Introduction to Types of Bonds

Why bother making bonds?

Atoms want to have a full outer shell
like the noble gases have:

Why bother making bonds?

Atoms want to have a full outer shell like the noble gases have:

Ne: $1s^2 2s^2 2p^6$

Ar: $1s^2 2s^2 2p^6 3s^2 3p^6$

Na: $1s^2 2s^2 2p^6 3s^1$

One valence electron

***NOTICE:**

A full outer shell = 8 e^-

What happens during a chemical reaction?

A CHEMICAL REACTION IS A CHANGE TO THE ELECTRONS:

Transferring or sharing electrons in order to make “bonds”

Which electrons are involved in bonding?

Valence Electrons:

The e- in the highest occupied energy level of an atom

During a Chemical Reaction…

- **Ionic** – electrons transferred
- **Covalent** – electrons shared
- **Metallic** – free flowing electrons

Types of Chemical Bonds

Ionic

Bond between: (Cation – Anion) – usually….
(Metal - Nonmetal)

Covalent

Bond between: (Nonmetal - Nonmetal)

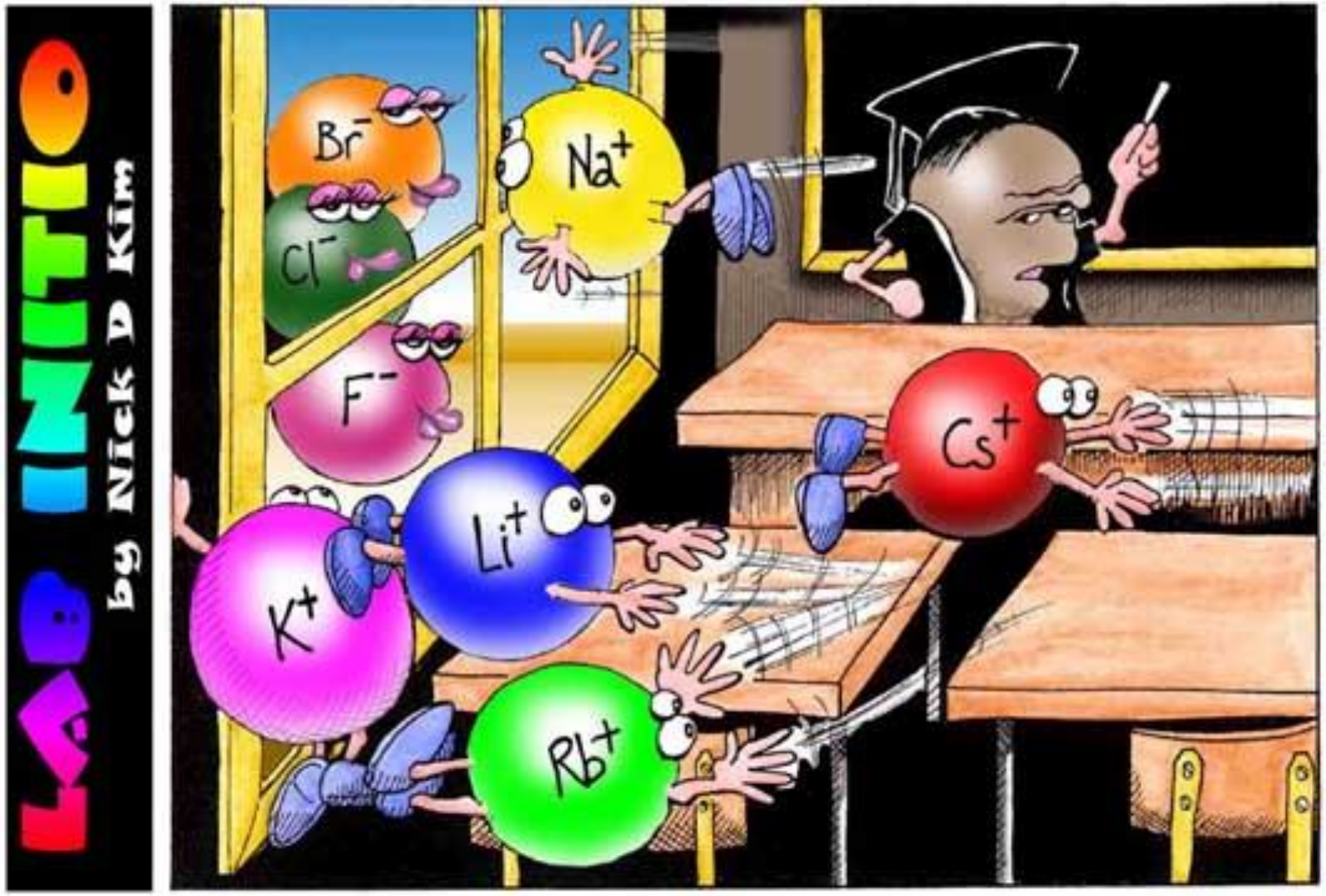
Metallic

Bond between: (Metal - Metal)

IONIC BONDS

Transferring Electrons

(to make ions, then ions are attracted to each other)



Ionic Bonds

"The name is Bond.
James Bond.

Shaken not stirred"

**"The name is Bond.
Ionic Bond.**

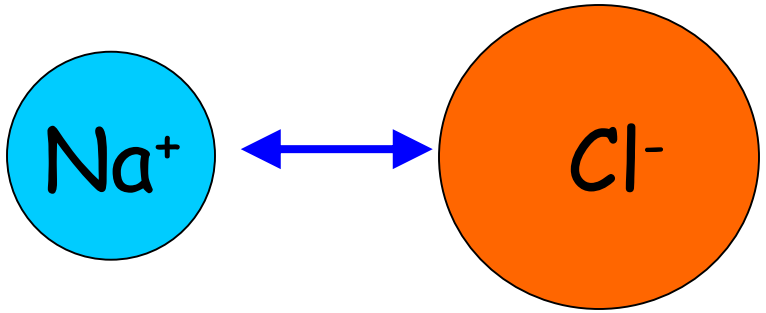
Taken not shared"

Example: Na & Cl…

Sodium (Na) has 11 electrons	Chlorine (Cl) has 17 electrons
$1s^2 2s^2 2p^6 3s^1$	$1s^2 2s^2 2p^6 3s^2 3p^5$
One valence electron	Seven valence electrons
By losing this electron it becomes…	By gaining an electron it becomes...
Na^+ $1s^2 2s^2 2p^6$	Cl^- $1s^2 2s^2 2p^6 3s^2 3p^6$
Which has a full outer electron level.	Which also has a filled outer energy level.

NaCl – opposites attract!

The two “happy” ions now attract each other electrically. The resulting attraction is an ionic bond. A bond between ions.



