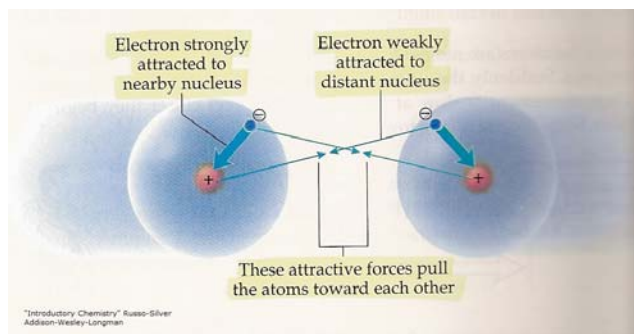


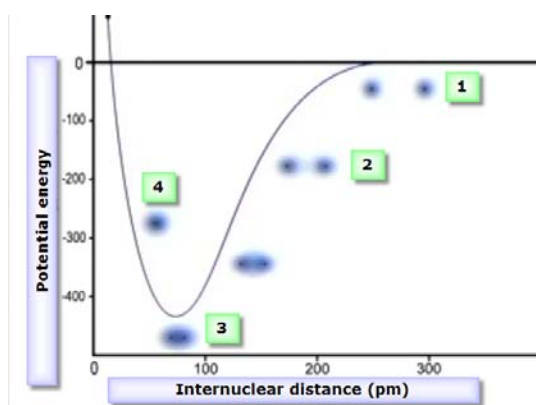
| | |
|--|-------------------------|
| Topic: | Covalent Bonding |
| Objective: | FK_03_04 |
| Given two nonmetals | |
| the student must be capable of doing the following: | |
| <ul style="list-style-type: none"> • determine the bonds that are formed • describe the molecule formed using the Lewis notation | |

The Formation of a Covalent Bond

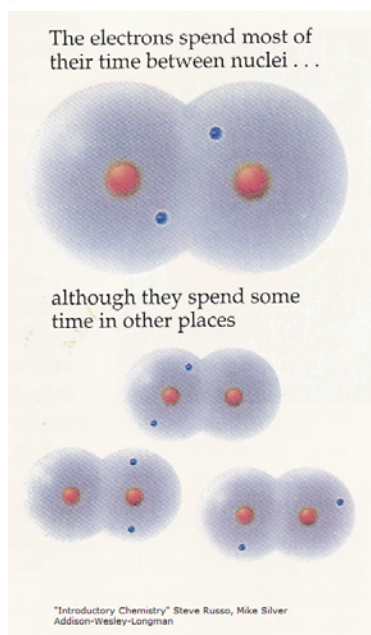
When two isolated H atoms approach each other they tend to form a H₂ molecule.



Covalent bond formation in H₂.



- At "1" the atoms are too far apart to attract each other
- At "2" each nucleus attracts the other atom's electron.
- At "3" the combination of nucleus-electron attraction and electron-electron and nucleus-nucleus repulsions gives the minimum energy of the system
- At "4" repulsions increase the system's energy and force the atoms apart to point "3" again



In a covalent bonding the electrons are shared between two nuclei (atoms).

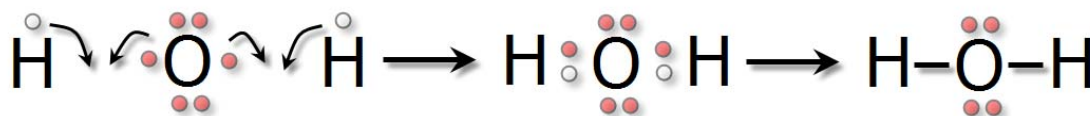
We can use the Lewis notation to describe the bonding in this way:



A shared pair of electrons can be represented by a line:

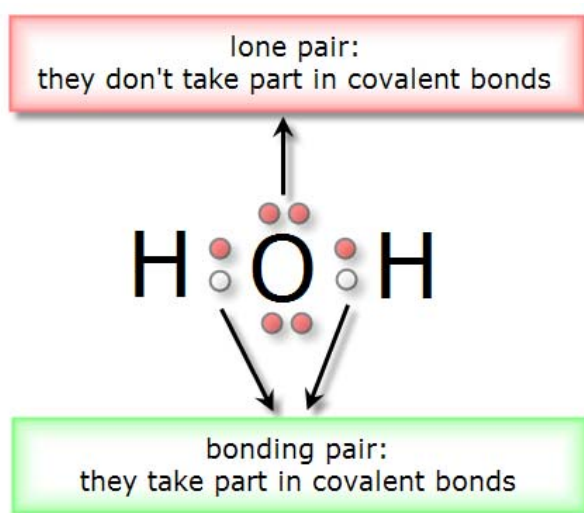


Oxygen and hydrogen can combine together, share electrons (covalent bonds) and form a molecule:

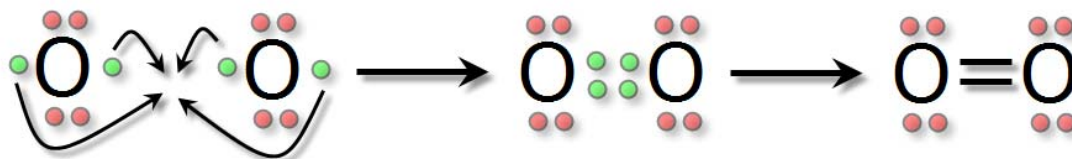


From this example, we can draw the following conclusions:

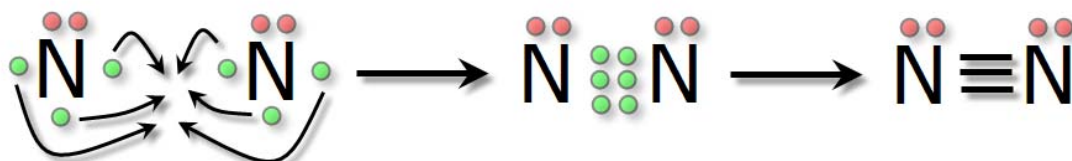
- Only outer level electrons take part in covalent bonds
- Only unpaired electrons (from this outer level) are shared and form covalent bonds
- In a molecule, we have two types of electrons: shared electrons and lone electrons (not shared):



A **double bond** consists of two bonding pairs, four electrons shared between two atoms:



A **triple bond** consists of three bonding pairs, six electrons shared between two atoms:

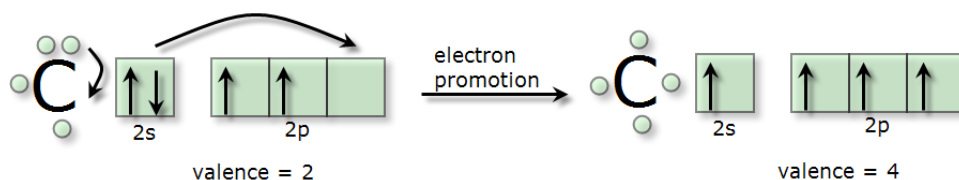


Covalent valence

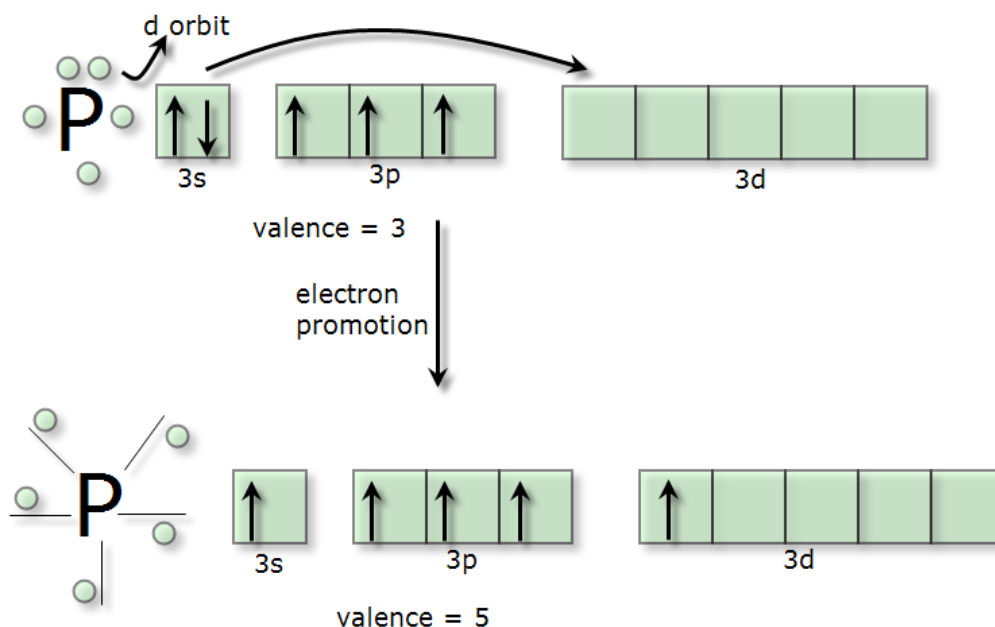
We will define "covalent valence" as the number of unpaired electrons an atom can have.

