

Covalent bonding & electronegativity

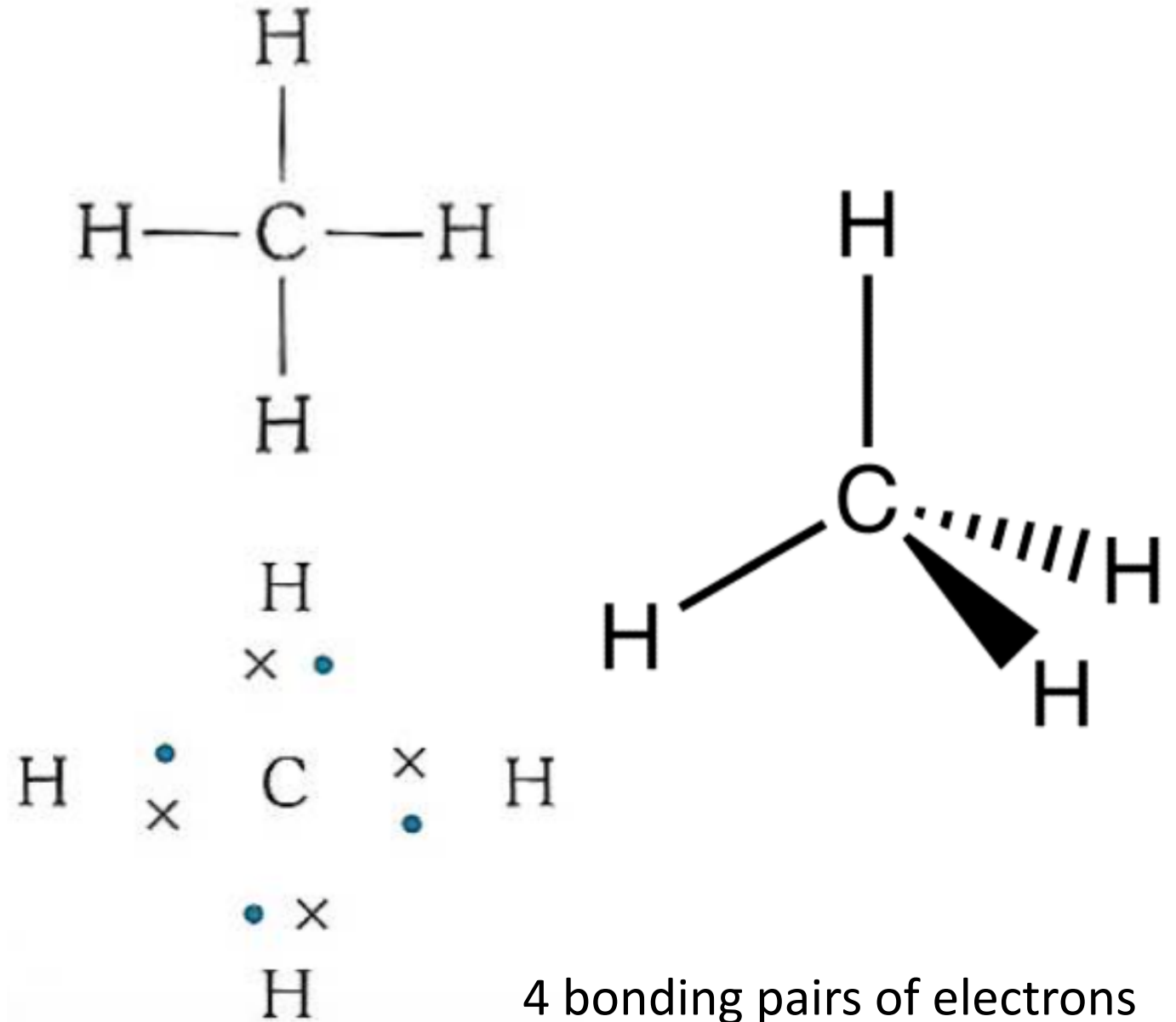
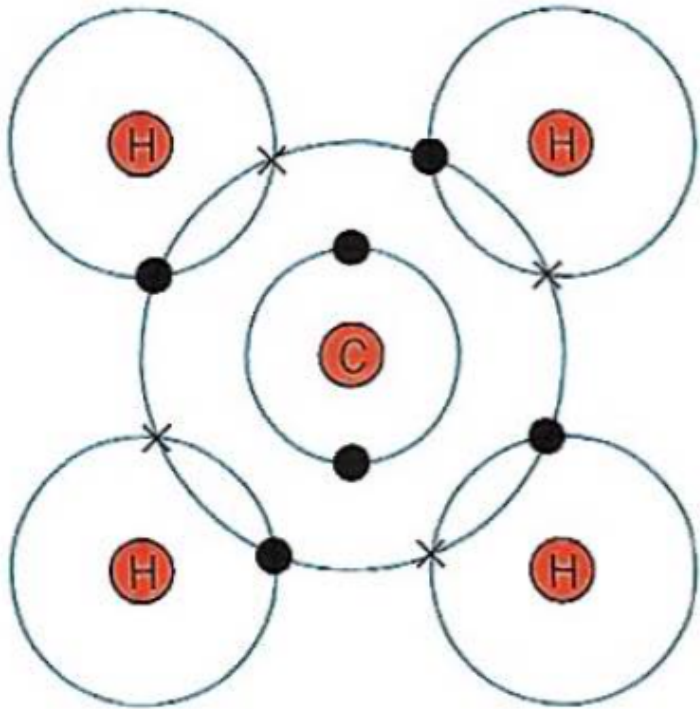
Covalent bonding

