The Molecular Geometry ABC's

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This book is dedicated to:
the equilibrium shifts that we could never actually figure out so we studied molecular geometry angles instead

Bond Angles

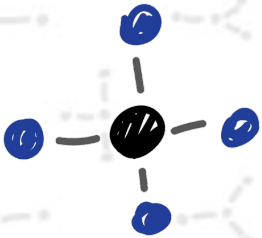
Bond angles determine the shape,

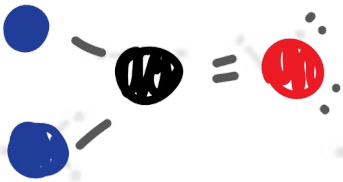
Of all of the molecules in the world,

Valence electrons push each other apart.

180, 120, and 109.5 degrees,

Are many of the angles formed with ease!





Bent Angles

Sisters but not twins,

A little less than 109.5 and 120 degrees,

Valence electrons keep them apart;

It's where VSEPR theory plays a part.

Angle measures determined by lone pairs,

And 2 bonding regions they both share!

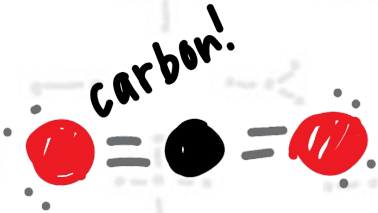
Central Atom

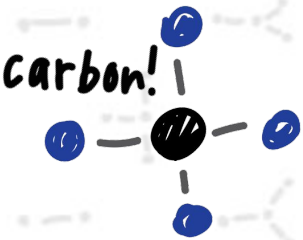
Central atom is stuck in the middle,

Always Carbon if it is included,

Lowest electronegativity is its
determining factor.

To lone pairs, it is a big attractor!





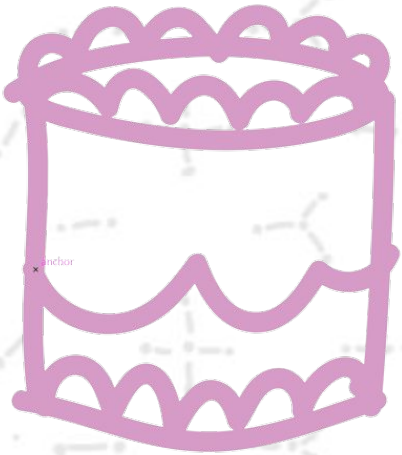
Dipole Forces

Two types: gotta catch 'em all,

Dipole-dipole and ion-dipole,

Ones got metals and the others got no metals

Ionic takes the cake when they play tug o' war!



Valence Electrons

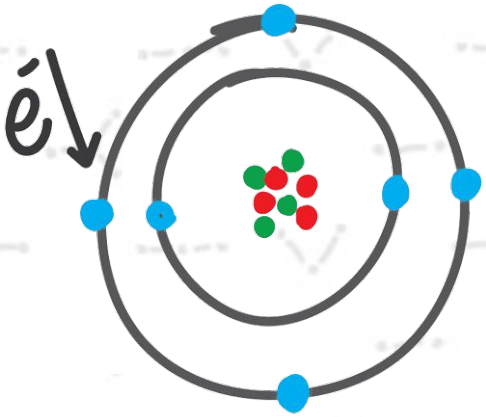
Special electrons on the outermost orbit of an atom,

Help with ionic and covalent bonds,

You can figure out valence electrons by looking at the columns (periodic table).

Molecular geometry and VSEPR hinge on the number of valence electrons

Other electrons form bonds!



Forces of Intermolecular Theory

Ionic Bond: the buffest of them all,

Ion-Dipole: is the best of both worlds: ionic and covalent

Hydrogen Bonding: the tiny but mighty hydrogen bond is allies with Nitrogen, Oxygen and Fluorine

runner up!