Ionic Bonds

metal + nonmetal

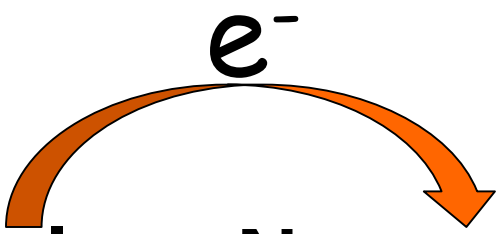
Wants to get rid of an electron

low ionization energy

Wants to gain an electron

high electronegativity

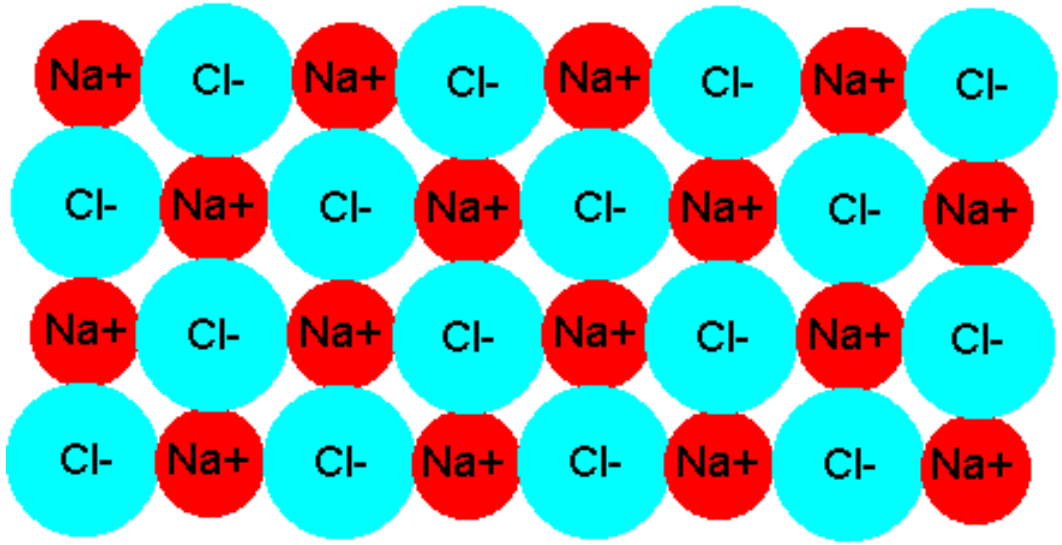
Therefore:

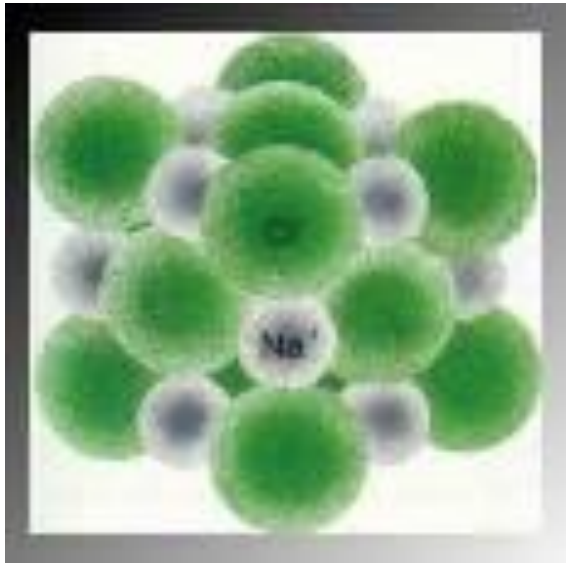


Metal + Nonmetal

Cation (positive) + Anion (negative)

Sodium Chloride – an Ionic Compound





Properties of Ionic Compounds

- They are solids with high melting points (typically > 400°C)
- Many are soluble in water (the bonds are broken by water molecules getting in between the atoms)

Properties of Ionic Compounds

- Molten compounds conduct electricity well because they contain mobile charged particles (ions).
- Aqueous solutions conduct electricity well for the same reason.

Properties of Compounds

Properties of compounds often have VERY different properties than the individual elements.

Sodium is an explosive metal

Chlorine is a poisonous gas.

Sodium Chloride you put on your fries

Sodium (Na)

- Highly reactive explodes in contact with water.

Chlorine (Cl)

- poisonous/deadly gas.

Sodium chloride (NaCl)

- Food preservative and Flavoring agent.

WHY ARE PROPERTIES OF COMPOUNDS/MOLECULES SO DIFFERENT THAN THE PROPERTIES OF THE INDIVIDUAL ATOMS THEY MAKE UP?

Because chemical properties are due to the electron configuration of the valence electrons. During bonding, this configuration changes.

COVALENT BONDS

Sharing Electrons

(between two atoms – not as good as ionic, but better than nothing!)

