Example:

Lewis structures for two H's and one O:

Hydrogen is an exception to the octet rule. It only needs \_\_\_\_\_ electrons to be stable.

How could you put these atoms together so that the oxygen has 8 electrons and the two hydrogens have 2 electrons?

\*\*Every time there is a single electron on a side, it must be joined with a single electron on another atom to form a bond.

Example:

Lewis structures for the atoms:

How could you put these atoms together so that they are all stable?

What is wrong with these structures?

What about these?

Are these OK?

\*\*As long as the same atoms are connected, and the same electrons are around each atom, it is the same molecule.

## Other compounds with hydrogen

If nitrogen forms a compound with hydrogen, what formula will it have?

Lewis structure for nitrogen:

How many H's will be needed?

Draw a Lewis structure for the compound:

formula:

If carbon forms a compound with hydrogen, what formula will it have?

Lewis structure for carbon:

How many H's will be needed?

Draw a Lewis structure for the compound:

formula:

What about chlorine?

Lewis structure for chlorine:

How many H's will be needed?

Draw a Lewis structure for the compound:

formula:

Why are some formulas written with the H's last, and others first?

What is the relationship between the number of valence electrons and the number of bonds that an atom can form?

	valence electrons	Lewis structure	bonds formed
hydrogen		H•	
carbon family		• Ç•	
nitrogen family		• N•	
oxygen family		•0•	
halogens		: F•	
noble gases		Ne	

\*\*For every electron that an atom is short:

## Multiple bonds

Example:

formula:

Lewis structure for hydrogen atom:

Two atoms joined together:

Lewis structure for H<sub>2</sub>:

Number of bonds between atoms:

Example:

formula:

Lewis structure for two oxygen atoms:

Lewis structure for the molecule:

Number of bonds shared between atoms: Example:

formula:

Lewis structure for two nitrogen atoms:

Lewis structure for the molecule:

Number of bonds shared between atoms:

Is it possible to have four bonds between two atoms?

Why does carbon form complex molecules like diamond and graphite?

Which atoms can have double bonds? H C N O F

Which atoms can have triple bonds? H C N O F

H•	1 bond	
: F •	1 bond	
• • •	2 bonds	
• • •	3 bonds	
٠Ċ٠	4 bonds	

## 3 – New molecules

In the examples above, which of the molecules are you already familiar with?

 $F_2 \quad H_2O \quad H_2O_2 \quad NH_3 \quad CH_4 \quad HCl \quad H_2 \quad O_2 \quad N_2$ 

What about the others?

NH<sub>3</sub>:

CH<sub>4</sub>:

N<sub>2</sub>:

Try your hand at creating Lewis structures for the following molecules:

methanol CH<sub>4</sub>O

description:

Lewis structure of atoms:

Lewis structure of molecule: formaldehyde CH<sub>2</sub>O

description:

Lewis structure of atoms:

Lewis structure of molecule:

Why does formaldehyde have a double bond, but methanol does not?

Draw a Lewis structure for each of the following formulas:

ethane: C<sub>2</sub>H<sub>6</sub>

ethylene: C<sub>2</sub>H<sub>4</sub>

acetylene: C<sub>2</sub>H<sub>2</sub>

Where are these compounds found?

ethane:

ethylene:

acetylene:

Propane C<sub>3</sub>H<sub>8</sub>

Lewis structure of atoms: Lewis structure of molecule:

description:

Butane C<sub>4</sub>H<sub>10</sub>

Lewis structure of atoms:

Lewis structure of molecule:

description:

There is actually more than one compound with the formula  $C_4H_{10}$ . Can you think of another way to put these atoms together?

This compound is called:

boiling point of butane:

boiling point of isobutane:

When there are two different molecules that have the same formula, these compounds are called:

There are two isomers with the formula C<sub>2</sub>H<sub>6</sub>O. Can you draw them both?

How many isomers does isopropyl alcohol have?



What about ethylene glycol?



The more atoms you get, the larger the number of possible isomers!

What patterns do you see here?

methanol	н н-с-о-н н	
ethanol	н-с-с-ю-н н Н	
ethylene glycol	н-:с-:-н	
isopropyl alcohol	н н :0: н н-с-с-с-н н н н	

Patterns like this are called:

Another common functional group is the carboxylic acid.

Find the common pattern in these two examples:



Compounds with one carbon start with: Compounds with two carbons start with: Compounds with three carbons contain: Compounds with four carbon contain: