Ionic Compounds

When a metal and a non-metal combine and there is a transfer of e- between them.

Covalent compounds

When 2 non-metals share e- between them so that each of the elements have a full orbit of e-

Ions

Form from IONIC Compounds.

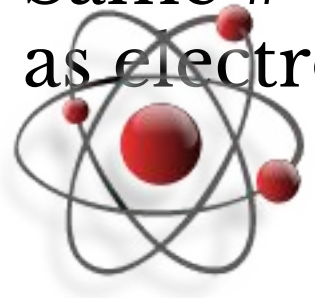
They are Atoms that have a + or -charge (they are no longer neutral.)

- When atoms have the same # of protons and electrons – the atom is neutral. And it is called an ATOM.
- When an atom loses or gains electrons from another element – it gets a charge and is now called an ION.
- Ions from when a METAL and a NON-METAL combine to form a new compound. They create an IONIC BOND between them.
- In an ionic bond, e- are transferred (not shared)

Let's recap…

ATOM

- No charge
- Neutral
- Same # of protons as electrons



ION +1 Or -1

- Has a charge (because it has gained or lost e-)
- Not Neutral
- Protons stay the same, but a different # of electrons

So how did the Ion get a charge?

- Every atom in the periodic table wants to be just like the nearest NOBLE GAS, because it has full outer shell of e- and is stable – that is what every atom wants.
- ***"I want to be a Noble Gas...please...I'll give up e-, I'll take them from another element, just please...they are so stable!"***
- Notice that the metals have more electrons than the stable noble gas, and that non-metals don't have enough electrons to be a noble gas.
- So...Metals tend to give up e- to become more stable
- Non-metals tend to gain or take e- to become more stable.

Let's look at an example

Sodium (Na) has 11 e-

- If Sodium could just find a way to lose 1 e-, then it would look like Neon (a noble gas with 10 e-)

Chlorine (Cl) has 17 e-

- If Chlorine could just find a way to gain 1 e-, then it would look like Argon (a noble gas with 18 e-)

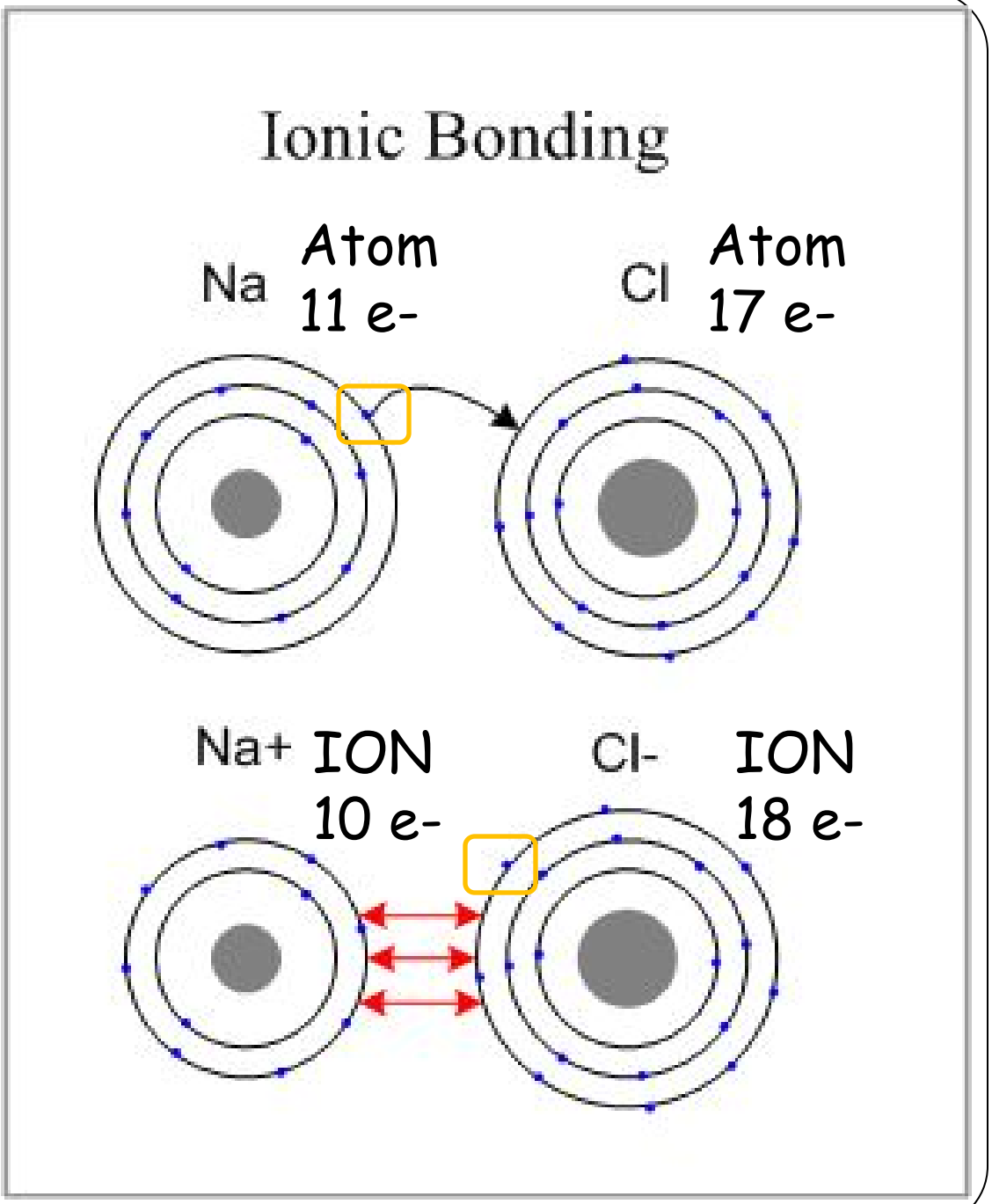
If these 2 could meet – it would be a match made in Heaven!! They could bond together and Sodium could give up it's e- to Chlorine, who would happily accept it and they would both end up like noble gases!!!