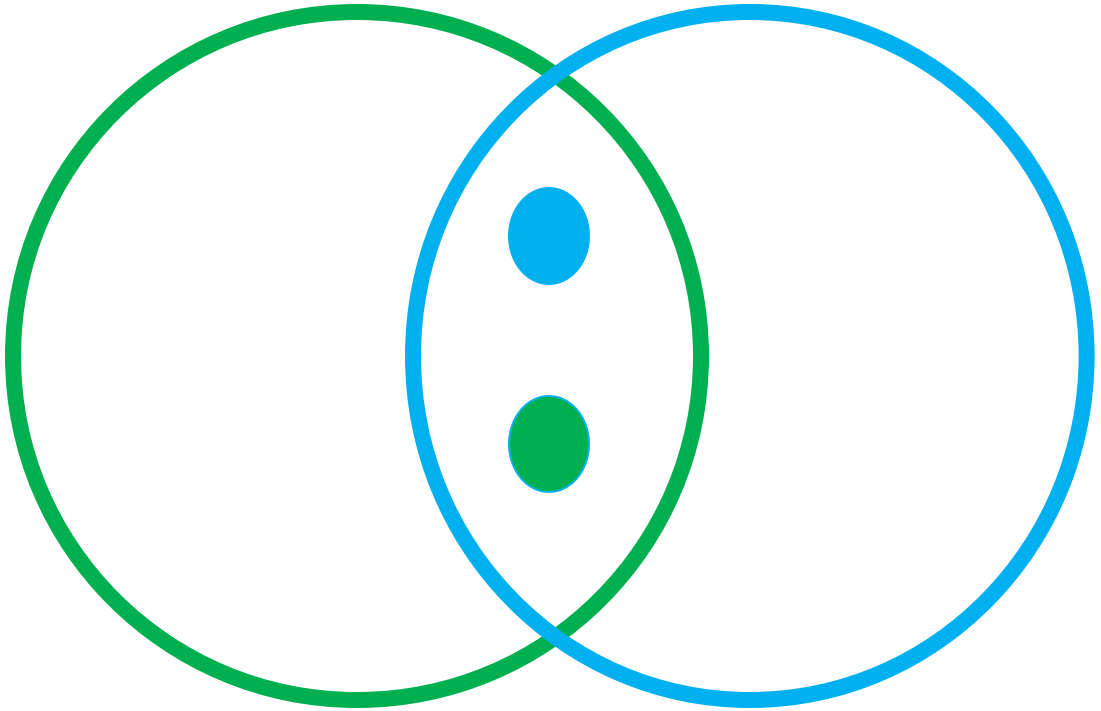
Nonmetal - Nonmetal

Sharing electrons tricks each element into thinking it has 8

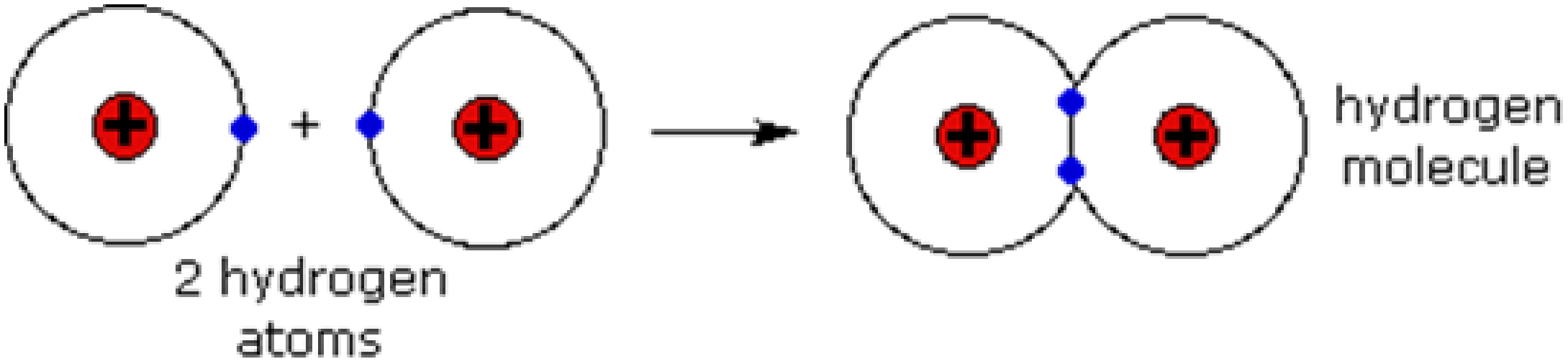
Each atom THINKS it owns both electrons…

