High School Science Virtual Learning

Chemistry

Covalent Bonds

May 21st, 2020

Chemistry

Lesson: May 21st 2020

Objective/Learning Target:

The learner will be able to identify how covalent bonds form.

Bell Ringer

1. What is the name of this compound...NaF?

2. What is the formula for Nickel (II) Oxide??

Bell Ringer Answers:

1. Sodium Fluoride

2. NiO

Instead of electrons being transferred, like they are in ionic bonds, in a covalent bond, electrons are shared between the atoms.

A molecule is a neutral group of atoms joined by covalent bond.

Think water molecule (H_2O)

A diatomic molecule is a molecule consisting of two atoms.

Think oxygen Gas (O_2), Hydrogen Gas (H_2), and Chlorine Gas (Cl_2)

A compound composed of molecules is called a molecular compound

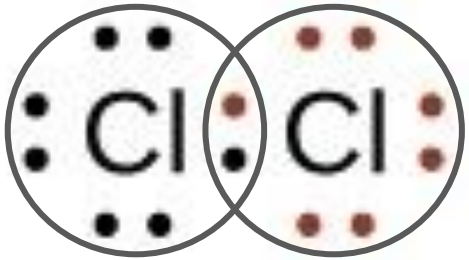
Molecular compounds tend to have relatively lower melting and boiling points than ionic compounds. This causes them to be liquids or gasses at room temperature.

Most molecular compounds are composed of atoms of two or more nonmetals.

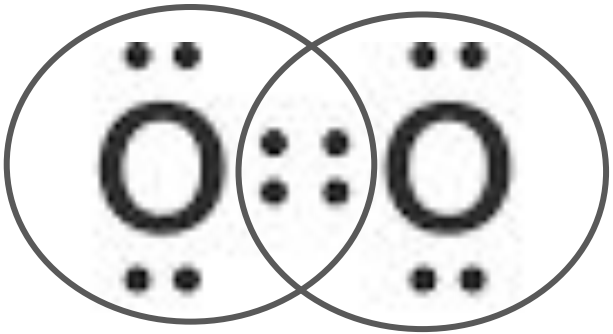
The molecular formula is the chemical formula of a molecular compound and shows how many atoms of each element a molecule contains.

In forming covalent bonds, electron sharing usually occurs so that atoms attain the electron configuration of noble gases. (2 valence electrons around the nucleus...except for Helium)

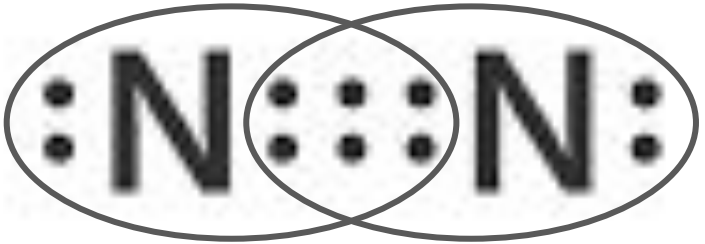
In a single covalent bond, the two atoms are held together by sharing a single pair (2 total) electrons.



In a double covalent bond there are two pairs of (4 total) shared electrons.

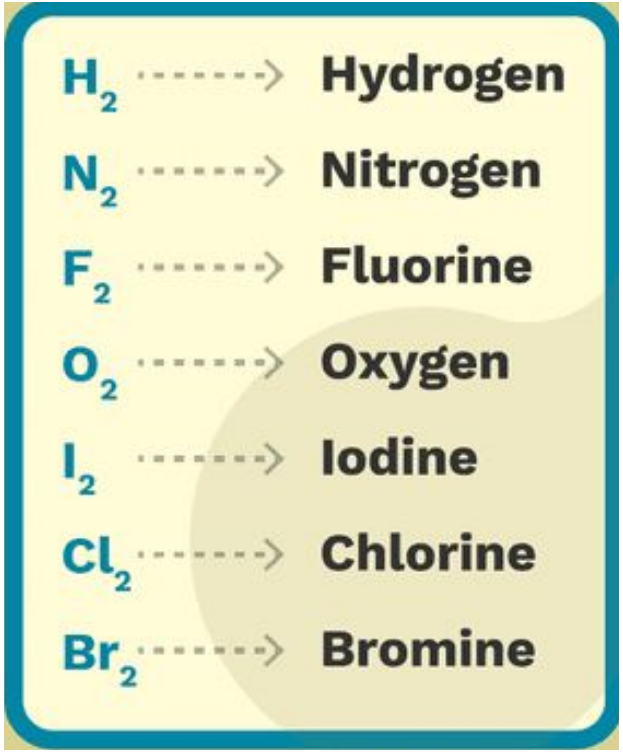


In a triple covalent bond there are three pairs of (6 total) shared electrons.



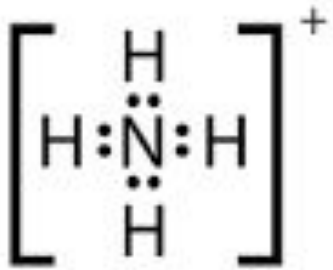
Special Covalent Bonding Situations:

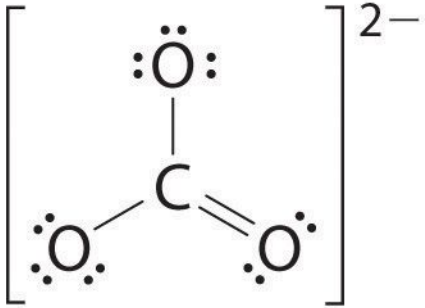
We already talked about diatomic molecules, but there are seven (7) elements that exist as diatomics.



Special Covalent Bonding Situations:

Polyatomic ions are tightly bound groups of atoms that have a positive or negative charge and behaves as a unit





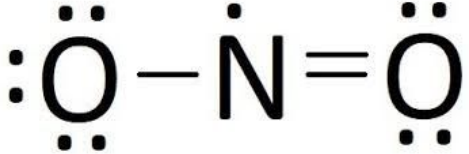
Common Polyatomic Ions

Ion	Name
Hg_2^{2+}	mercury (I)
NH_4^+	ammonium
NO_2^-	nitrite
NO_3^-	nitrate
SO_3^{2-}	sulfite
SO_4^{2-}	sulfate
HSO_4^-	hydrogen sulfate (bisulfate)
OH^-	hydroxide
CN^-	cyanide
PO_4^{3-}	phosphate
HPO_4^{2-}	hydrogen phosphate
$H_2PO_4^-$	dihydrogen phosphate

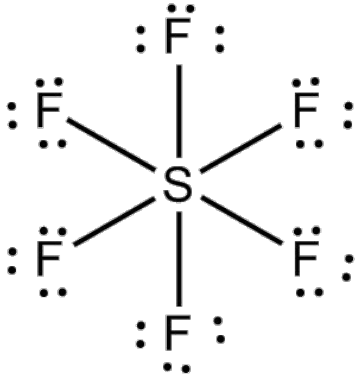
Ion	Name
NCS^-	thiocyanate
CO_3^{2-}	carbonate
HCO_3^-	Hydrogen carbonate (bicarbonate)
ClO^-	hypochlorite
ClO_2^-	chlorite
ClO_3^-	chlorate
ClO_4^-	perchlorate
$C_2H_3O_2^-$	acetate
MnO_4^-	permanganate
$Cr_2O_7^{2-}$	dichromate
CrO_4^{2-}	chromate
O_2^{2-}	peroxide
$C_2O_4^{2-}$	oxalate

Exceptions to the Octet Rule:

The octet rule cannot be satisfied in molecules whose total number of valence electrons is an odd number. There are also molecules in which an atom has fewer, or more, than a complete octet of valence electrons.



In nitrogen dioxide, the nitrogen has 7 valence electrons



In sulfur hexafluoride, the sulfur has 12 valence electrons

For information about the differences between ionic and covalent bonds, watch this video from Tyler DeWitt.

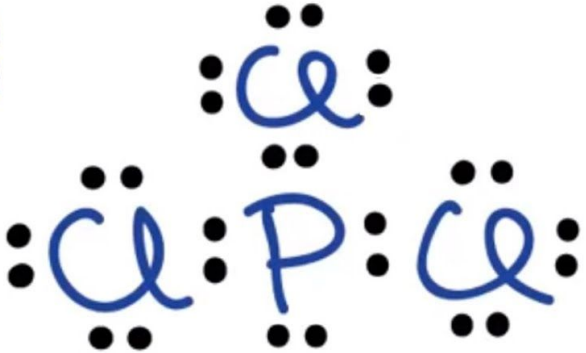
For more information about covalent bonding watch this video from Crash Chemistry Academy.

Questions

1. How are covalent bonds different than ionic bonds?

2. Give the formula for the following structures.

A



B

Questions

3. Draw the electron dot structures for the following molecules, which have only single covalent bonds.

a. H_2S

b. PH_3

c. ClF

Answers

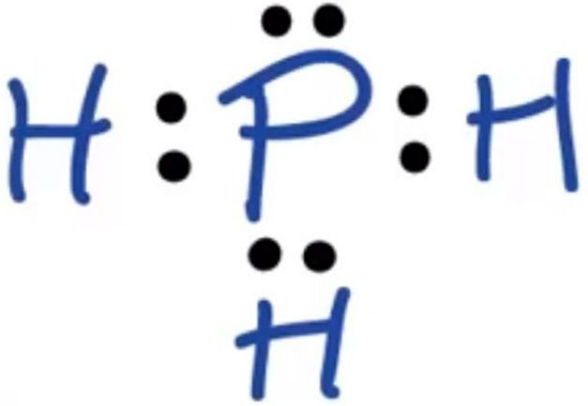
1. Ionic bonds deal with a transfer of electrons from one atom to the other and those atoms are then held together by an electrical charge. Covalent bonds are where atoms share electrons and it is that sharing that holds the atoms together.

2. a. H_2O_2 b. PCl_3

Answers

3. a. H_2S

b. PH_3



c. ClF

More practice:

Work your way through this simulation from PBS about covalent bonding.

Try this practice worksheet. Do not worry about the shape of the molecule part. Check your answers here.

Practice with this Quizizz.