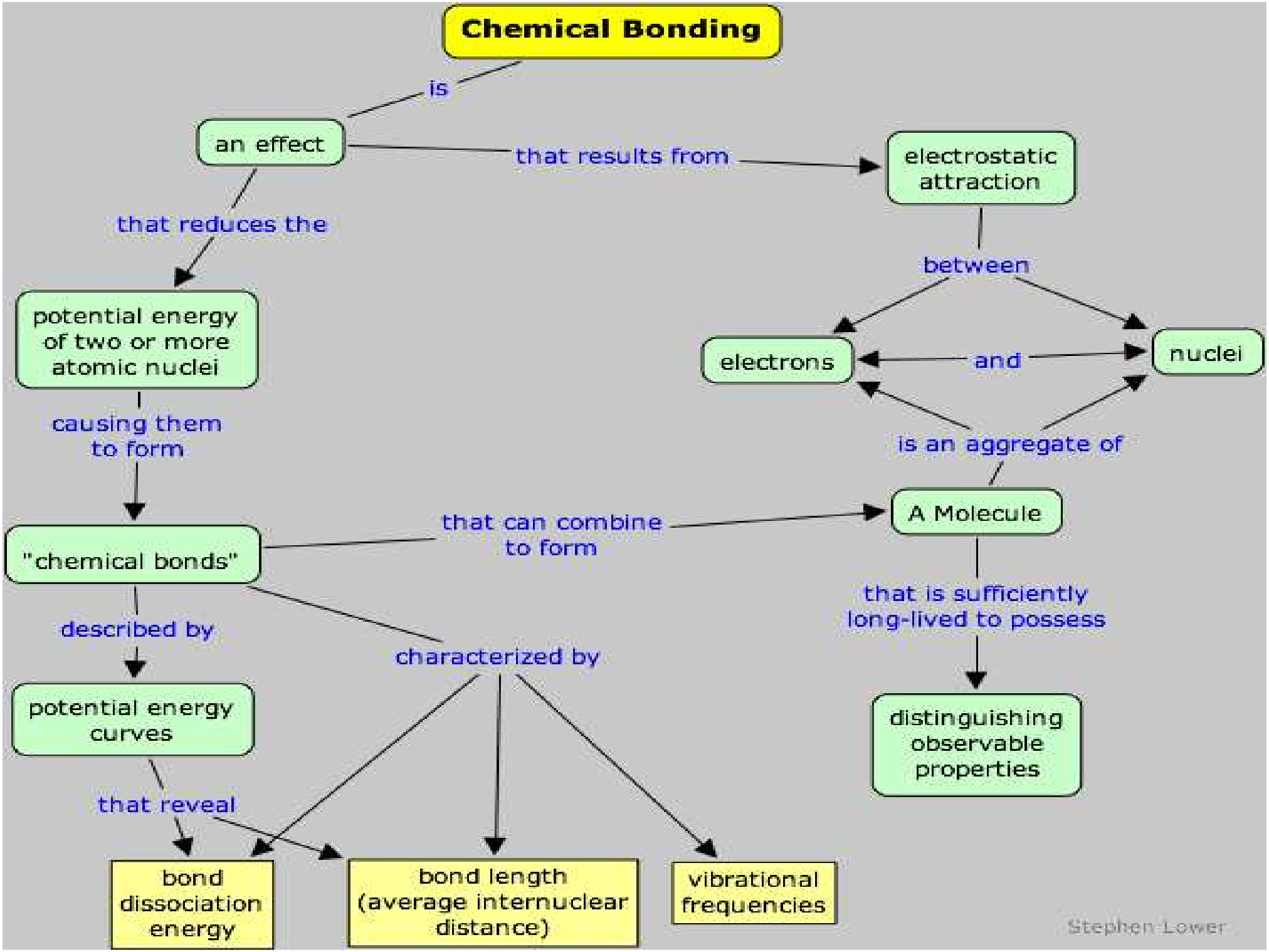
Chemical Bonding

Cause of Chemical Combination

The detailed study of the electronic configuration of atoms, the discovey of noble gaes and the study of their behaviour led chemists to understand why do atoms combine together and enter into chemical reactions. The bond is caused by the electromagnetic force of attraction between opposite charges, either between electrons and nuclei, or as the result of a dipole attraction. The strength of chemical bonds varies considerably; there are "strong bonds" and "weak bonds". Other factors which compel atoms to do so are as follows.

- Tendency to acquire stability : It is the law of nature that an unstable or a less stable system has a basic urge to acquire stability. The most stable of a system corresponds to the state of minimum energy. Therefore, every system in this universe tends to behave in such a way that it can attain minimum energy an the maximum stability.

- Tendency to acquire noble gas configuration : The noble gases possess practically no tendency to form chemical bonds and to enter into chemical combination. This implies that these gases are stable. Since an atomic system is also a part of the universe and has a a basic tendency to acquire stability i.e. a stste of minimum energy, it takes part in chemical reactions to acquire a stable electronic configuration similar to that of its nearest noble gas.


Chemical Bonding
is
an effect
that results from
electrostatic attraction
that reduces the
between
potential energy of two or more atomic nuclei
electrons
and
nuclei
causing them to form
is an aggregate of
A Molecule
that can combine to form
"chemical bonds"
that is sufficiently long-lived to possess
described by
characterized by
potential energy curves
distinguishing observable properties
that reveal
bond dissociation energy
bond length (average internuclear distance)
vibrational frequencies
Stephen Lower

The type of bond can usually be calculated by finding the difference in electronegativity of the two atoms that are going together.

1A	2A						8B			1B	2B	3A	4A	5A	6A	7A
							H 2.1									
Li 1.0	Be 1.5											B 2.0	C 2.5	N 3.0	O 3.5	F 4.0
Na 0.9	Mg 1.2	3B	4B	5B	6B	7B				1B	2B	Al 1.5	Si 1.8	P 2.1	S 2.5	Cl 3.0
K 0.8	Ca 1.0	Sc 1.3	Ti 1.5	V 1.6	Cr 1.6	Mn 1.5	Fe 1.8	Co 1.8	Ni 1.8	Cu 1.9	Zn 1.6	Ga 1.6	Ge 1.8	As 2.0	Se 2.4	Br 2.8
Rb 0.8	Sr 1.0	Y 1.2	Zr 1.4	Nb 1.6	Mo 1.8	Tc 1.9	Ru 2.2	Rh 2.2	Pd 2.2	Ag 1.9	Cd 1.7	In 1.7	Sn 1.8	Sb 1.9	Te 2.1	I 2.5
Cs 0.7	Ba 0.9	La 1.1	Hf 1.3	Ta 1.5	W 1.7	Re 1.9	Os 2.2	Ir 2.2	Pt 2.2	Au 2.4	Hg 1.9	Tl 1.8	Pb 1.8	Bi 1.9	Po 2.0	At 2.2

