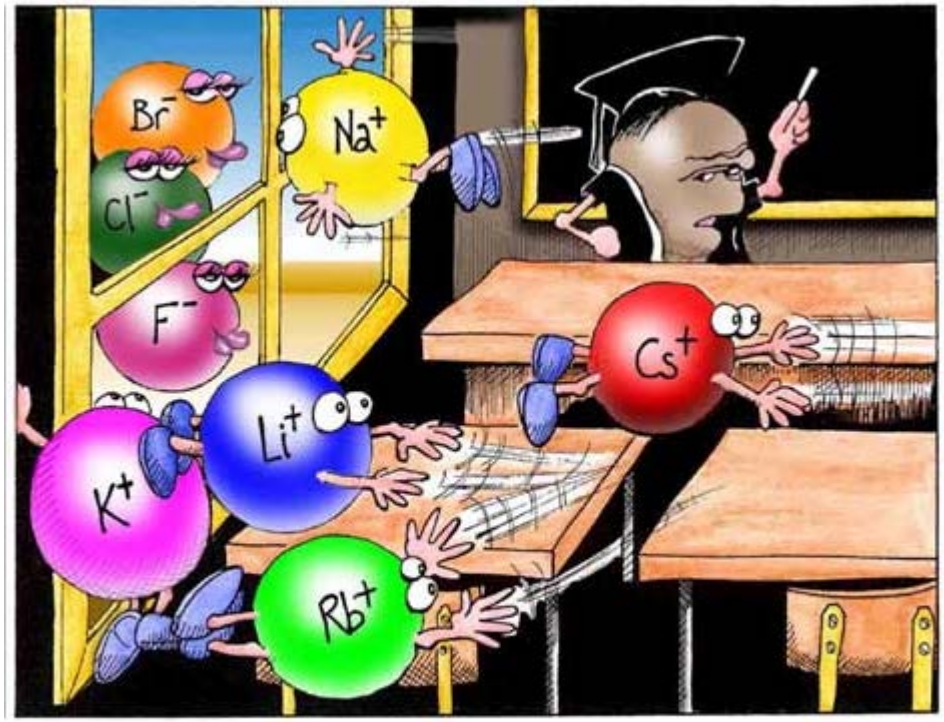
How do Elements Combine???



"Perhaps one of you gentlemen would mind telling me just what it is outside the window that you find so attractive...?"

S2-2-02 Explain, using the periodic table, how and why elements combine in specific ratios to form compounds. *Include: ionic bonds, covalent bonds.*

Lewis dot diagrams…

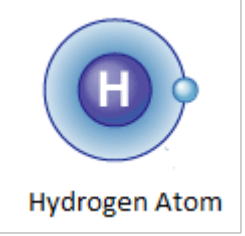
NaCl

We must be able to differentiate between the following terms:

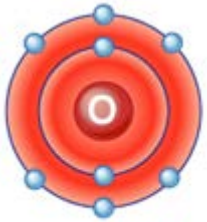
Atom:

- Smallest **UNIT** of an **ELEMENT**.
- Made of **PROTONS**, **ELECTRONS** and **NEUTRONS**

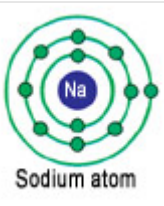
Examples:



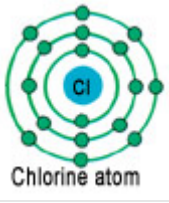
Hydrogen Atom



Oxygen Atom



Sodium atom



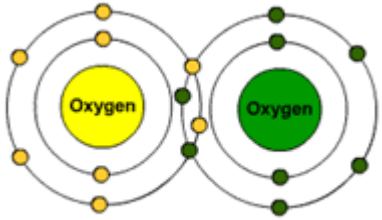
Chlorine atom

Element

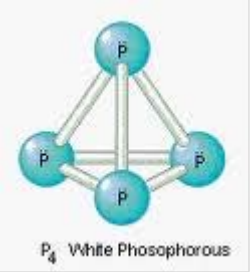
- A **PURE SUBSTANCE** made of **IDENTICAL ATOMS**.
- Cannot be **BROKEN DOWN** into **DIFFERENT KINDS** of atoms.
- Elements are made of atoms

Examples:

Hydrogen Atom



Oxygen Gas

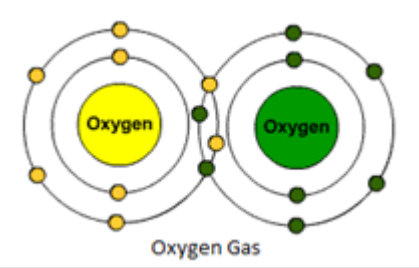

P_4 White Phosphorous

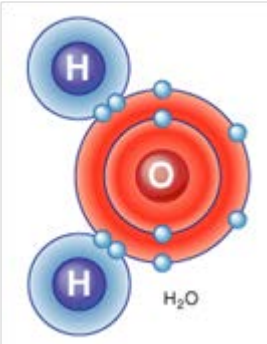
A bit of review…

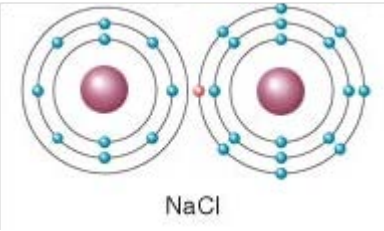
Molecule/Compound

- Is a **PURE SUBSTANCE** made of a **CLUSTER** of atoms of **SIMILAR** or **DIFFERENT ELEMENTS**.
- Can be **BROKEN DOWN** into those **ATOMS** during a **CHEMICAL CHANGE**.

Examples:







Note:

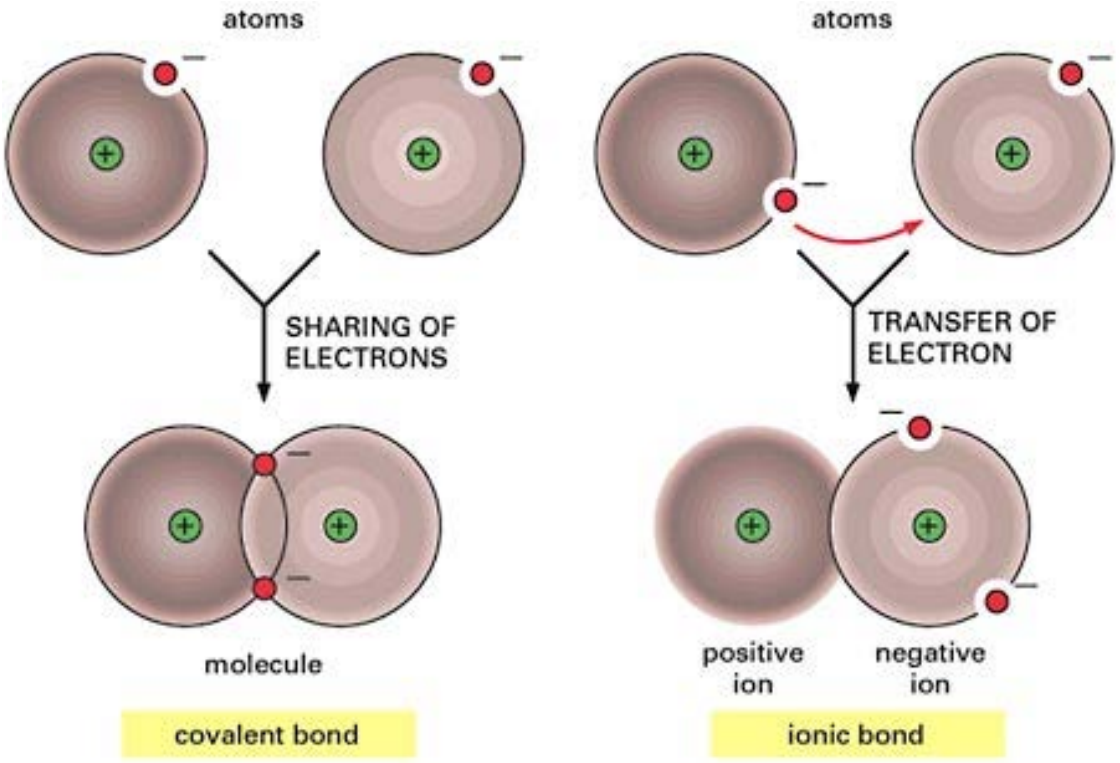
The terms **MOLECULE** and **COMPOUND** refer to the **TYPE** of **BOND**…