Dipole-Dipole: the woe of no hydro(gen); all the rest can't be the best

London-Dispersion: the weakest but still not meek; everything experiences it

Geometry of molecules

Atoms held together by a force,

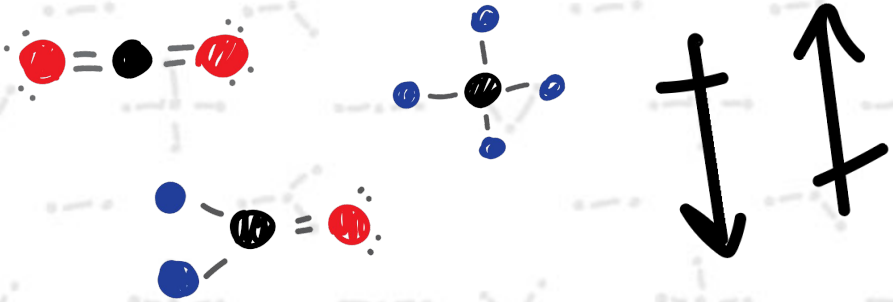
Three dimensional structures are formed,

Linear, trigonal planar, bent, and so many more,

Are mainly determined by bond angles and the lone pair count.

This structure reveals the molecule's reactivity, phase or polarity,

Drawing geometry gives you clarity!



Hydrogen bonding

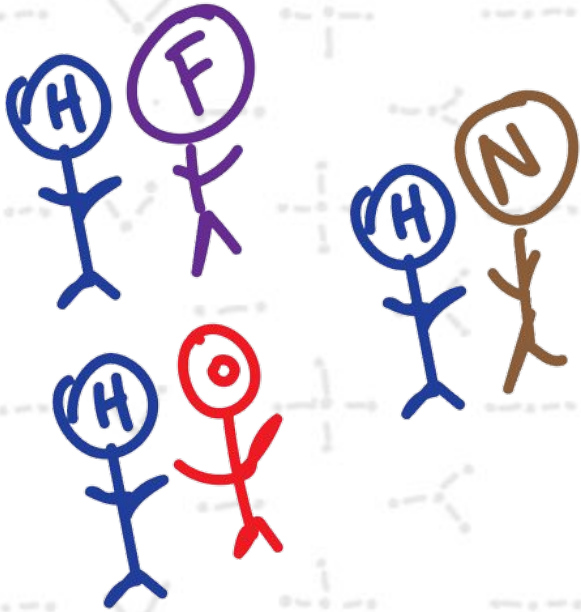
Strongest type of dipole-dipole bonding,

Occurs with elements that have the greatest difference in electronegativity (with hydrogen),

Such as Fluorine, Oxygen, and Nitrogen.

Hydrogen is tiny, it can leave other atoms in the dust,

Polarity is a must!



Ionic Bond

Happens between a metal and non-metal,

The metal become a cation,

The non-metal becomes an anion.

Ionic bonds experience the strongest intermolecular force,

Compared to weaker bonds, they will never divorce

James the Non-Polar Bond

007 plays the game, James Bond is the name

"Shaken not stirred" is his game,

His stay in London is divine, always there because he can't waste time

The atoms may change but he's the one that rises to fame

James not Jame because they're both the same

Kebab Structures

Linear is the place to be,

Atoms are meat on those sticks of grease,

The angle at which you char these is 180 degrees.

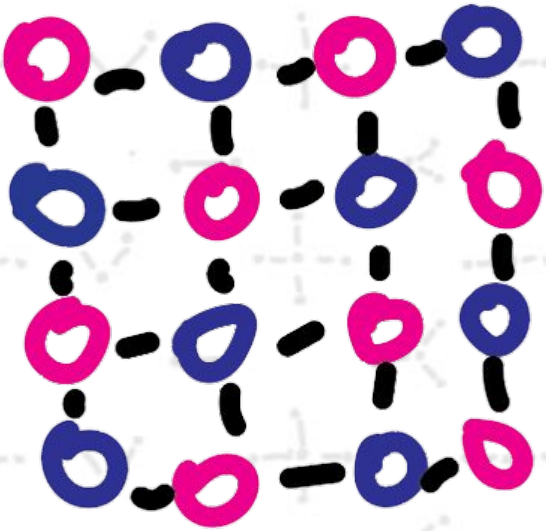
Lattice structure

Exclusive to ionic bonds,

Metals and non-metals get together,

The strongest type of bond they nurture.