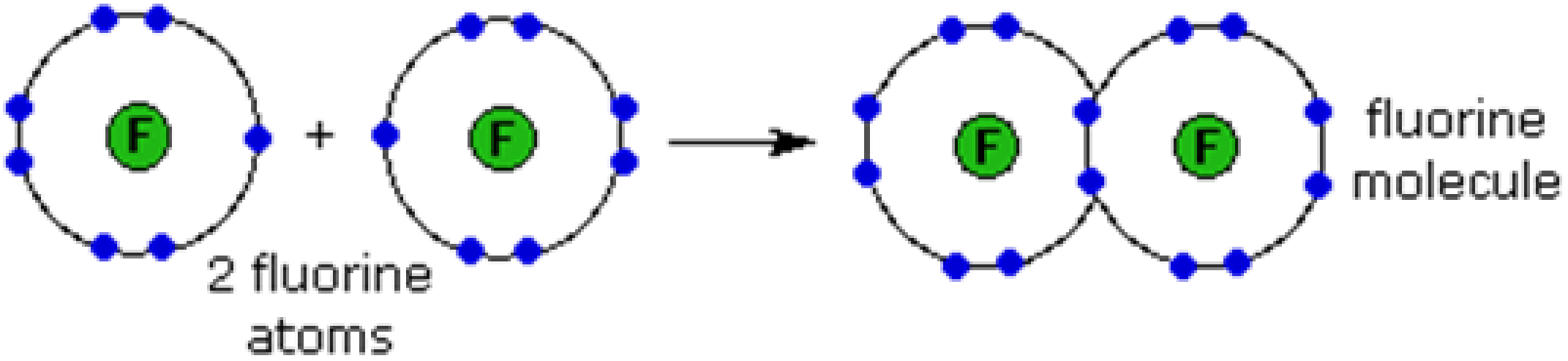
Even though they are sharing!

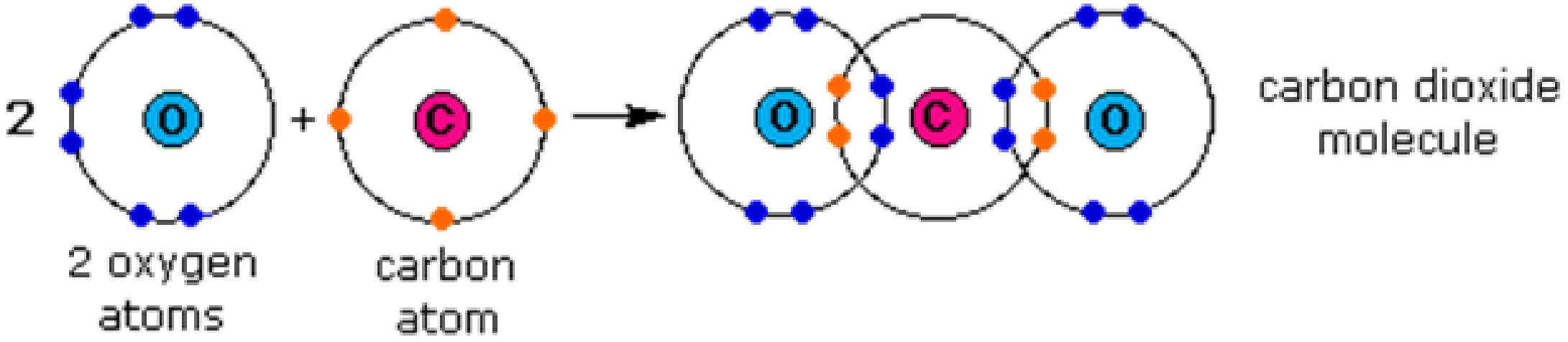
They each “donate”
what they can to the bond