So why does Na get a + charge??

-Because it gave up an electron (got rid of a "-" charge) – so it now has 1 more proton than e-, so 1+ charge!
* Remember – Givers of e- are happy – they always end up feeling good for being nice – they end up positive
*Sharing is caring!!

Chlorine is a taker – takers are selfish and end up being negative.
Chlorine has received an extra e-, so it's got more e- than p+, so it's 1-.

We form NaCl



Let’s see it happen…

- http://www.youtube.com/watch?v=QqjcCvzWwww

Two types of Ions

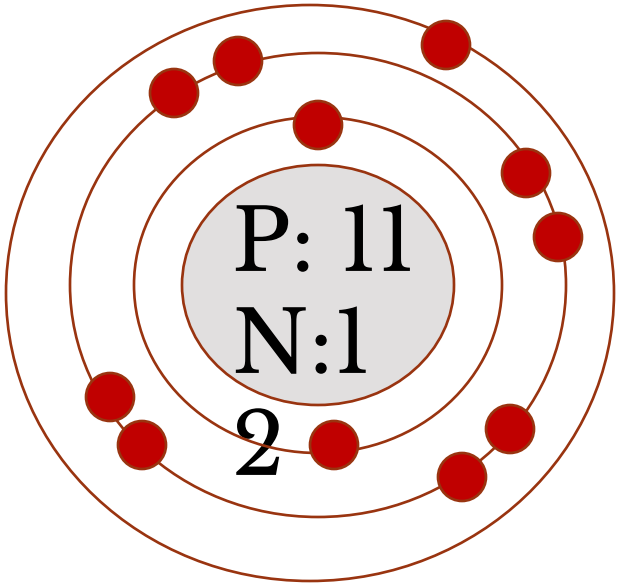
- Metals that give up e- to form "+ "charged IONS are called ***CATIONS***
  - Eg. Mg^{2+}, Li^{1+}, $Al^{3+,}$ etc…
- Non-metals that take e- to form "-" charge IONS are called ***ANIONS***
  - Eg. S^{2-} , F^{1-} , $N^{3-,}$ etc…