The smaller the ionic size, the stronger the lattice structure.



Melting Point

Melting point, boiling point, why are they important?

With intermolecular forces, they are anything but dormant!

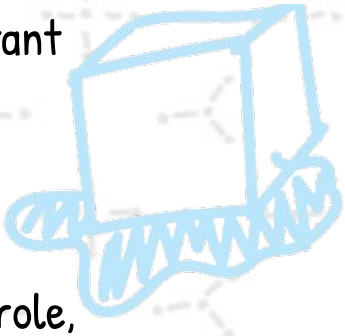
Ionic (the buff one) is much harder to change,

Its elements are strong in how they arrange.

The stronger the force, the more heat needed,

To melt or boil, they would have succeeded!

Melting and boiling point are important properties to note,



Liquid, solid, or gas that floats,

Intermolecular forces play a major role,

They're something chemists can't control!

Electro N egativity

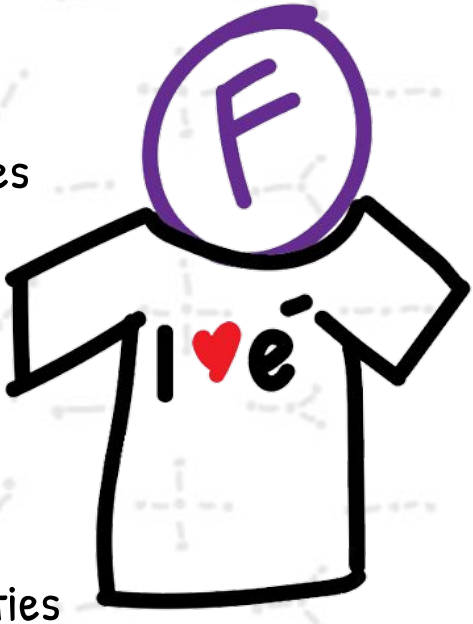
Electronegativity is the ability to attract electrons,

It plays an important role in polarity,

Dipoles form when differences of electronegativity are detected,

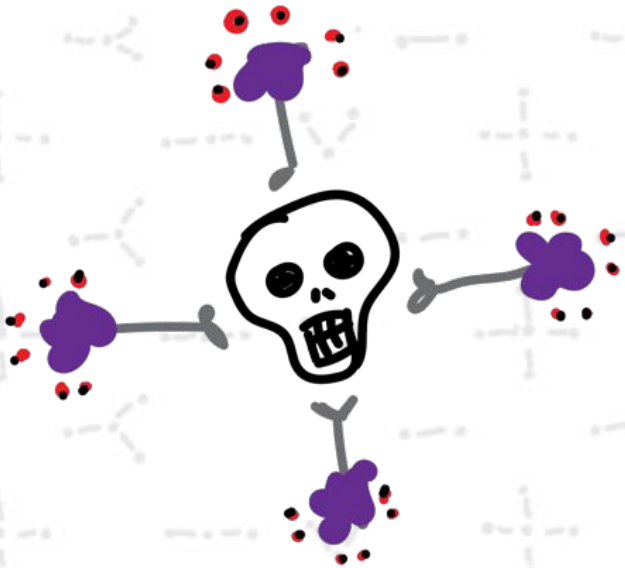
Increases as you go up and across (the periodic table),

Influencing chemical properties like gain or loss (of electrons).



bey the Rules

1. Add up the total eyeballs
2. Determine the skull
3. Draw the spooooky skeleton
4. Place lonely eyeballs in their pairs
5. Lone pairs can share into bones
6. Checkity check the octets!
7. Resonance structures might be near, check for them dear!