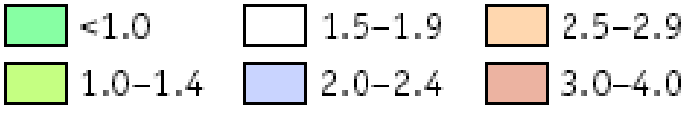
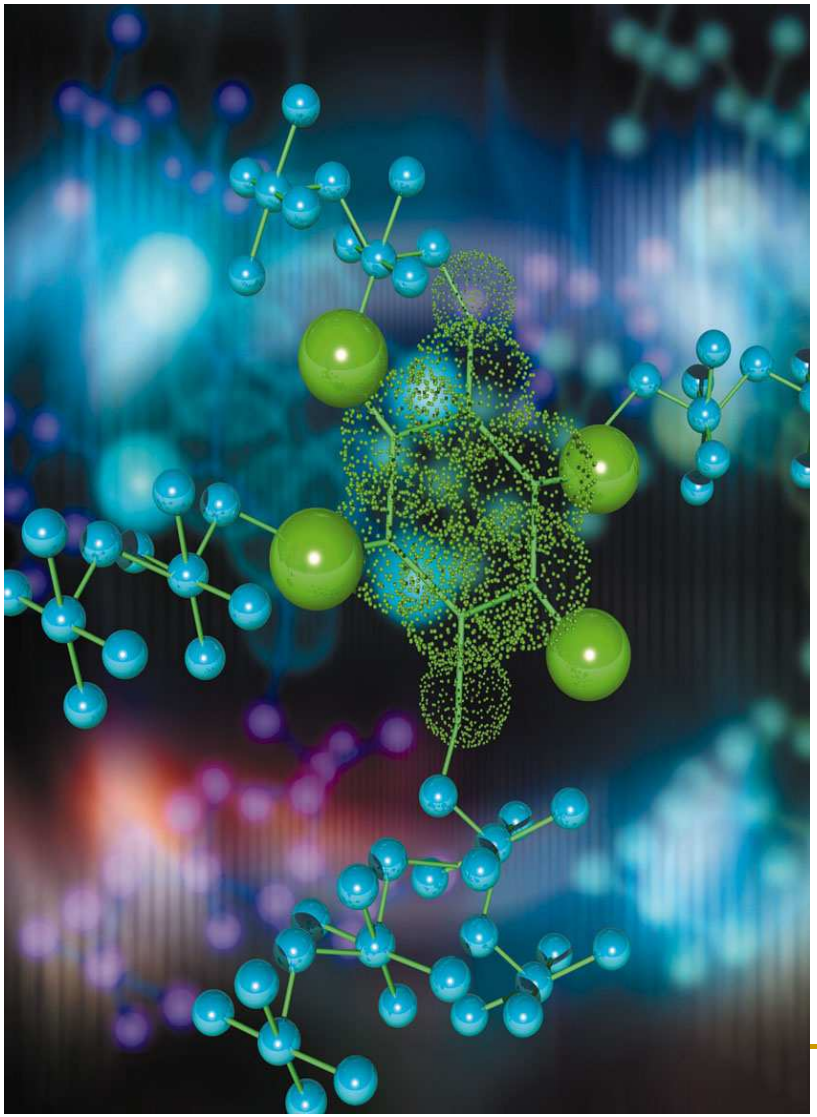


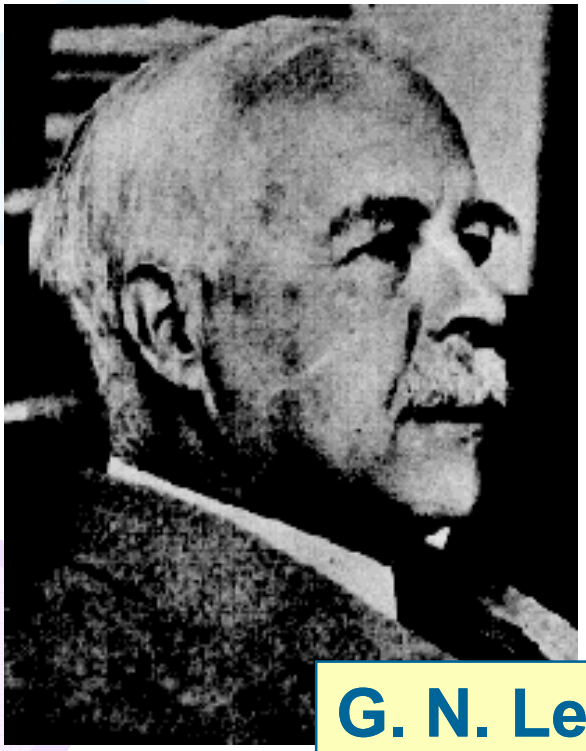
Figure 9.9 **Electronegativity values for the elements according to Pauling.** Trends for electronegativities are the opposite of the trends defining metallic character. Nonmetals have high values of electronegativity, the metalloids have intermediate values, and the metals have low values.