Bonding…

Crash Course - Bonding

Elements combine to form compounds one of two ways:

- **TRANSFERRING (EXCHANGING) ELECTRONS**
- **SHARING ELECTRONS**



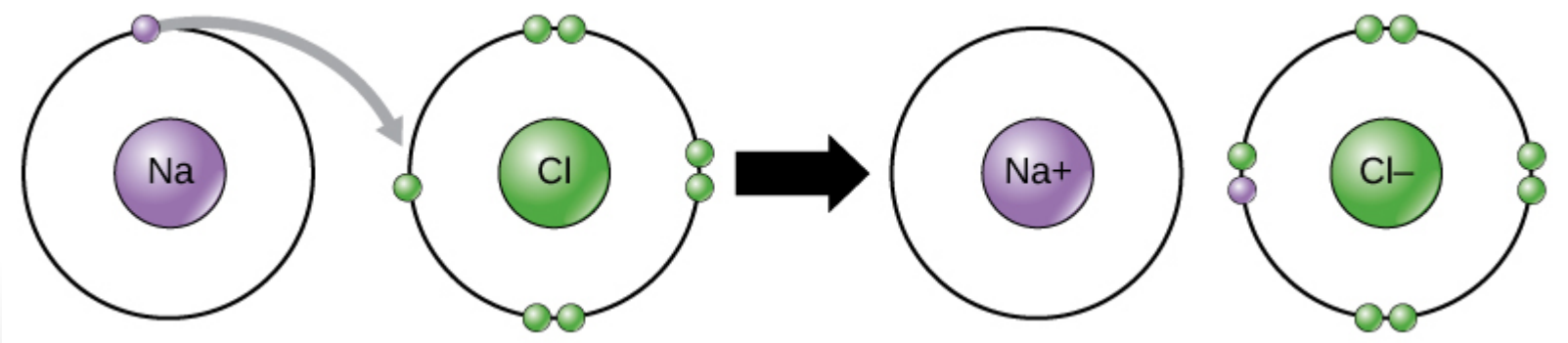
Ionic Bonds – Transferring Electrons

- Is the result of the **FORCE** of **ATTRACTION** between a **POSITIVE** and **NEGATIVE** ion (like **STATIC CLING**)
  - **METALS** really want to **LOSE** electrons →become **POSITIVE**
  - **NON-METALS** really want to **GAIN** electrons →become **NEGATIVE**.

- These **POSITIVE** and **NEGATIVE** ions are **ATTRACTED** to each other, and result in a chemical **BOND**

- Because **METALS** form **POSITIVE** ions, and **NON-METALS** form **NEGATIVE** ions, we can say:

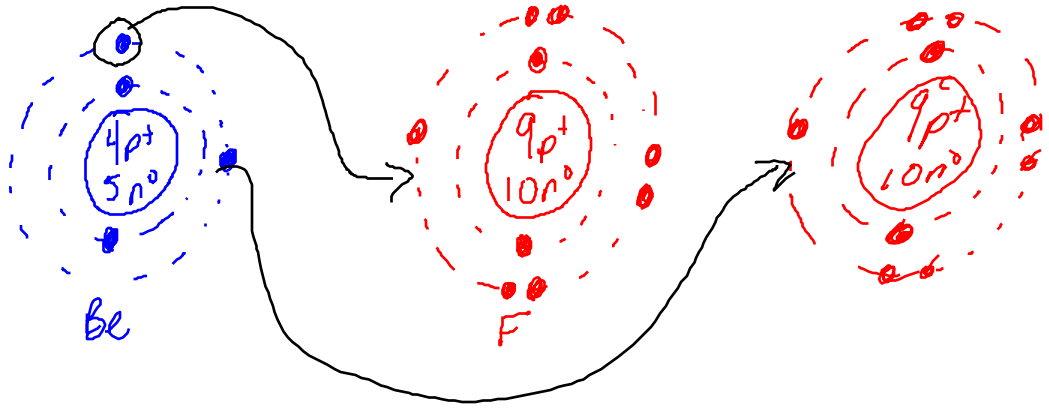
Ionic bonds are bonds between metals and non-metals!!!