Polarity

Polar, non-polar, what's the difference?

Partial charges and electronegativity are what you should look at,

Molecular geometry also plays a part,

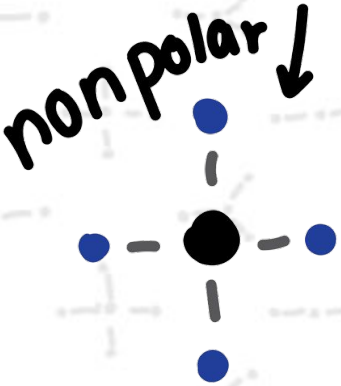
For even structures tend to be non-polar (tetrahedral).

Lone pairs signal a polar molecule (Like H2O),

Don't forget,

Hydrocarbon chains are ALWAYS non-polar,

Or you'll be ridiculed!

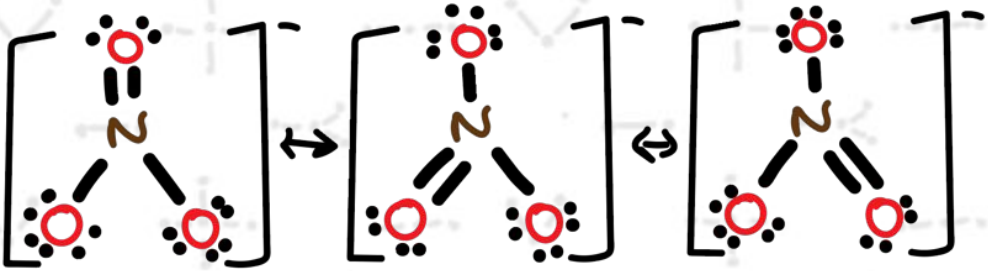


Quiz Time

Pop Quiz!

Win a sweet treat to eat or wail if you fail.

3 is a clue, we want you to draw NO3-



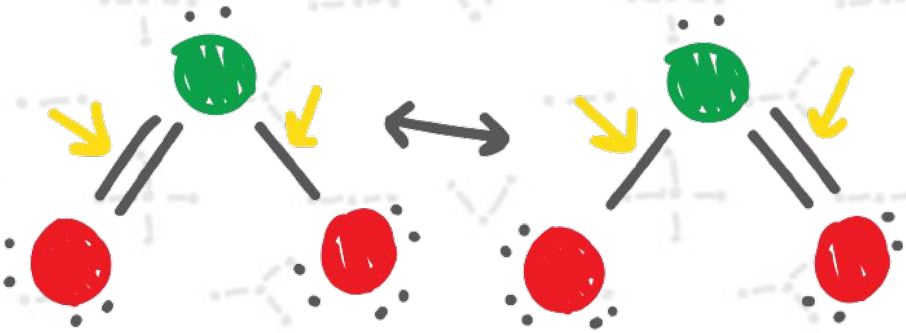
Resonance Structures

Special enough to need two (or more)
Lewis structures,

Bonds can happen in more than one
possible place.

Delocalization of electrons is the cause,

Forming other possible bonds just
because!



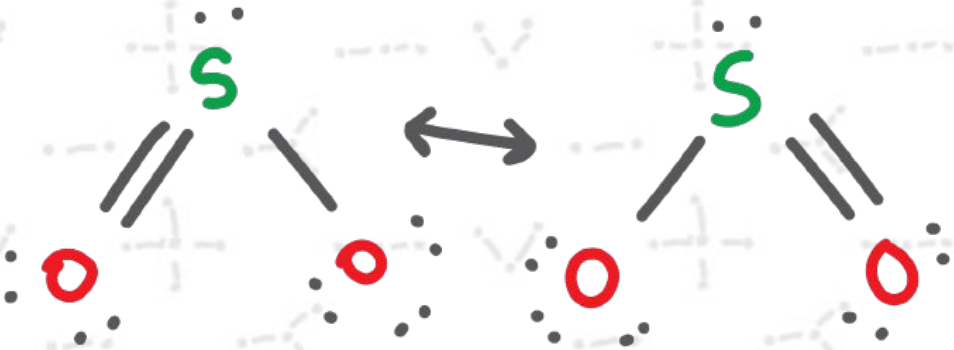
O_2

Sulfur dioxide is an example,

Where one Lewis structure does not suffice,

Instead two are needed to show the possible bonds,

In order to be the most precise



Trigonal Planar

Trigonal planar is a great example,

Of a type of bonded molecule,

Where bonding regions are ample.

