Chemical Bonding

Part 2: Ionic Bonds

Brainpop Ions

- Click here

Brain POP IONS

1 What is an ion?
A An atom with an extra neutron
B An atom or molecule with an electrical charge
C The outermost shell of an atom

2 What is the nucleus of an atom made up of?
A Neutrons and protons
B Protons and electrons
C Electrons and neutrons

3 What are the negatively-charged particles orbiting an atom called?
A Electrons
B Protons
C Neutrons

4 When do ions form?
A When an atom loses a proton
B When two atoms bond together
C When an atom loses or gains an electron

5 Electrons orbit the nucleus in layers called:
A Valence clouds
B Shells
C Potentials

6 Electrons in the outermost shell are:
A Valence electrons
B Ionization electrons
C Orbital electrons

7 What is the tendency to lose electrons called?
A Negative valence
B Ionization
C Positive valence

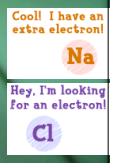
8 Atoms on the right side of the periodic tend to:
A Gain electrons easily
B Lose electrons easily
C Lose protons easily

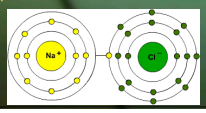
9 How do ions stick together?
A With covalent bonds
B With negative bonds
C With ionic bonds

10 What happens to the ionic bond when sodium chloride is dissolved in water?
A The bond strengthens
B The bond breaks
C The bond is unaffected

Ions ions ions

- We've also talked about ions…. What is an ion?
- An ion is a **charged atom** or an atom that has either **lost** or **gained** an **electron**.
- We also talked about how Sodium willingly gives away its lone valence electron.
- Chlorine very greedily takes that electron, in order to fill its outer shell.





Of Cats and Ions

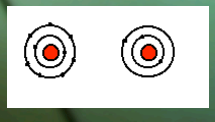
- Like we said, sodium & chloride are a match made in heaven.
- As sodium gives away its electron, it becomes a **positive** ion
- This is called a **cation**.
- When chlorine receives the electron, it becomes a **negative** ion
- This is called an **anion**.

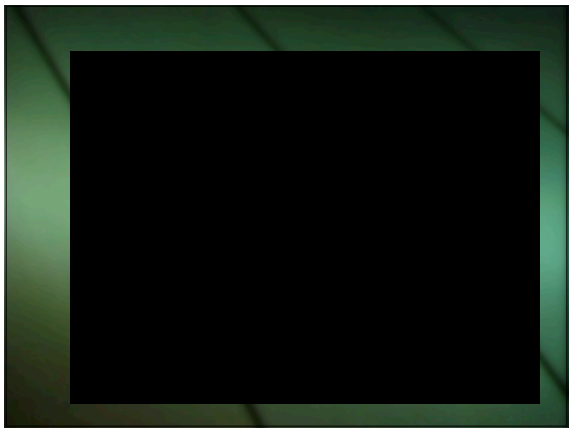
Na^+

$:\ddot{Cl}:^-$

Why, I ask?

- So, after the electron moves, the positive sodium ion is then immediately attracted to the negative chloride ion.
- Why are they attracted to each other?

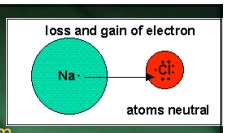




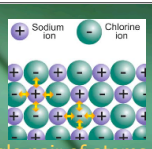
Well, as Paula says…

Opposites Attract!

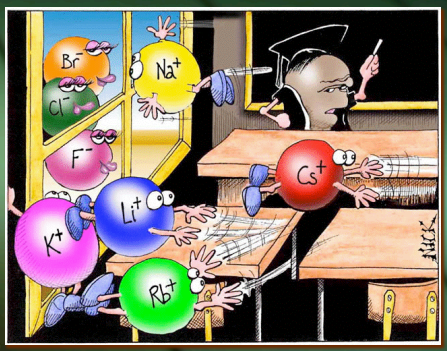
Ionic Bonds



- This bond is called an ionic bond, because the electrons are **transferred** from one atom to another, creating an **attraction** between **opposite charges**.
- In other words, 1 element's atom is going to **give** electrons, and the other is going to **take them.**

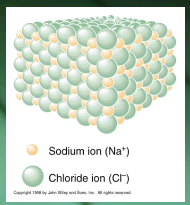


- These bonds are not limited to a single pair of atoms.
- In NaCl, each Na+ is attracted to all of the neighboring chloride ions.
- Likewise, each Cl- is attracted to all the neighboring sodium atoms.
- NaCl video

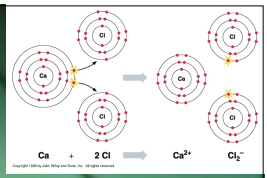


Ionic Bonds

- These ions form in a repeated, 3-dimensional pattern called a **crystal lattice**.
- This means the positive and negative atoms are arranged in alternating patterns.
- This is why salt is formed in cubes.