Drawing Ionic Bonds

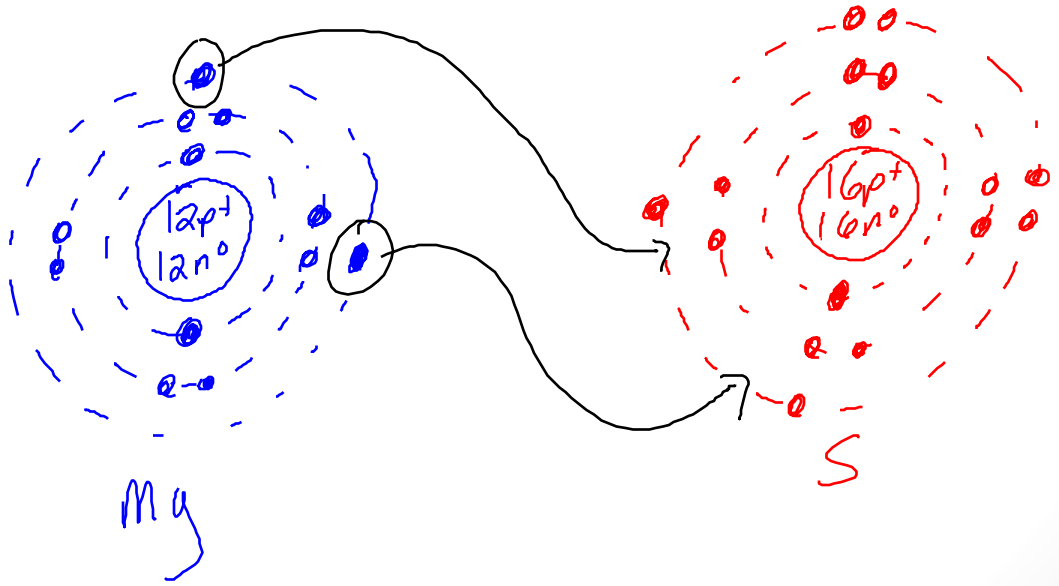
Examples of ionic bonds using Bohr diagrams:

~~CaF_2~~ BeF_2



MgS

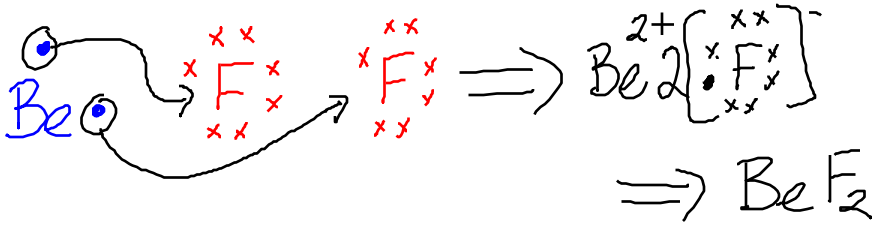
~~MgS_2~~



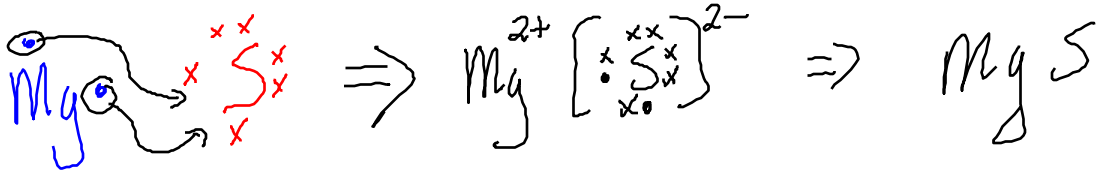
Drawing Ionic Bonds

Examples of ionic bonds using Lewis diagrams:

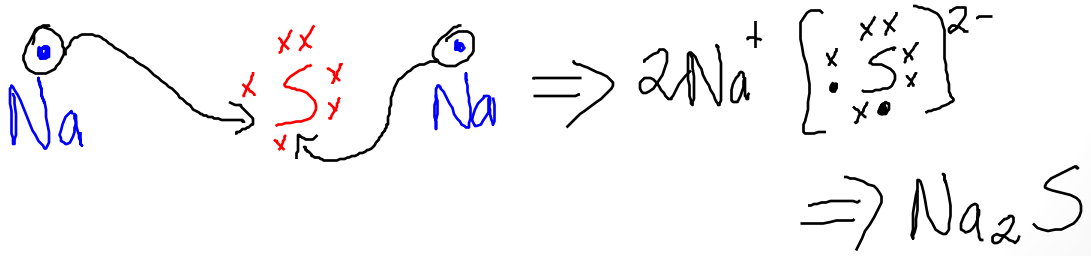
BeF_2



MgS



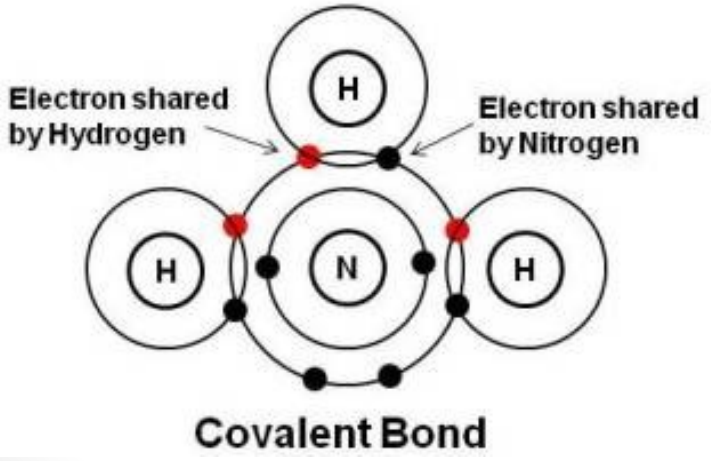
Na_2S



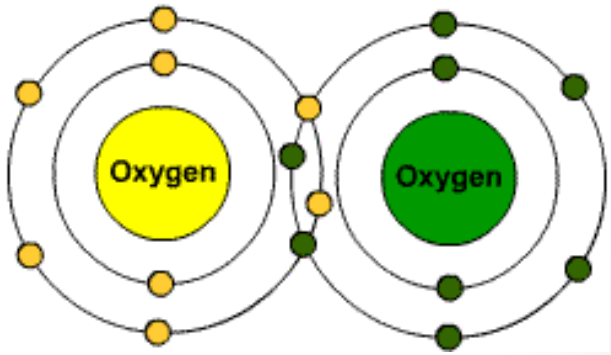
Covalent Bonds: Sharing Electrons

- Remember that **NON**-**METALS** really want to **GAIN** electrons.
- When **TWO** **NON**-**METALS** get together, they get into a "**TUG-OF-WAR**" for electrons. No one wins (they are similar in **STRENGTH**), so they end up **SHARING**.
- When electrons are **SHARED** between **TWO** **NON**-**METAL** atoms, a **COVALENT** **BOND** forms.

Covalent Bonds are bonds between two non-metals!!!



Covalent Bond



Comparing Covalent & Ionic

Covalent	Ionic
Bond between 2 non metals	Bond between a metal and a non-metal
Sharing electrons	Transferring electrons
No charges	Contain ions (charged atoms)
Called molecules	Called compounds

Rule of thumb…

Hydrogen can act as both a **NON-METAL (GAIN)** and a **METAL (LOSE)**, which creates some issues. Here`s how we will deal with hydrogen:

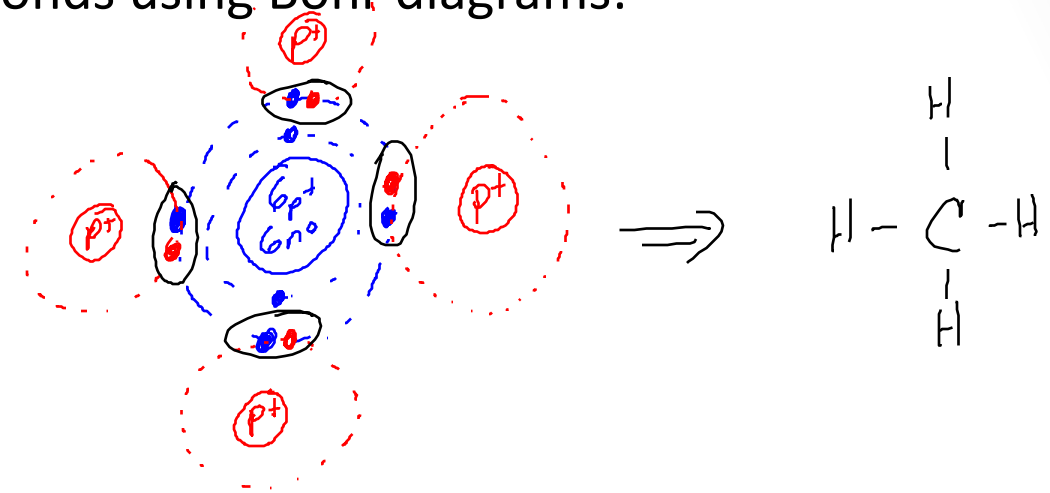
Compounds that contain Hydrogen will be considered **IONIC** – except **WATER**.

