

Lewis Dots + Bonding

Interpreting Chemical Formulas

Do Now: Label next 2 pages in ISN Lewis Dots and Bonding

Answer the following questions on your LEFT side page

1. What does the atomic number tell us?
2. How do we know how many electrons an atom has?
3. Where are valence electrons located?
4. What are the two ways we can use to determine the number of valence electrons?

Let's hear from Tyler DeWitt

- <https://www.youtube.com/watch?v=Qf07-8Jhhpc>
- <https://www.youtube.com/watch?v=5EwmedLuRmw>

Chemical bonds form when atoms give up, take or share electrons.

- A *covalent bond* is formed only when atoms share electrons.
- An *ionic bond* forms when electrons are transferred from one atom to another.

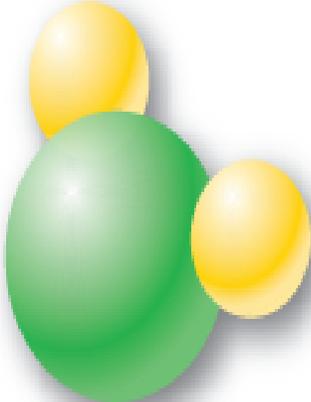
What is a molecule and an ion?

- A molecule is a group of atoms bonded together making a chemical compound
- An ion is an atom that has lost or gained an electron giving it a positive or negative charge.

Chemical formulas

- A molecule's *chemical formula* tells you the ratio of atoms of each element in the compound.

Reading a chemical formula



Water molecule

Element symbol indicates hydrogen — **H** — Element symbol indicates oxygen

Subscript means there are 2 hydrogen atoms in each molecule

No subscript means there is one oxygen atom in each molecule

Ratio of 2 hydrogen atoms to 1 oxygen atom in the compound

H₂O

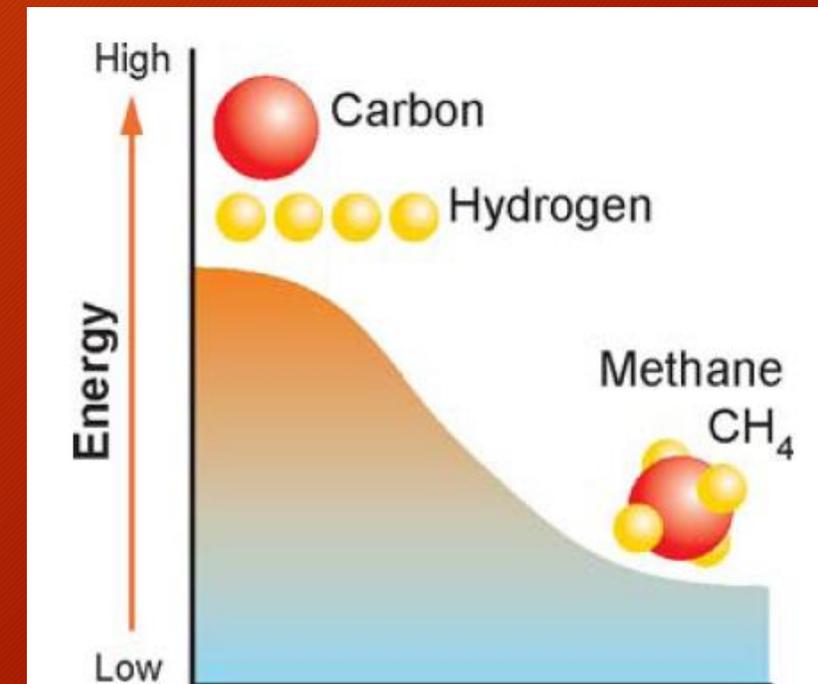
The diagram shows a ball-and-stick model of a water molecule on the left, consisting of one large green sphere (oxygen) and two smaller yellow spheres (hydrogen). To the right is the chemical formula H₂O. Lines connect the text labels to the corresponding parts of the formula: 'Element symbol indicates hydrogen' points to the 'H', 'Subscript means there are 2 hydrogen atoms in each molecule' points to the '2', 'Element symbol indicates oxygen' points to the 'O', and 'No subscript means there is one oxygen atom in each molecule' points to the 'O'.

Let's Practice Ratios

1. CCl_4
2. HCl
3. NH_3
4. CH_2Cl_2
5. HOCl

Why chemical bonds form

- It takes energy to separate atoms that are bonded together.
- The same energy is released when chemical bonds form.
- Atoms form bonds to reach a lower energy state.



Reactivity

- *Reactive* means an element readily forms chemical bonds, often releasing energy.
- Some elements are more reactive than others.
- The closer an element is to having the same number of electrons as a noble gas, the more reactive the element is.