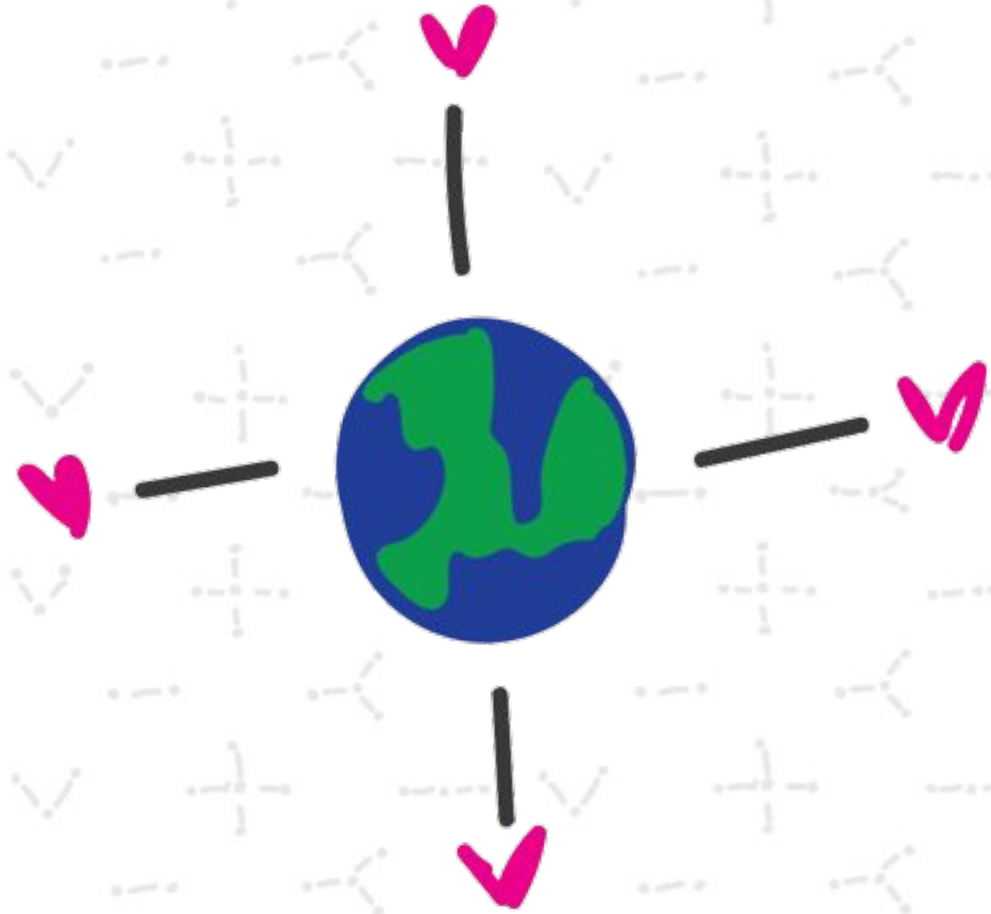
Three bonding regions and zero lone pairs,

Can be polar or nonpolar,

Depending on its affairs!

U R a Carbon Atom

Cuz you are the center of my world ;)



SEPR

VSEPR, or

Valence
Shell
Electron
Pair
Repulsion

Keeps non-bonded electrons apart,
preventing any mess,

Forms molecules with precise angles, very neat,

Determines geometry, making it easy to complete.