Let's recap…

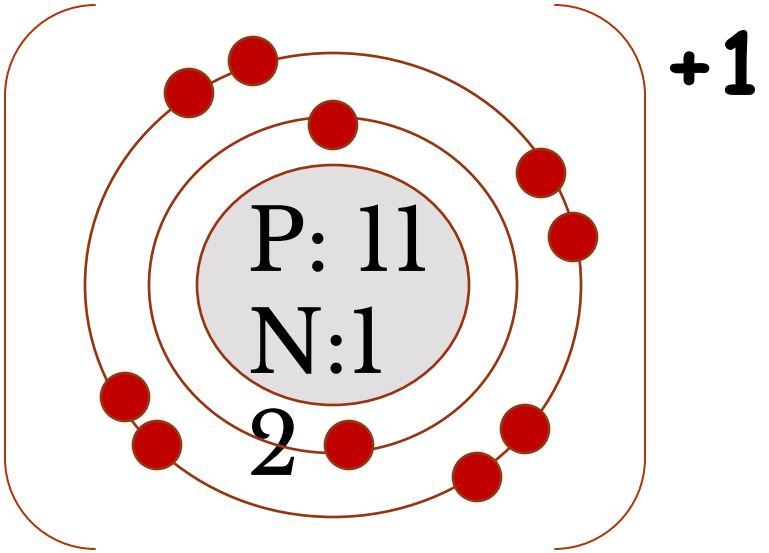
- **Givers of e-**
- They are losing negative charges
- Become positive
- The # of e- they lose, is the number of + charges they get.
- Eg. Give up 3 e- = end up with a 3+ charge
- Called Cations

- **Takers of e-**
- They are gaining negative charges
- Becoming more negative
- The # of e- they gain, is the number of - charges they get.
- Eg. Take 3 e- = end up with a 3- charge
- Called Anions