Ionic Bond Examples

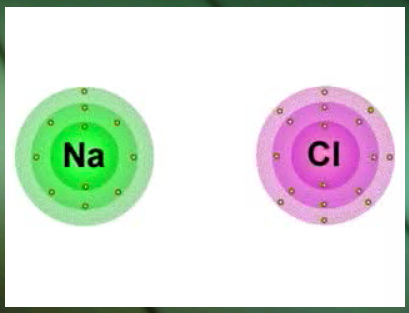


- The prime example of an ionic bond is NaCl, but there are many more examples of ionic bonds.
- Look how it takes 1 calcium atom to bond with 2 chlorine atoms.
- Also, notice how calcium is now Ca^{2+}. Why?
- Well, because calcium **lost 2** electrons, leaving it with an overall charge of 2+.
- Conversely, each chlorine **gained 1** electron, leaving each with an overall charge of 1-.
- This new compound would be written as **$CaCl_2$**.

Ionic Bonding

Ions Example #2

- Here's another example.
- I've got two ions: H^{1+} and $(SO_4)^{2-}$
- This time, the **superscript** (high #) represents the charge number.
- Remember that the subscript (low #) refers to the number of atoms.
- How many hydrogens does it take to pair with the sulfate ion (SO_4)?
- 2 : I need 2 positive charges to match the 2- charge.
- The final compound would be H_2SO_4



You Try It!

- See if you can write the chemical formula for each of the two ions.
- Remember, positive ions can only bond with negative ions, and vice versa.

Cation (+)	Anion (-)	Compound
Li^{1+}	S^{2-}	
Mg^{2+}	Cl^{1-}	
Al^{3+}	$(PO_4)^{3-}$	

You Try It!

Cation (+)	Anion (-)	Compound
Li^{1+}	S^{2-}	Li_2S
Mg^{2+}	Cl^{1-}	
Al^{3+}	$(PO_4)^{3-}$	

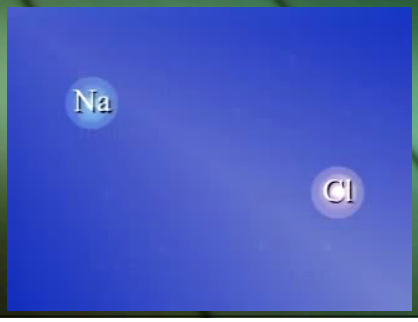
You Try It!

Cation (+)	Anion (-)	Compound
Li^{1+}	S^{2-}	Li_2S
Mg^{2+}	Cl^{1-}	$MgCl_2$
Al^{3+}	$(PO_4)^{3-}$	

You Try It!

Cation (+)	Anion (-)	Compound
Li^{1+}	S^{2-}	Li_2S
Mg^{2+}	Cl^{1-}	$MgCl_2$
Al^{3+}	$(PO_4)^{3-}$	$Al(PO_4)$

Ionic Bond Review



Quick Information

- More details to come…
- 3 types of bonds:
- 1. Ionic: taking/giving of electrons
- 2. Covalent: went to Kindergarten and learned to share!! (Sharing of electrons- more info on this next time)
- 3. Metallic Bonds

Metallic bond

- Quickly… a metallic bond is the force of attraction between a positively charged **metal ion** and the **electrons** in a metal.
- Metals atoms are so tightly packed, their electron shells overlap.
- This lets electrons move freely from one atom to another.
- THIS lets metal conduct electricity & change shape easily (ductility, malleability).
- Cool animation: click here

Comparing Bonds

- It is really important that you understand the difference between covalent bonds.

Covalent	Ionic
Share Electrons	Transfer/give-take Electrons
Creates molecules	Creates ions
Bond consists of 2 electrons	Bonds form with all oppositely charged neighbors
Nonmetal - Nonmetal	Metal - Nonmetal

Ionic & Covalent Bonding