Periodic Table and Reactivity

← Electrons away from noble gas →

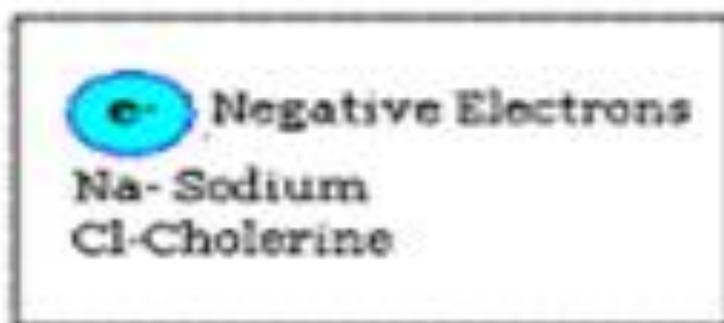
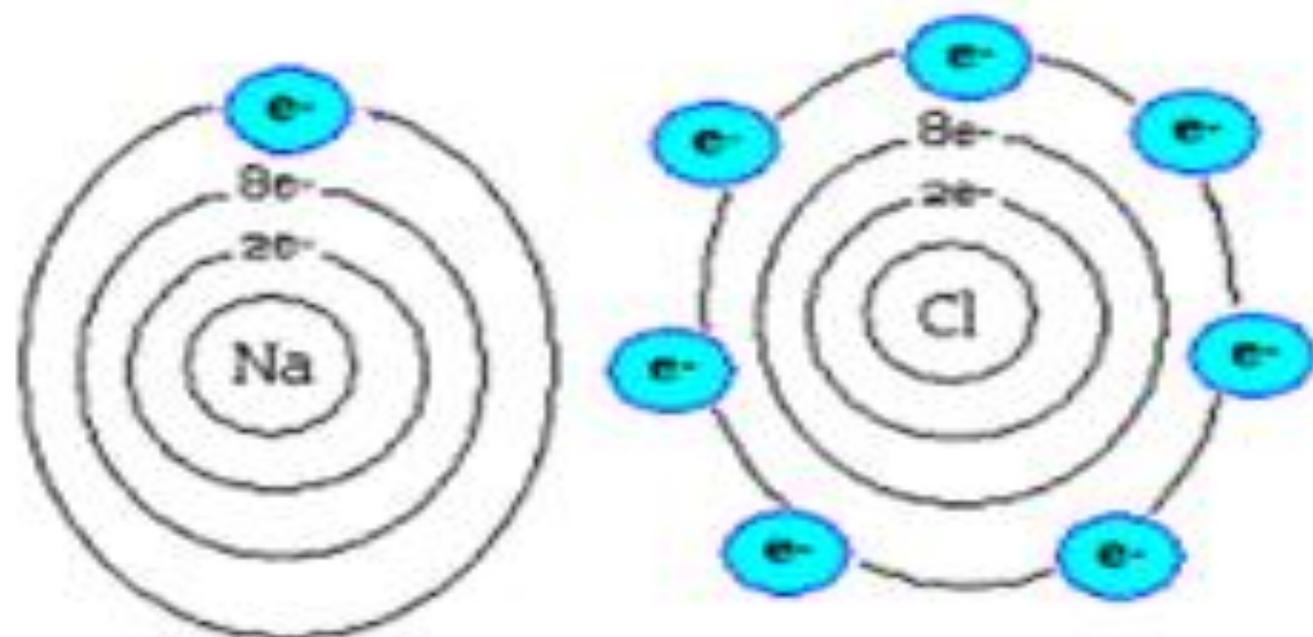
1	2													3	2	1			
H 1	↓																He 2		
Li 3	Be 4													B 5	C 6	N 7	O 8	F 9	Ne 10
Na 11	Mg 12													Al 13	Si 14	P 15	S 16	Cl 17	Ar 18
K 19	Ca 20	Sc 21	Ti 22	V 23	Cr 24	Mn 25	Fe 26	Co 27	Ni 28	Cu 29	Zn 30	Ga 31	Ge 32	As 33	Se 34	Br 35		Kr 36	
Rb 37	Sr 38	Y 39	Zr 40	Nb 41	Mo 42	Tc 43	Ru 44	Rh 45	Pd 46	Ag 47	Cd 48	In 49	Sn 50	Sb 51	Te 52	I 53		Xe 54	