- **Covalent bonding** occurs when atoms share electrons, and a **covalent bond** is the electrostatic attraction between a shared pair of electrons and the nuclei of the atoms that are bonded.
- Covalent compounds are those formed between non-metals. Can you think of some examples of covalent compounds?

- State whether the following compounds have ionic or covalent bonding:
- NF_3 , LiF , CF_4 , CaO , NH_3 , PCl_3 , CuCl_2
- Ionic bonding LiF , CuCl_2 , CaO
- Covalent bonding NF_3 , CF_4 , NH_3 , PCl_3

Single covalent bonds

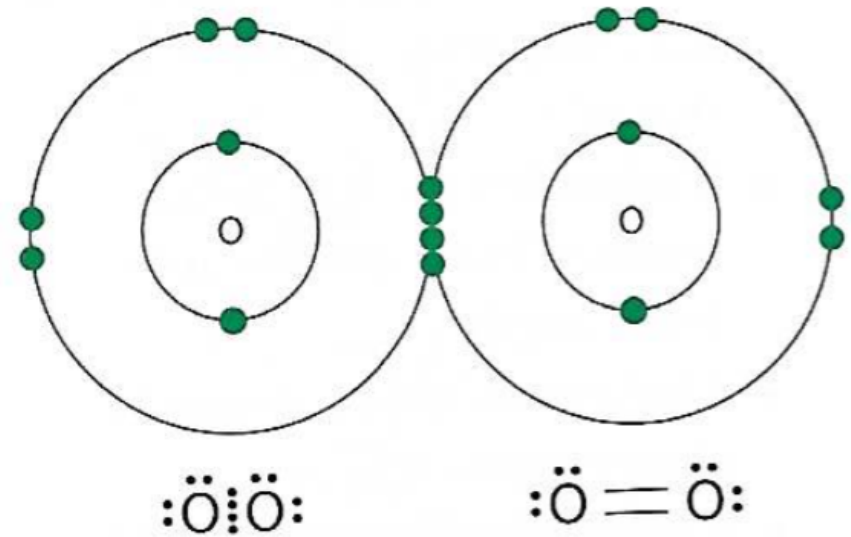
- One example of covalent bonding is in methane (CH_4)



Multiple covalent bonds

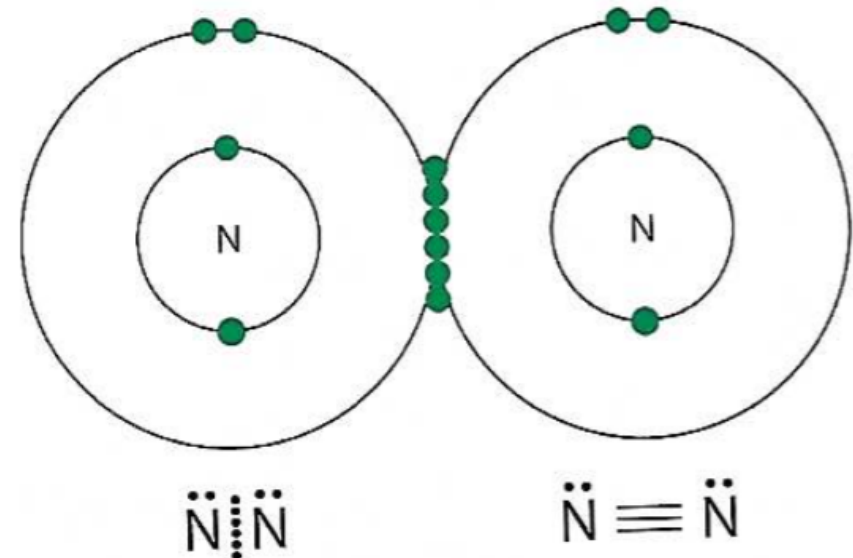
- Oxygen, O_2

2 bonding pairs of electrons
4 non bonding or lone pairs of electrons

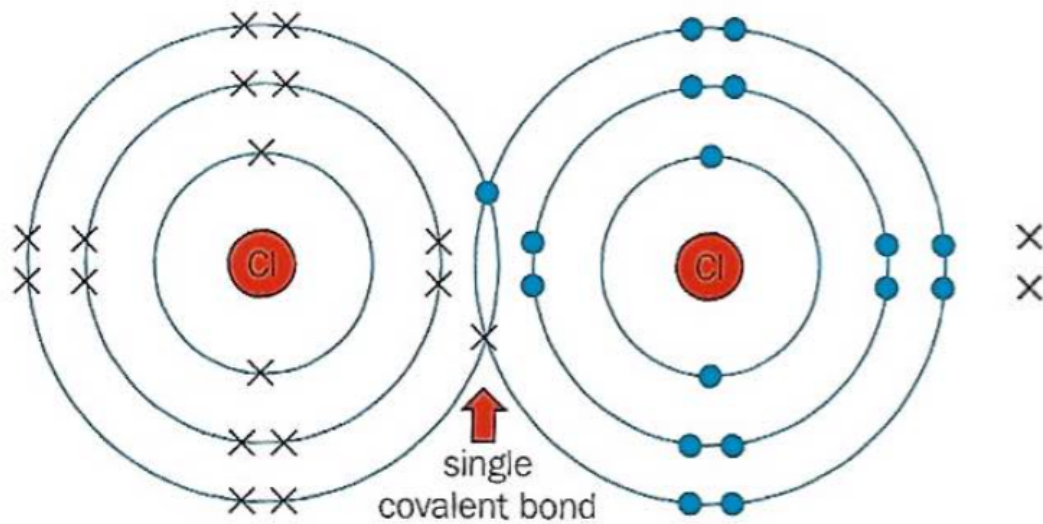


- Nitrogen, N_2

How many bonding pairs?
How many lone pairs?



- We know that chlorine is diatomic, Can you draw a diagram to represent the electrons?



x x

Cl

x x

x
•

• •

Cl

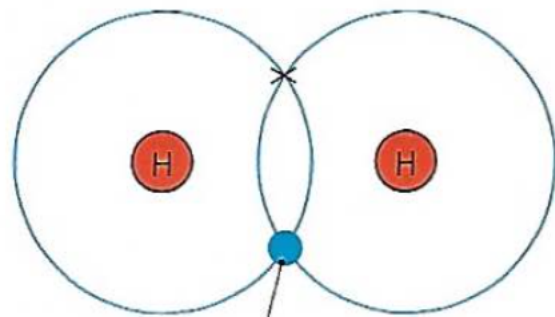
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single
covalent bond

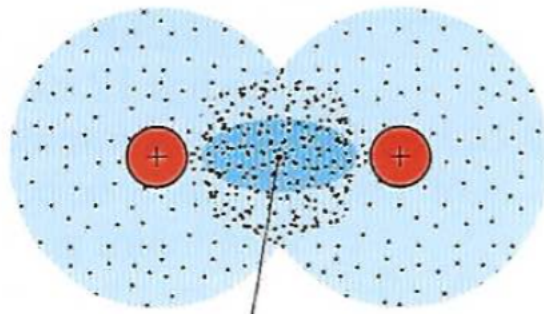


What holds atoms together

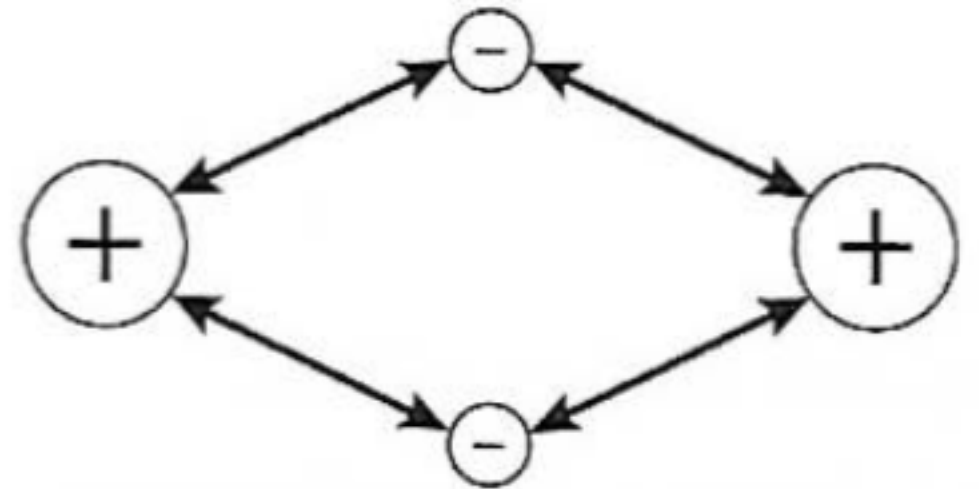
- A **covalent bond** is the electrostatic interaction between the positively charged nuclei of both atoms that are bonded and the shared pair of electrons.



the shared pair of
electrons in the
covalent bond



the electrons in the covalent
bond are more likely to be
found between the two nuclei

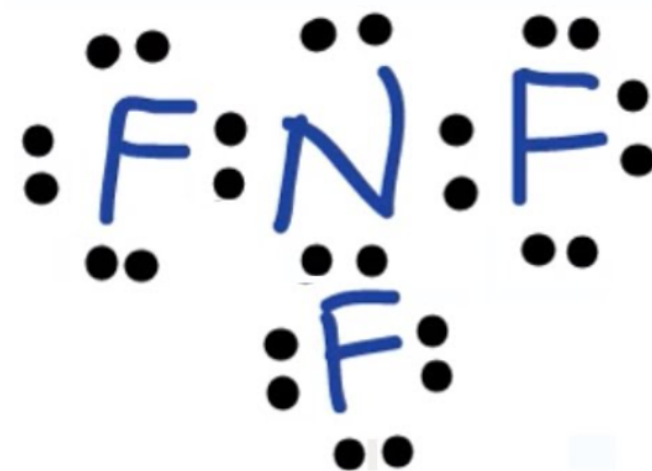
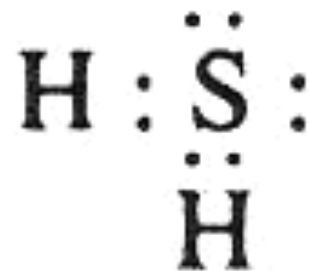
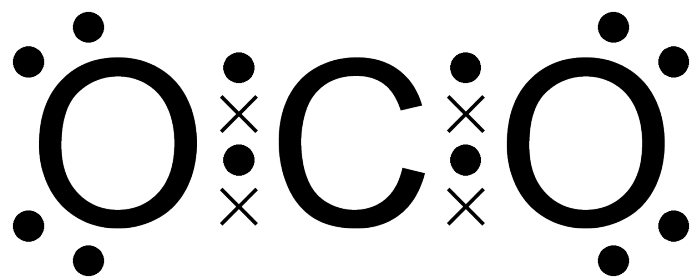
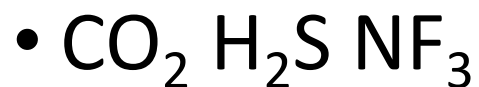


The octet Rule

- Atoms in a covalent bond have a tendency to have a full valence shell with a total of eight electrons (or two in the case of hydrogen). This is known as the octet rule.