In order to have more unpaired electrons the outer electrons of an atom can have a promotion: they can jump from one orbit to another always at the same level (they can not jump from $n=2$ to $n=3$, for instance)

Covalent valences of carbon: 2, 4



Covalent valences of phosphorus: 3, 5

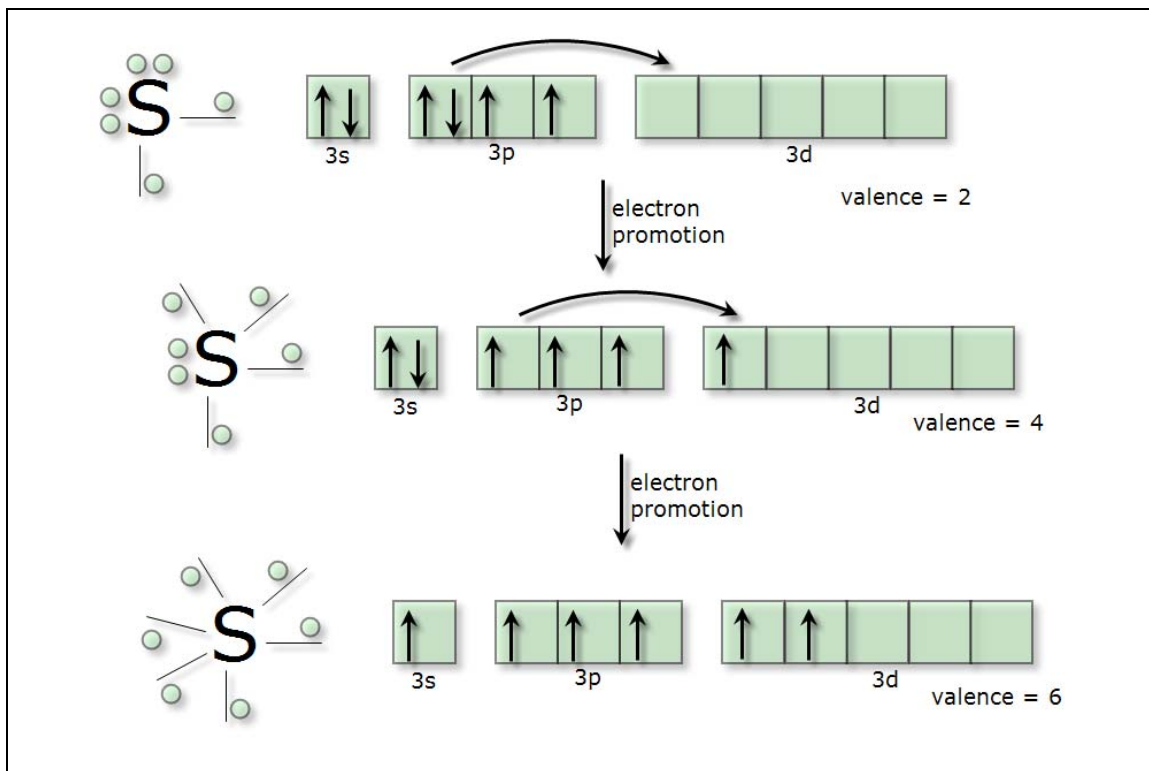


Diference between oxygen (valence 2) and sulphur (2, 4, 6)

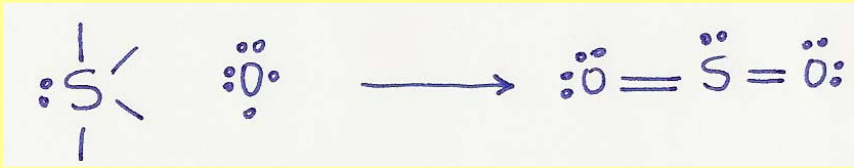
Oxygen can't promote more electrons, because there is no "2d" orbits:



But sulphur (which belongs to the same group) can promote its electrons:



| EXERCISE: Draw the following molecules, using the Lewis notation | |
|--|--|
| NH ₃ | |
| CO ₂ | |
| CH ₄ | |
| H ₂ S | |
| CO | |
| BF ₃ | |
| HCl | |

| | |
|--------------------------------|--|
| SO ₂ |  |
| SO ₃ | |
| PCl ₃ | |
| PCl ₅ | |
| SF ₆ | |
| HCN | |
| P ₂ O ₅ | |
| Cl ₂ O ₅ | |