Not reactive
 Moderately reactive
 Very reactive

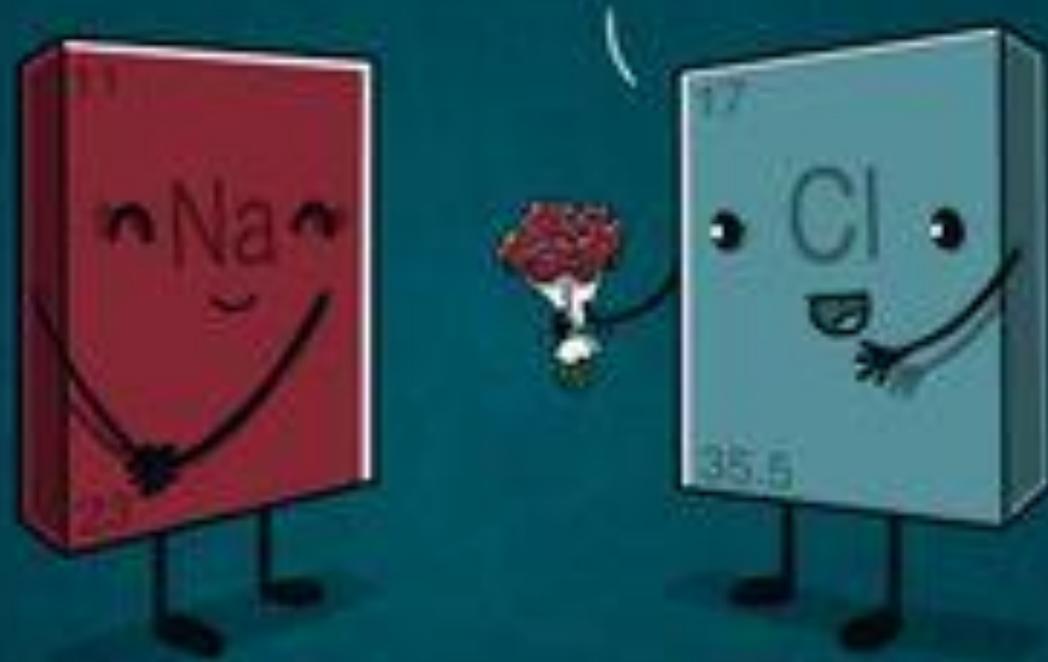
Ionic Bonding

- Electrons are transferred between valence shells of atoms
- Ionic compounds are made of ions and not molecules
- Always forms between metals and non-metals

Ionic Bond



What did the chlorine atom say to the sodium atom? You complete me....



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Covalent Bonds

- Electrons are shared between non-metal atoms

A COVALENT BOND YELLS
AT AN IONIC BOND:



DIDN'T ANYBODY EVER
TEACH YOU TO SHARE?

Let's think about some elements and the types of bonds they form

- Oxygen
 - Hydrogen
 - Chlorine
- How many valence electrons do each of these have?
 - Are these elements more likely to share, give up or take?

Drawing ionic compounds using Lewis Dot Structures

This is the finished Lewis Dot Structure



How did we get here?



- Step 1
 - Determine which atom will be the $+$ ion
 - Determine which atom will be the $-$ ion
- Step 2
 - Write the symbol for the $+$ ion first.
 - NO DOTS
 - Draw the Lewis dot diagram for the $-$ ion
 - COMPLETE outer shell
- Step 3
 - Enclose both in brackets and show each charge

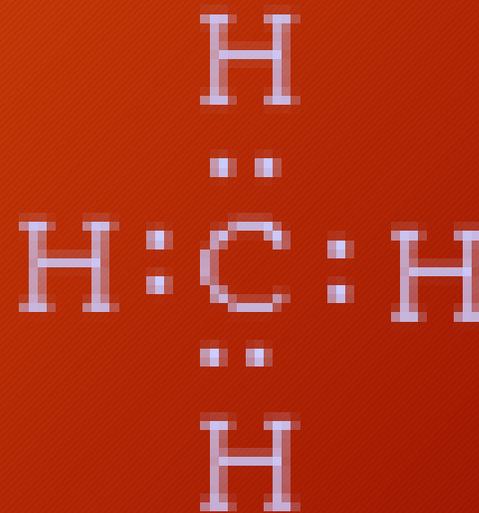
Draw the Lewis Diagrams

- LiF
- MgO
- CaCl₂
- K₂S

Drawing *molecules* using Lewis Dot Structures

Methane CH₄

This is the finished Lewis dot
structure



Step 1

count total valence electrons involved

Step 2

connect the central atom (usually the first in the formula) to the others with single bonds

Step 3

complete valence shells of outer atoms

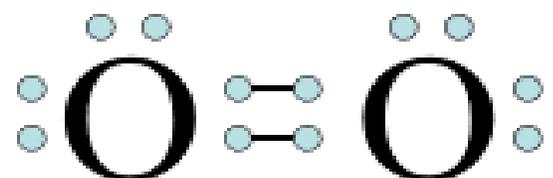
Step 4

add any extra electrons to central atom

IF the central atom has 8 valence electrons surrounding it . . . YOU'RE DONE!

- **DOUBLE bond**

- atoms that share two electron pairs (4 e-)



- **TRIPLE bond**

- atoms that share three electron pairs (6 e-)

