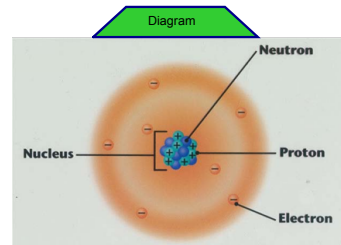


## THE ATOM



Oct 20-11:50 AM

Sep 13-1:08 PM

PARTICLE	SYMBOL	RELATIVE CHARGE	ACTUAL MASS (g)	LOCATION
Proton	p <sup>+</sup>	1+	1.67x10 <sup>-24</sup>	nucleus
Neutron	n <sup>0</sup>	0	1.67x10 <sup>-24</sup>	nucleus
Electron	e <sup>-</sup>	1-	9.11x10 <sup>-28</sup>	orbital

Mass Number

Atomic Number

Sep 13-1:09 PM

Oct 20-11:38 AM

Q. How many protons, electrons, and neutrons are in the following atoms?

Element	Atomic #	Mass #	#p	#e	#n
Carbon (C)	12				
Carbon (C)	13				
Magnesium (Mg)	24				
Magnesium (Mg)	26				
sodium (Na)	23				
chlorine (Cl)	36				

$$\text{Neutrons} = \text{mass \#} - \text{atomic \#}$$

Atoms

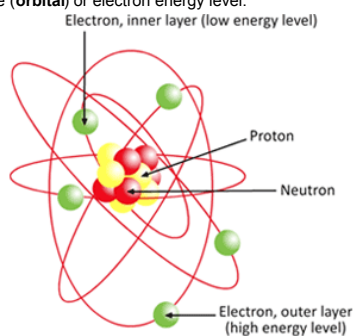
Atomic Number	Mass Number	Number of protons	Number of electrons	number of neutrons	Element Symbol
8				9	
		11		10	
	40		20		
	88	38			

Sep 20-10:53 AM

Sep 20-8:24 PM

#### Quantum Mechanics Theory of the Atom:

According to this theory, an electron with a specific energy occupies a region in space (**orbital**) or electron energy level.



#### Electron Energy Diagrams of Atoms:

- An energy level represents a specific value of energy of an electron and corresponds to a general location

The number of occupied energy levels in any atom is normally the same as the period number in which the atom appears

- for the first 3 energy levels, the maximum number of electrons that can be present are 2, 8 and 8 in order of increasing energy (increasing distance from nucleus)

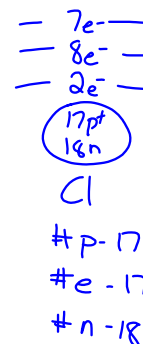
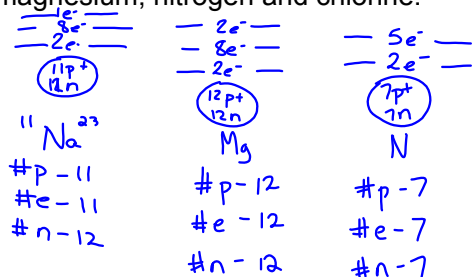
- a lower energy level is filled with electrons to its maximum before the next level is started.

- the electrons in the highest (outermost) occupied energy level = **valence electrons**, which is the same as the **group number** (for group A elements)

Sep 13-1:10 PM

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Draw bohr diagrams and energy level diagrams for the following atoms: sodium, magnesium, nitrogen and chlorine.



Nov 19-10:50 AM

Sep 16-10:14 AM

**STABLE ATOMS**

- have low chemical reactivity
- include noble gases, all of which have 8 valence electrons (except He, has 2)
- other atoms can become more stable by reacting and changing the number of their electrons, thereby attaining the same stable electron configuration (structure) of the nearest noble gas:
- atoms can follow one of two rules:

wl

**Ions**

- an atom or group of atoms that gain electrons attain an overall negative charge as an ion. → **anion**
- an atom or group of atoms that lose electrons attain an overall positive charge as an ion. → **cation**
- single atoms: form simple ions (*monatomic ions*)
- group of atoms: form complex ions (*polyatomic ions*)