Valence Bond Theory



In 1927, valence bond theory was formulated and argued that a chemical bond forms when two valence electrons, in their respective atomic orbitals,work or function to hold two nuclei together, by virtue of system energy lowering effects. Building on this theory, chemist Linus Pauling published in 1931 what some consider one of the most important papers in the history of chemistry: "On the Nature of the Chemical Bond" , he presented six rules for the shared electron bond.

Electron Distribution in Molecules



G. N. Lewis
1875 - 1946

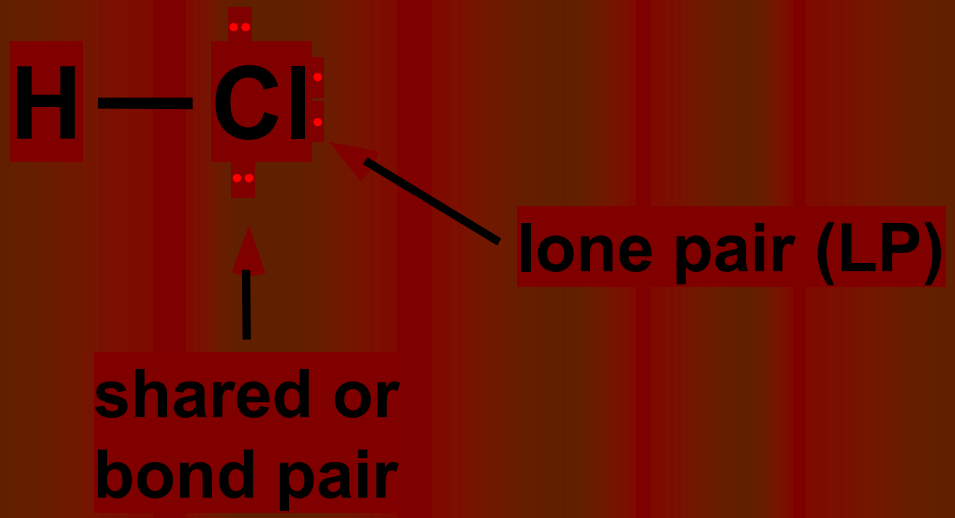
- Electron distribution is depicted with Lewis (electron dot) structures

- This is how you decide how many atoms will bond covalently!

(In ionic bonds, it was decided with charges)

Bond and Lone Pairs

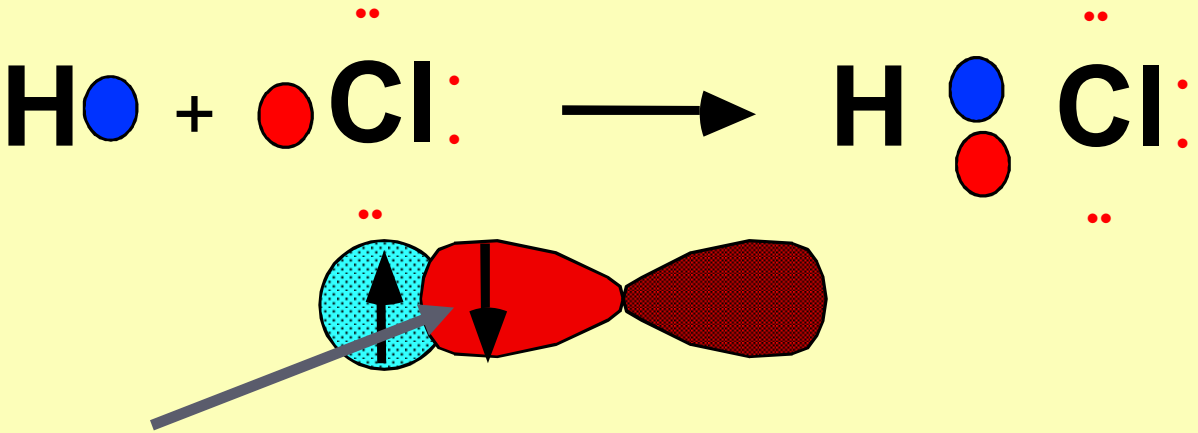
- Valence electrons are distributed as shared or **BOND PAIRS** and unshared or **LONE PAIRS.**



This is called a LEWIS structure.

