Learning Guide 3A – Salts
Chem 1010

Introduction

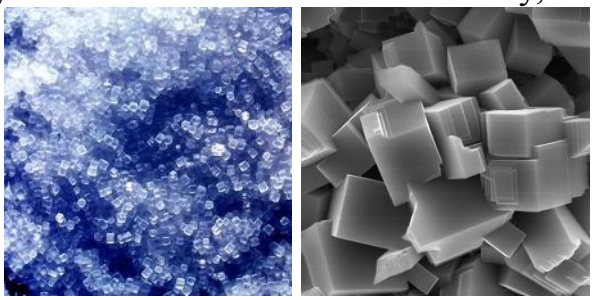
Look at the samples in the two bottles you were given.

What observations can you make about them?

A:

B:

If you could look at them more closely, here's what you would see.

A: 

B: 

Now what observations can you make?

A:

B:

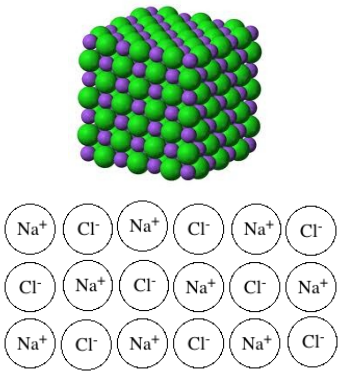
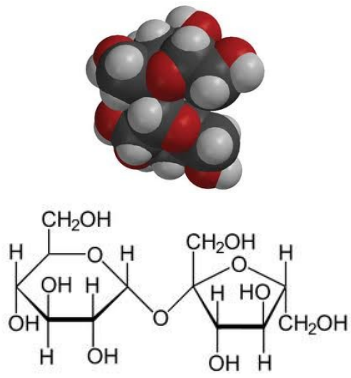
Both of these substances are safe to ingest. After tasting them, can you identify them?

A:

B:

Now that you know what they are, can you think of any other ways in which they are similar?

What ways are they different?

	table salt	table sugar
taste		
melting point		
source		
chemical name		
formula		
type of elements		
type of compound		
molecules or ions		
picture		
how atoms are held together		

A bit of review

Since ionic compounds are made of ions, we need to review what we know about ions and chemical bonds.

What is an ion?

Where does the charge come from?

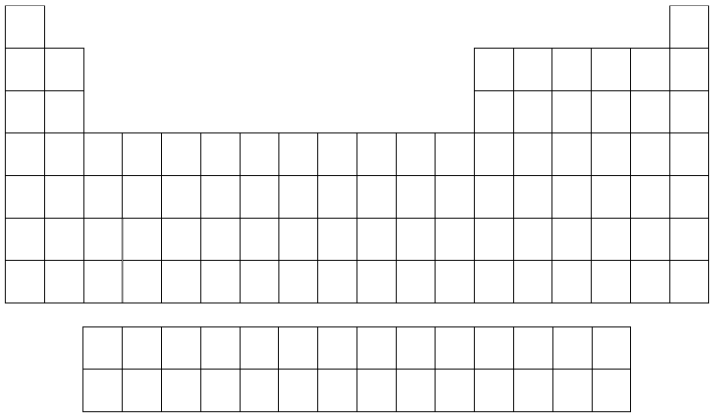
Fill in the following table:

protons	electrons	charge	symbol
8	8		
8	10		
		0	Mg
		+2	Mg^{+2}

What are positive ions called?

What are negative ions called?

Where are the nonmetal atoms? The main group metals? The transition metals?



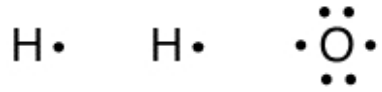
How are electrons organized?

What electrons are involved in forming chemical bonds?

Why do atoms form chemical bonds?

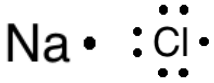
How do nonmetal atoms join to make this happen?

example: water

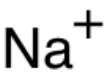


Bonding in NaCl

Can a sodium and a chlorine atom fill the octet by sharing electrons? Why or why not?

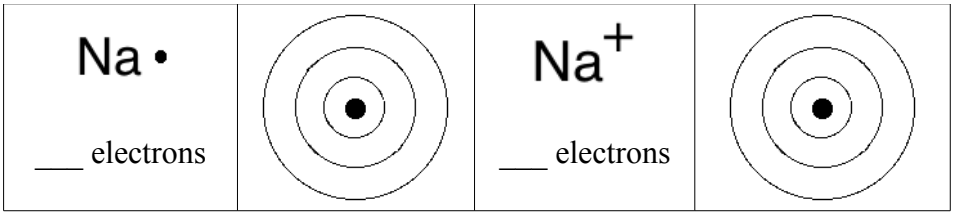


Instead, atoms that form ionic compounds _____ electrons.