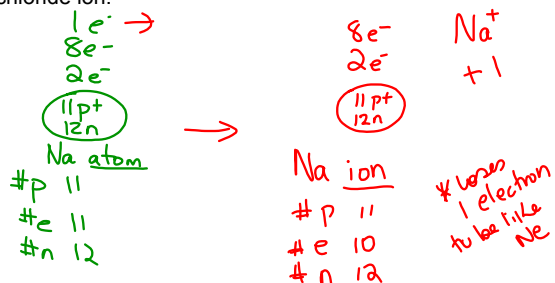


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**Energy level diagrams for ions:**

Draw bohr diagrams and energy level diagrams for the following ions: sodium ion, magnesium ion, nitride ion and chloride ion.



Nov 22-9:00 PM

*Example:* Sodium metal and chlorine gas react to produce NaCl, a very stable and unreactive substance, compared to Na (alkali metal) or Cl (halogen). They do so by first forming ions.

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

Na atom

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

Na<sup>+</sup> ion

Compare to nearest Noble gas:

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

Cl atom

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

Cl<sup>-</sup> ion

Compare to nearest Noble gas:

Nov 22-8:52 PM

**Summary:**

When sodium metal and chlorine gas react, the sodium atoms each lose one electron to a chlorine atom. In so doing the atoms form ions of opposite charge:



Remember that families of elements have similar chemical and physical properties. These families of elements will gain, or lose, specific numbers of electrons to attain a stable 'noble gas like' electron arrangement. All elements in group IA, for example will lose one electron to be like the nearest noble gas. The other families are as follows.

Group A	Gain or Loss of electrons to become an Ion
Group IA (alkali metals)	- lose of one electron to become an ion
Group IIA (alkaline earth)	- lose two electrons to become an ion
Group IIIA	- lose three electrons to become an ion
Group VA	- gain three electrons to become an ion
Group VIA	- gain two electrons to become an ion
Group VIIA (halogens)	- gain one electron to become an ion
Group VIIIA (noble gases )	Do not gain or lose electrons

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Nov 22-9:06 PM

Groups A	Valence electrons	(Element)
1A	1e <sup>-</sup>	
2A	2e <sup>-</sup>	
3A	3e <sup>-</sup>	
4A	4e <sup>-</sup>	
5A	5e <sup>-</sup>	
6A	6e <sup>-</sup>	
7A	7e <sup>-</sup>	
8A	8e <sup>-</sup>	

*Valence e<sup>-</sup> are # of electrons in last energy level of element.*

**Naming Ions:**

**Cations: element name + the word "ion"**

eg: Na<sup>+</sup> = sodium ion

Anions: stem of element name + ide + the word "ion"

eg: Cl, chlorine becomes Cl<sup>-</sup> = chloride ion

P, phosphorus becomes P<sup>3-</sup> = phosphide ion

O, oxygen becomes O<sup>2-</sup> = oxide ion

Dec 13-9:00 AM


Sep 13-1:16 PM








- Both cations and anions are more stable than the atoms from which they form since these ions attain the same stable electron configuration as the nearest noble gas.
- Boron, carbon and silicon do not tend to form ions (they instead share electrons with other atoms)
- The noble gases do not form ions since they are already stable (have filled orbitals)

Hydrogen can form a cation or an anion:

- Cation: H<sup>+</sup>, hydrogen ion has 1 proton but no electrons
- Anion: H<sup>-</sup>, hydride ion has 1 proton and 2 electrons

click here to check

Picture in Nature Form	State	Most Common Ionic Charge
		
Silver		
Neon		






Halogens  Transition Metals  +1 Gas Solid  Alkali Metals  +2  
 Noble Gases  Alkaline-Earth Metals  -2  
 Liquid  -1

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Element Properties

The Elements

Answer

	Location in Periodic Table	Picture in Pure Form	State at STP	Most Common Ionic Charge
Sodium	Alkali Metals		Solid	+1
Chlorine	Halogens		Gas	-1
Calcium	Alkaline-Earth Metals		Solid	+2
Silver	Transition Metals		Solid	+1
Neon	Noble Gases		Gas	0

Example

Symbol



ion name

magnesium ion

Barium ion

phosphide ion

sulfide

Element Properties Answer

Dec 13-9:10 AM