Take a look…

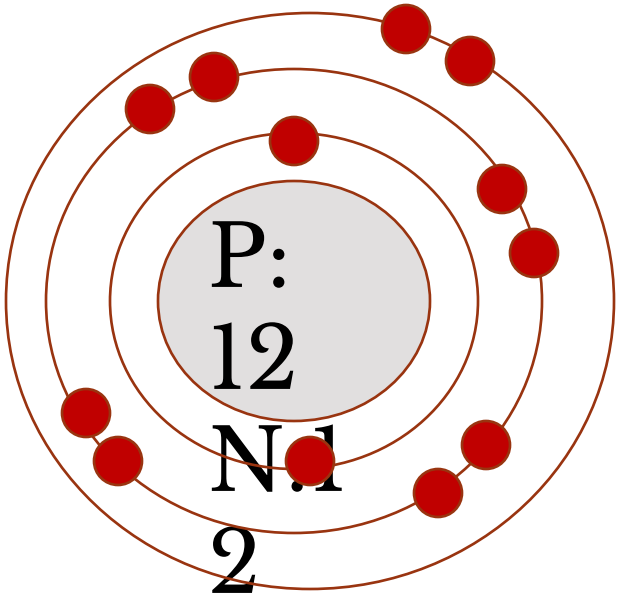


- Bohr model of a SODIUM "ATOM"
- All e- there (11).
- Na

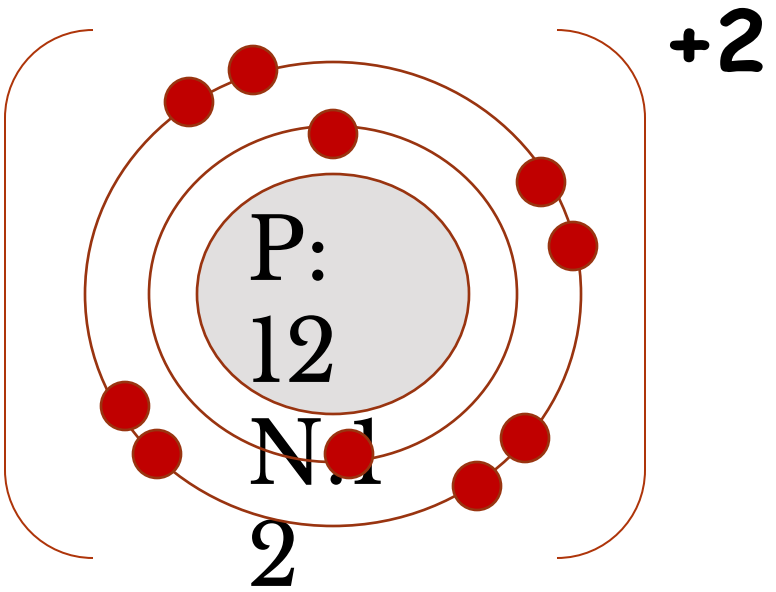


- Bohr model of SODIUM "ION"
- 1 valence e- gone (now 10 e-)
- Na^{1+}

Now you try it…

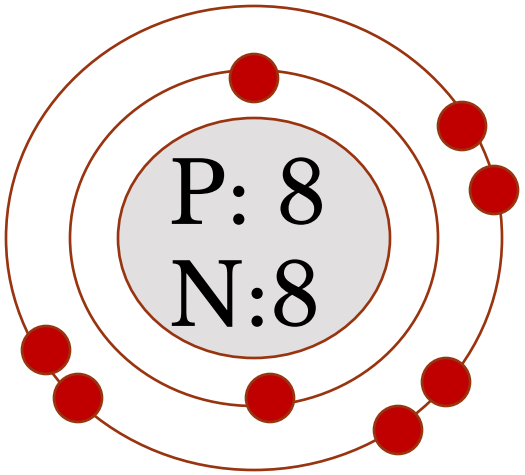


- Bohr model of a Magnesium "ATOM"
- All e- there (12).

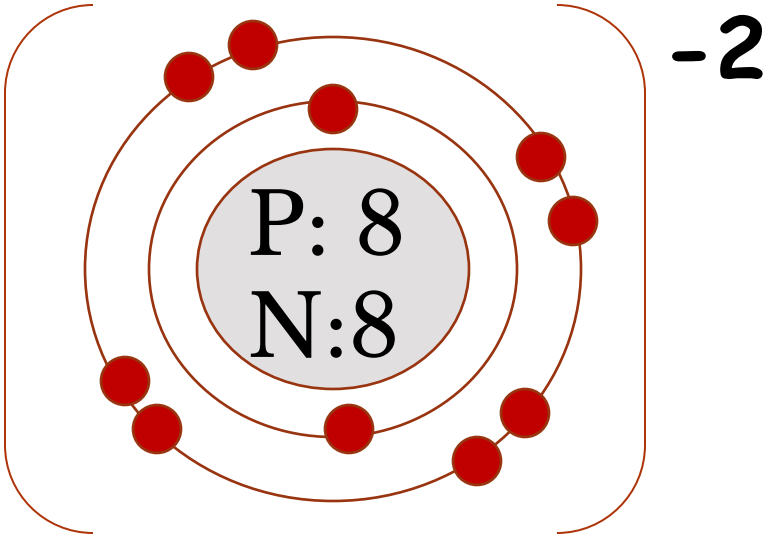


- Bohr model of Magnesium "ION"
- 2 valence e- gone (now 10e-) like Neon
- Mg^{2+}

Try again…



- Bohr model of a Oxygen "ATOM"
- All e- there (8).



- Bohr model of Oxygen "ION"
- 2 valence e- added (now 10 e-) –like Neon!
- O^{2-}

Let's Recap…

- All elements want to have a full outer shell of valence e-, just like their nearest noble gas.
- If an element gives up e-, it becomes an ION with a + charge (CATION)
- If an element takes an e-, it becomes an ION with a – charge (ANION)
- Notice that the ion charges of each element are given on your periodic table in the top right hand corner – called the **COMBINING CAPACITY.**
- The combining capacity helps you predict the # of e- the element will

But wait a minute…

- Notice on your periodic table, that many of the transition metals have more that 1 charge/combining capacity.
- That means that they can form ions in more than 1 way. Elements with more than 1 charge are called MULTIVALENT
- Eg. Iron (Fe) is multivalent because it has a charge of 2+ or 3+, so it can either lose 2 e- or 3 e- to become Fe^{2+} or Fe^{3+}
- It just depends on what it bonds with.