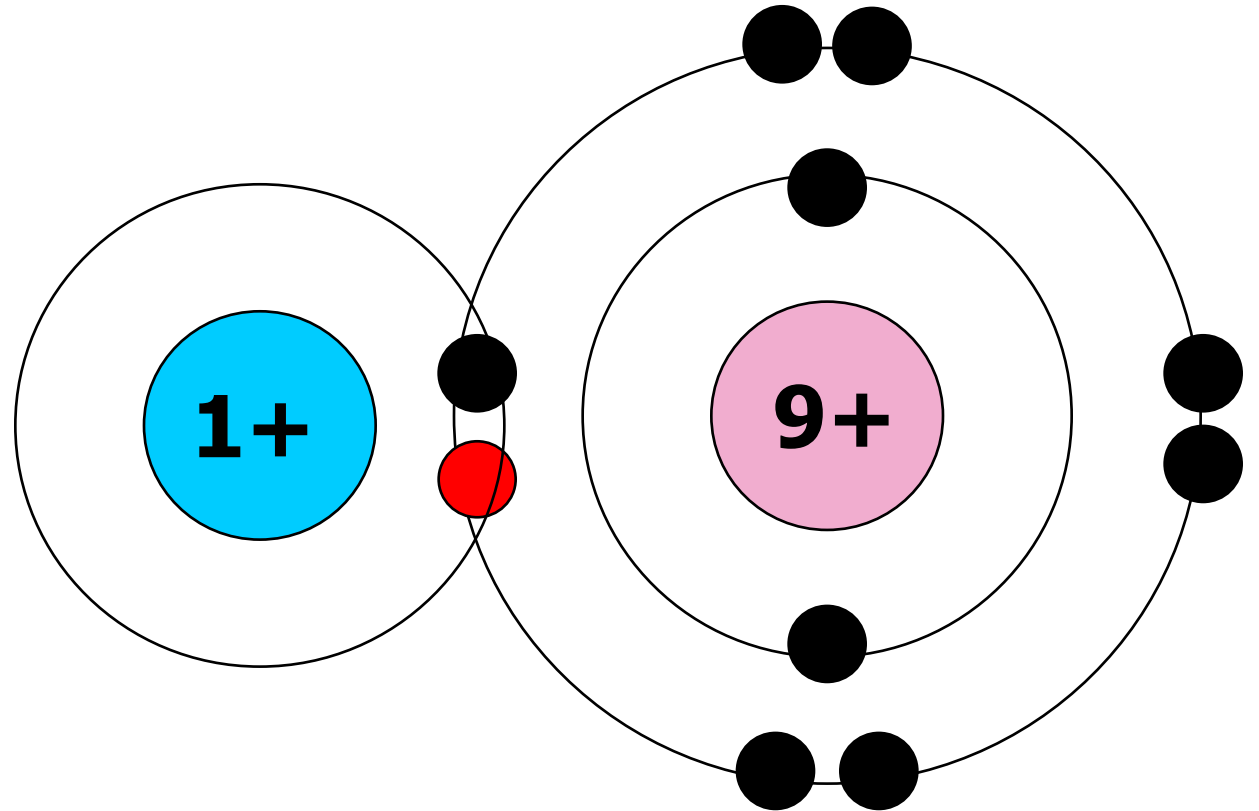
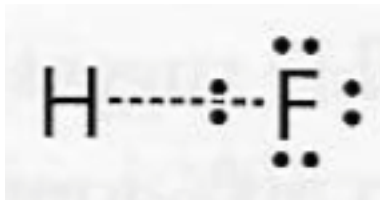
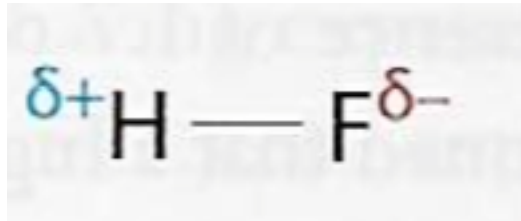
Questions

- Draw Lewis structures to show the covalent bonding in each of the following molecules.



In a covalent bond between two **different** atoms, the atoms do not attract the electron pair equally.