BOND FORMATION

A bond can result from an overlap of atomic orbitals on neighboring atoms



Overlap of H (1s) and Cl (2p)

Note that each atom has a single, unpaired electron.

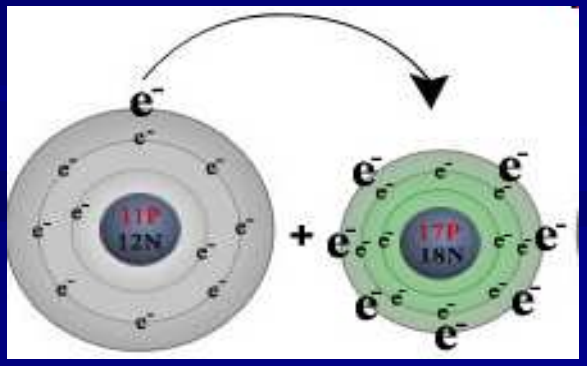
Types Of BONDS

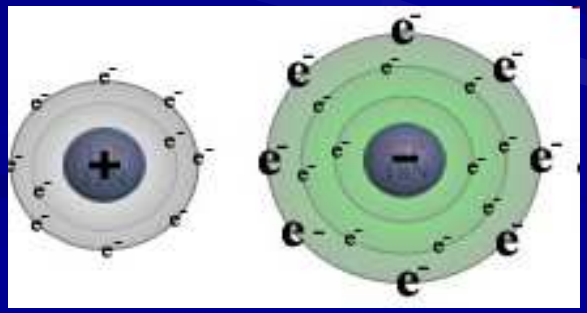
Electrovalent Or Ionic Bond

Ionic bond between two atoms is the electrostatic force of attraction which holds together the ions of the combining atoms formed by the complete transfer of one or more electrons from electropoitive to electronegative atom.

For example, during the reaction of sodium with chlorine:

sodium (on the left) loses its one valence electron to chlorine (on the right), resulting in a positively charged sodium ion (left) and a negatively charged chlorine ion (right).



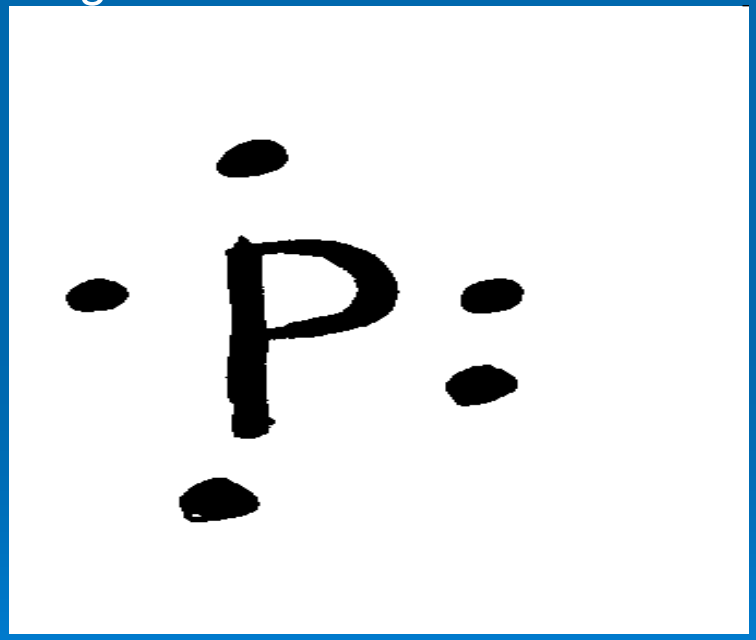


Formation of ionic bond

These ionic compounds are formed as a result of the formation of negative and positive ions (and electrically charged atom).