- If hydrogen is written **FIRST** (**HCl**) it's a **METAL**
- If hydrogen is written **SECOND** (**MgH_2**), it's a **NON-METAL**

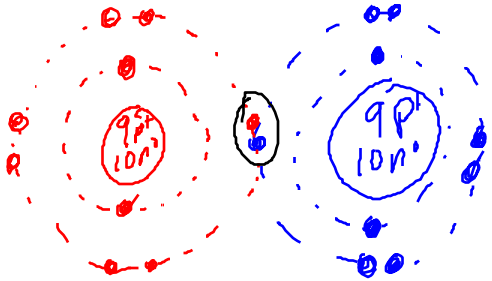
Drawing Covalent Bonds

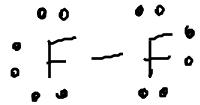
Examples of covalent bonds using Bohr diagrams:

CH_4

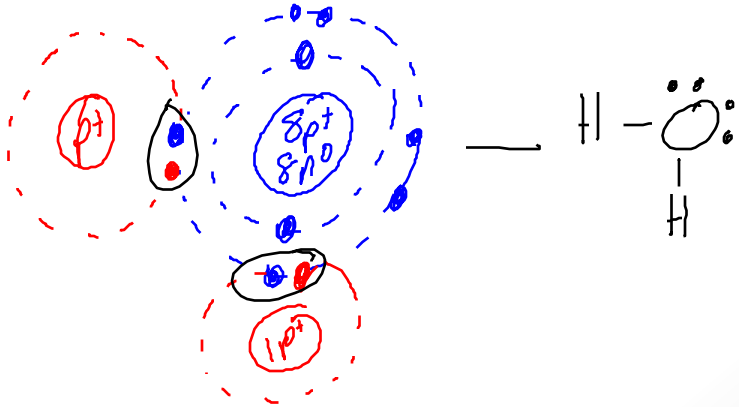


F_2





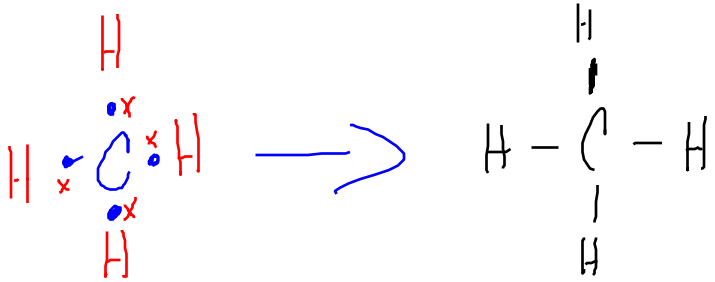
H_2O



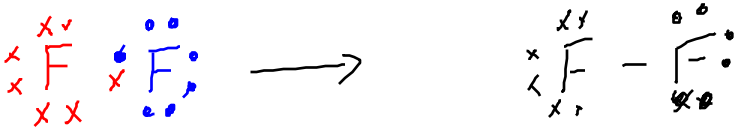
Drawing Covalent Bonds

Examples of covalent bonds using Lewis dot diagrams:

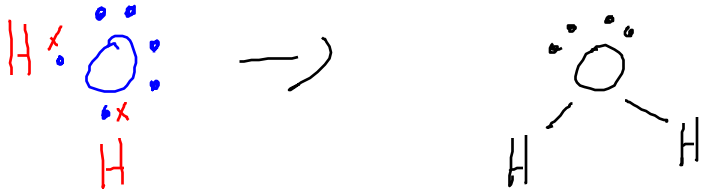
CH_4



F_2



H_2O



Try these ones…

Identify the compound as Ionic or covalent, then draw the bonding using Lewis dot diagrams:

SrF_2

PCl_3