Why? Discuss in pairs



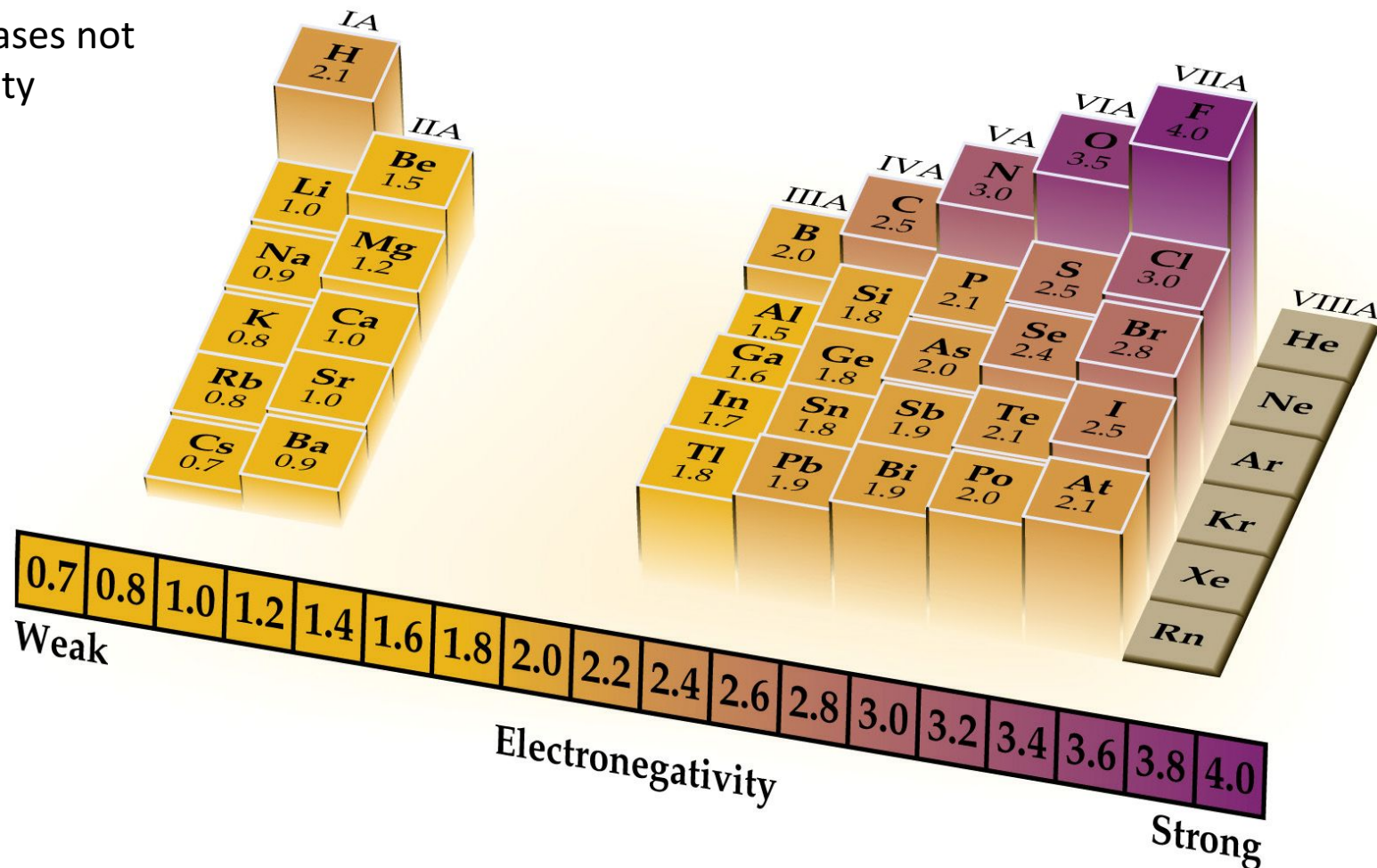
- In a covalent bond between two **different** atoms, the atoms do not attract the electron pair equally.
- Why?
- The size of the atoms and their nuclear charge.
- **Electronegativity** (a measure of the attraction of an atom in a molecule for the electron pair in the covalent bond of which it is a part)

Pauling electronegativity values

Pauling electronegativity values

Why do the noble gases not have electronegativity values?

They do not form compounds



Factors affecting electronegativity











































- 1) **Nuclear charge** – more protons, stronger attraction between nucleus and bonding pair of electrons.
- 2) **Atomic radius** – closer to the nucleus, stronger attraction between nucleus and bonding pair of electrons.
- 3) **Shielding** – less shells of electrons between the nucleus and the electrons, less shielding (less repulsion), stronger attraction between nucleus and bonding pair of electrons.

Trend down a group

Electronegativity decreases

- Atomic radius increases
- More shielding
- \therefore Less attraction between nucleus and bonding pair of electrons

Relative atomic sizes of the representative elements

	1A		2A		3A		4A		5A		6A		7A		8A
1	 H														 He
2	 Li	 B	 Be		 C		 N		 O		 F		 Ne		
3	 Na	 Al	 Mg		 Si		 P		 S		 Cl		 Ar		
4	 K	 Ga	 Ca		 Ge		 As		 Se		 Br		 Kr		
5	 Rb	 In	 Sr		 Sn		 Sb		 Te		 I		 Xe		
6	 Cs	 Tl	 Ba		 Pb		 Bi		 Po		 At		 Rn		

Sizes of atoms tend to increase down a column

Sizes of atoms tend to decrease across a period

Trend across a period

Electronegativity increases

- Atomic radius decreases
- More nuclear charge
- \therefore Stronger attraction between nucleus and bonding pair of electrons