Weakest Force: LDF

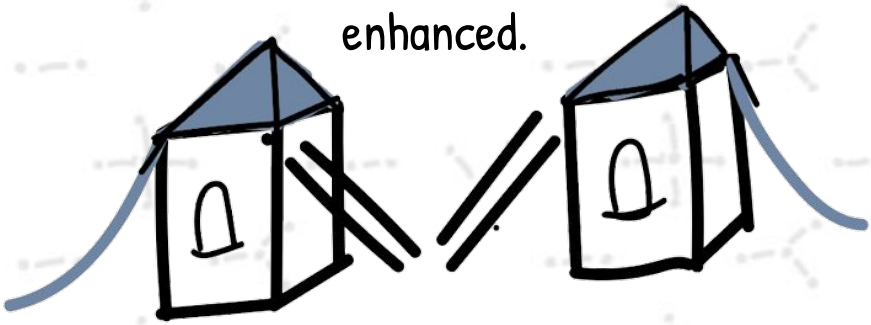
The London-Dispersion force is falling down,

It is the only force non-polar molecules can cross, the weakest

All molecules experience LDF

With more electrons in a molecule, LDFs will be advanced,

Stronger LDFs lead to boiling points enhanced.



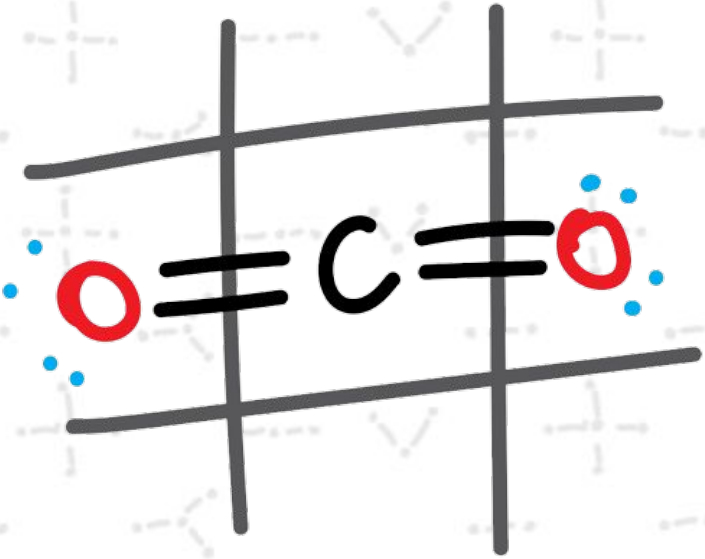
OXO

tic tac toe,

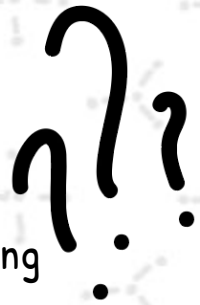
Here we have three in a row,

CO2 is OCO,

Linear is the way to go



Do We Need to Know This?



Why is this even important?

You might be asking,

The 3 states of matter can't be sent packing

Molecular geometry gotta be 3D

Gotta arrange or they'll be deranged

Molecular geometry is more important than you realize,

Melting point and boiling point is used in everyday life,

Through molecular geometry the properties are revealed,

Of many different molecules that were previously concealed!

Negative and positive poles,

Are used to determine chemical reaction roles!

Zero Lone Pairs

A lonely central atom without any friends,

Polar or nonpolar, it usually depends.

Lone pairs guarantee polarity,

And molecules with zero lone pairs aren't a rarity!

Linear, trigonal planar and tetrahedral,

Are just some that exist,

Listing all of them would be pointless,

For you get the gist!

ABOUT

The Authors

Anushree, Jessie, and Hetanshi are sophomores in high school who originally wrote this book as a project for their chemistry class. They enjoy baking many delicious treats together (or rather, they think they would enjoy it).This is their first ever children's book, but they are sure there will be more opportunities down the road for more collaborative projects.


THE
END