Representing Ionic Bonds:

G.N. Lewis developed a model of the valence electrons of single stoms or monatomic ions and he represented it on a paper as electron dot diagram or Lewis symbols. These consist of a element symbol and dots representing the valence electrons. For eg:



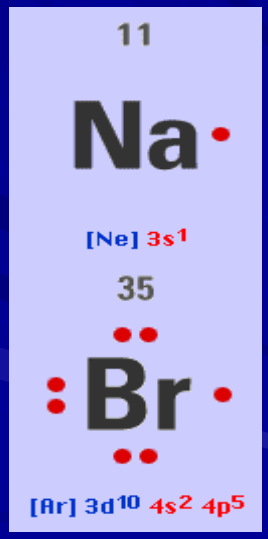
Electron dot diagrams help us to understand and represent the process of ion formation, and also illustrate that ionic bonds tend to produce full outer orbits of electron.

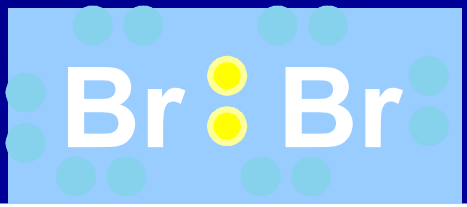
Covalent Bonding

Covalent bond is the sharing of the VALENCE ELECTRONS of each atom in a bond

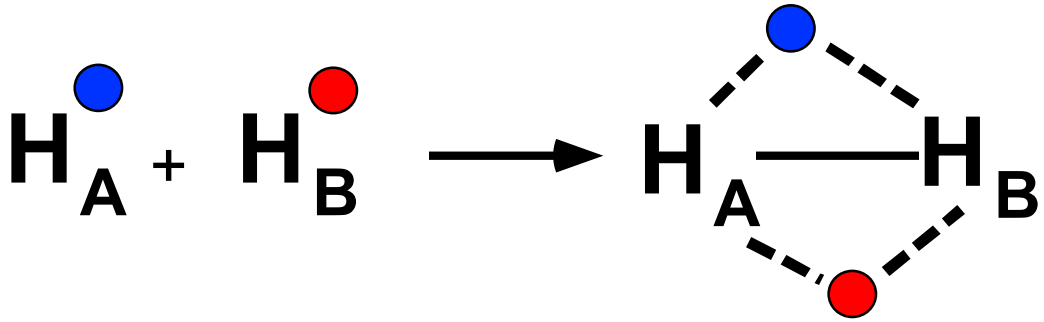
Recall: Electrons are divided between core and valence electrons.

ATOM		core	valence
Na	$1s^2\ 2s^2\ 2p^6\ 3s^1$	[Ne]	$3s^1$
Br	[Ar] $3d^{10}\ 4s^2\ 4p^5$	[Ar] $3d^{10}$	$4s^2\ 4p^5$

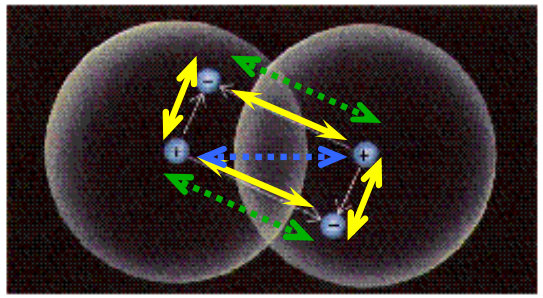




The bond arises from the mutual attraction of 2 nuclei for the same electrons.



A covalent bond is a balance of attractive and repulsive forces.



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THE END