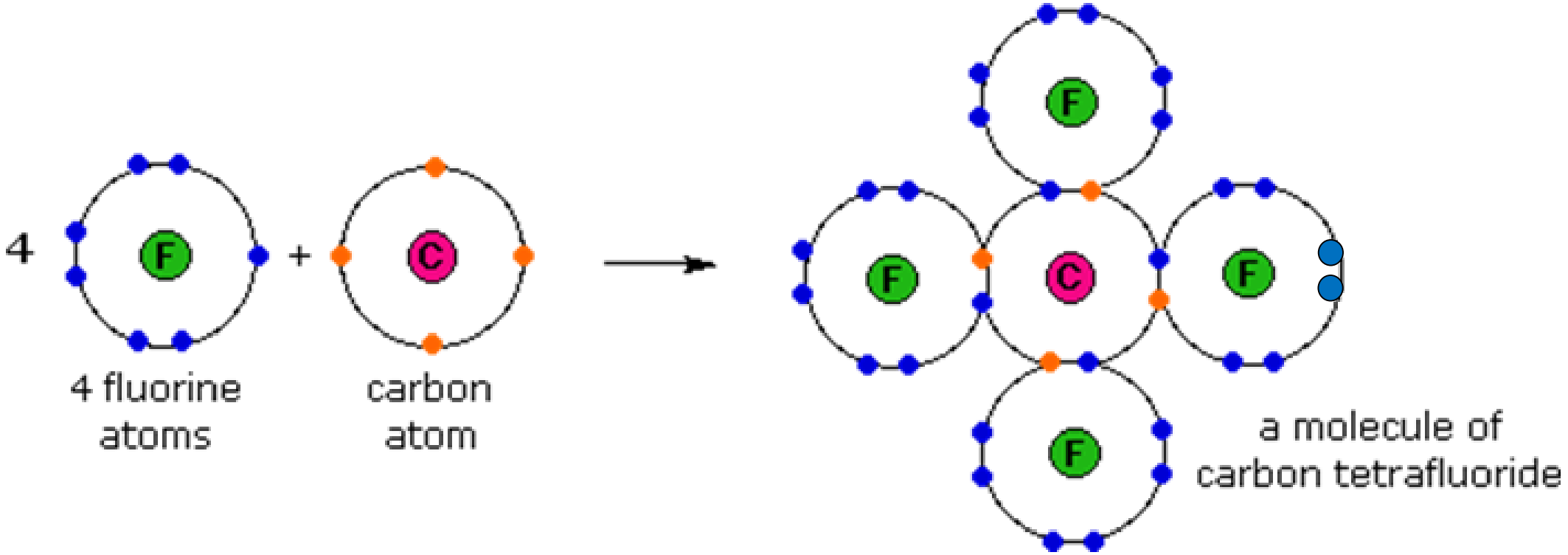


Some examples - don't need to write them down




F
+
F
2 fluorine atoms
F
F
fluorine molecule


2
O
+
C
O
C
O
2 oxygen atoms
carbon atom
carbon dioxide molecule


4
F
+
C
4 fluorine atoms
carbon atom
F
F
C
F
F
a molecule of carbon tetrafluoride

Properties of Covalent Bonds

- Don’t Conduct Electricity
- Low melting points
- Usually not soluble in water

METALLIC BONDS

Free Flowing Electrons

(electrons float around randomly, don't "belong" to one atom anymore)

Metal – Metal

Electrons are able to flow freely through the metal in a

“SEA OF ELECTRONS”

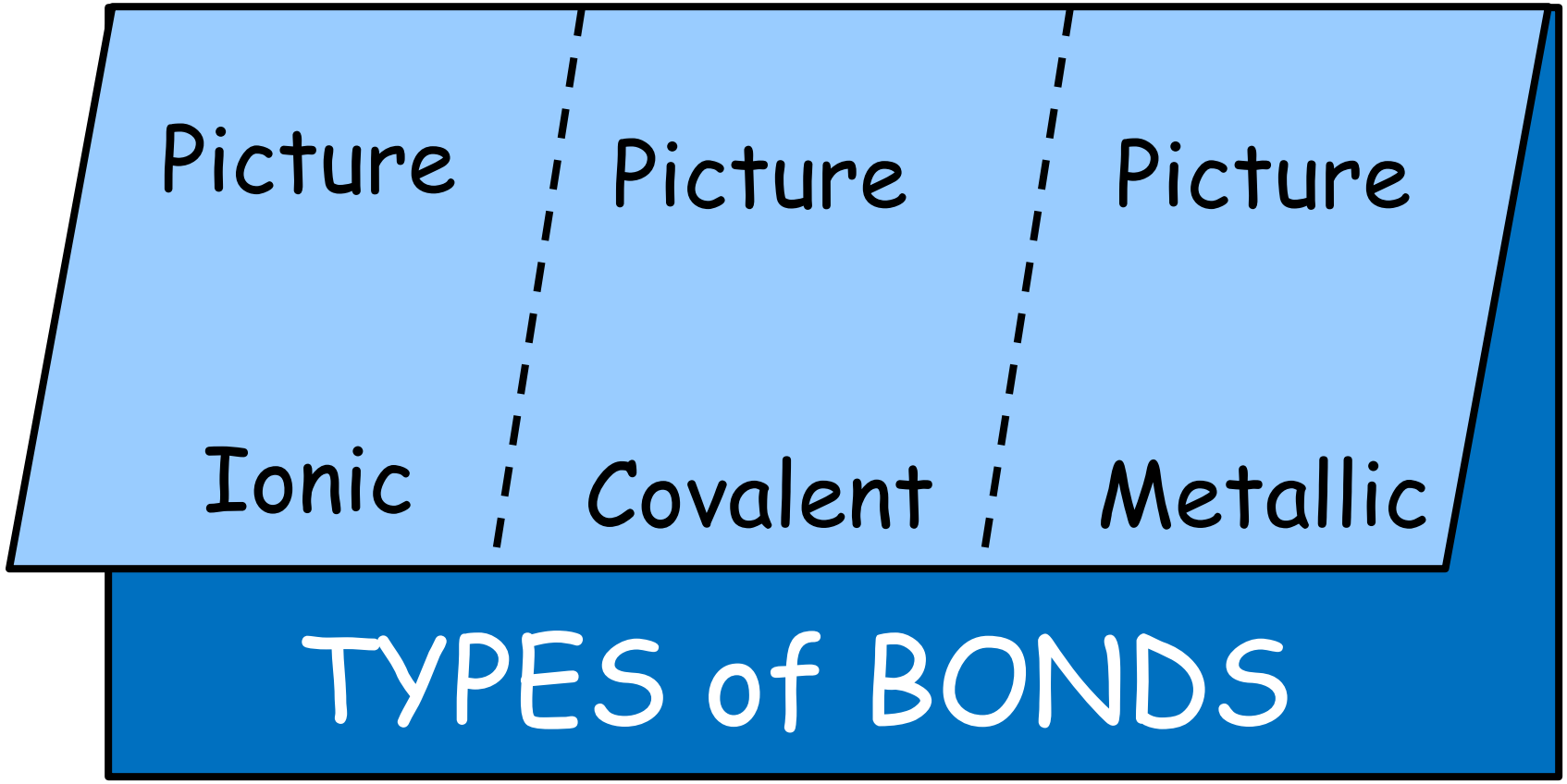
Watch this video clip:

https://www.youtube.com/watch?v=V5tj-xADB1c

Properties of Metals

- Solid at room temperature (except for mercury…it is a liquid!)
- Conduct electricity
- Malleable and Ductile
- Have a wide range of melting points.

Fold-up


Picture
Picture
Picture
Ionic
Covalent
Metallic
TYPES of BONDS

Properties Example Ionic	Properties Example Covalent	Properties Example Metallic
Three clock questions related to types of bonds. One for Each Type of Bond - see p. 4 in your notebook (or the next slide on this document)		

What makes up each type of bond?

Properties?

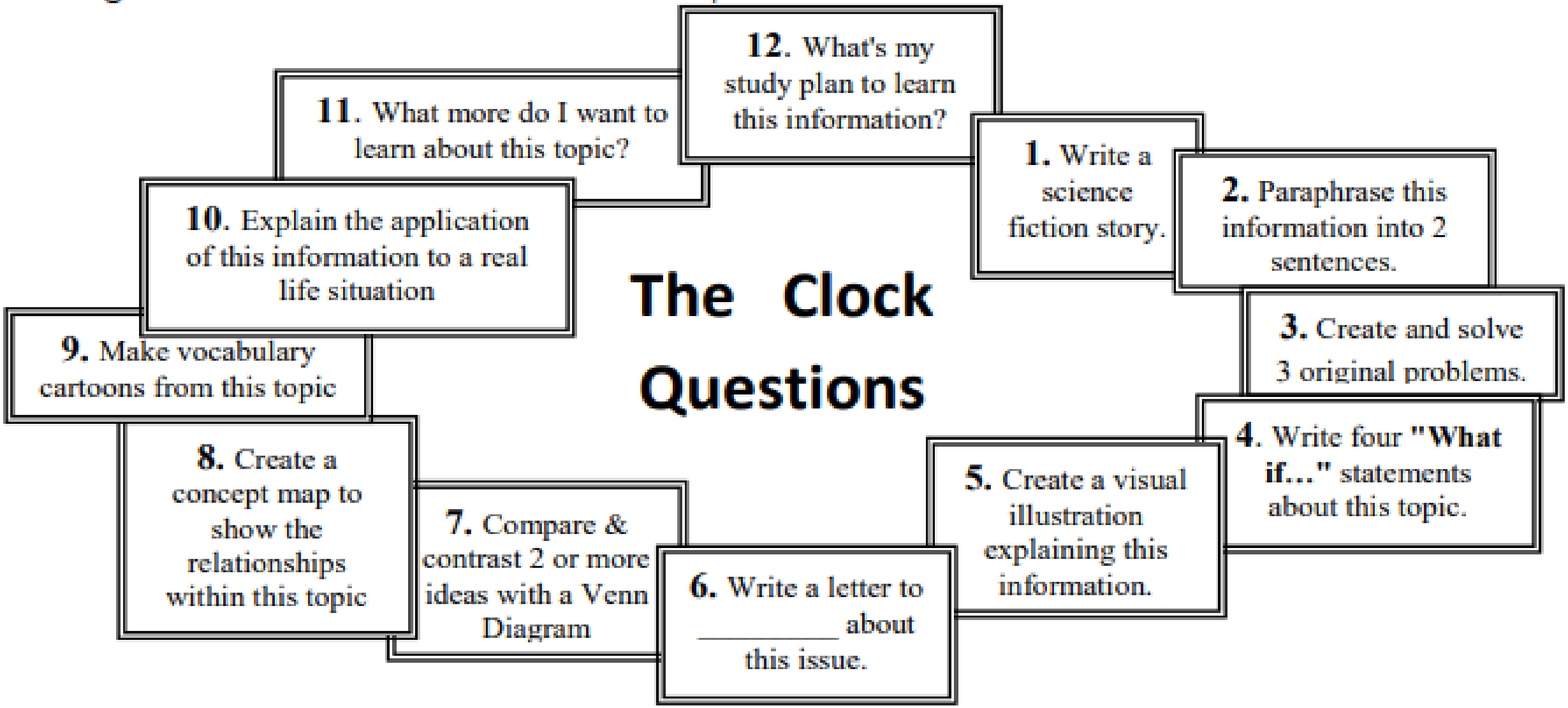
Examples?

What is happening in each?

Etc, etc, etc!!

The Clock Questions

The 12 clock questions are just a few ideas to help focus your attention and guide your learning of the science content and concepts.



YouTube Link to Presentation

https://youtu.be/36idWpPaO08