	Atoms			Ions	
					
protons					
electrons					
charge					

How does the chlorine fill the octet rule?

How does sodium fill the octet rule? look at the energy levels



If you take away all the valence electrons, the next level down becomes the highest; it always has 8 electrons.

Why does table salt have the formula NaCl?

Na^+	Cl^-

Would it be possible to have an ionic compound with the formula Na_2Cl? What about $NaCl_2$?

Na_2Cl:	Na^+	Na^+	Cl^-

$NaCl_2$:	Na^+	Cl^-	Cl^-

<u>Other salts</u>

Notice that every time we have been talking about sodium chloride, we call it "table salt." That's because in chemistry, the word "salt" refers to any ionic compound.

There are several categories of salts that we will discuss. What groups do you see here?

KCl – potassium chloride [white]	K_2SO_4 – potassium sulfate [white]
$FeCl_2$ – iron (II) chloride [light green]	$FeSO_4$ – iron (II) sulfate [blue-green]
$FeCl_3$ – iron (III) chloride [red]	$Fe_2(SO_4)_3$ – iron (III) sulfate [yellow]

Which are white?

Which are colored?

Which have one nonmetal?

Which have more than one?

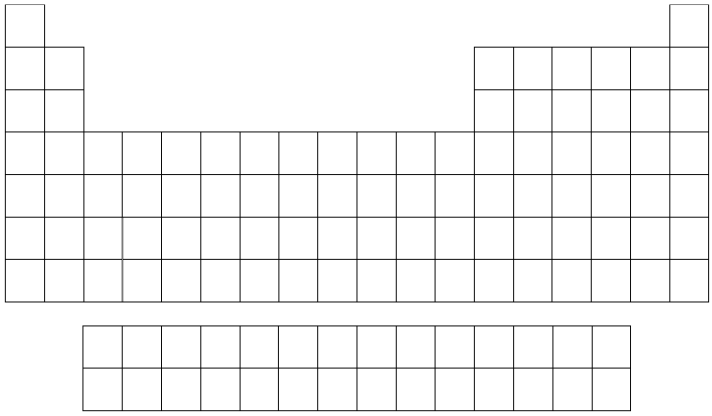
Main group metals, simple ions

Using the Periodic Table, predict what will happen to each of the following atoms when they form ionic compounds:

	valence electrons	lose/gain electrons	symbol
oxygen			
potassium			
nitrogen			
magnesium			
aluminum			
fluorine			

What pattern do you see?

If we look at all of the nonmetals and main group metals on the Periodic Table, we can see what ions they can form.



- noble gases do not form ions
- beryllium, boron, carbon, and silicon do not form ions
- the larger an atom is, the more electrons it can lose

What compounds could you make with the following ions?

	Cl^-	O^{-2}
Na^+		
Mg^{+2}		

What would these compounds be called?

-
-
-
-

Why doesn't the name give the number of atoms in the formula?

What names would the following compounds have?

NaBr

KI

CaF_2

BaS

What formulas would the following compounds have?

barium bromide

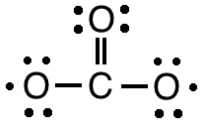
strontium sulfide

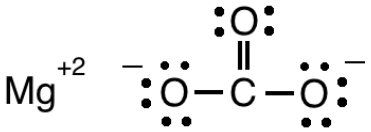
aluminum iodide

lithium oxide

Main group metals, polyatomic ions

Cl^-	Simple ions involve only one atom with a charge.
CO_3^{-2}	Polyatomic ions involve more than one atom with a charge. How does this work?





So how do you know what charge a polyatomic ion will have?

1) work out the line structure, figure out how many electrons are needed

2) look at the other ion it is with

$MgSO_4$		
KNO_3		

3) memorize them

you will be responsible to remember: CO_3^{-2}, SO_4^{-2}, NO_3^-

What compounds could you make with the following ions?

	NO_3^-	SO_4^{-2}
Na^+		
Mg^{+2}		

What would these compounds be called?

-
-
-
-

Do these names show the number of ions?

What names would the following compounds have?

$BaSO_4$

$LiNO_3$

$SrCO_3$

$Al_2(SO_4)_3$

What formulas would the following compounds have?

potassium nitrate

lithium sulfate

calcium nitrate

tin carbonate

Transition metals and simple or polyatomic ions

What is different about transition metals and inner transition metals?

How are we going to deal with this?

After studying many different compounds containing palladium, it has been found that it commonly makes ____ and ____ ions.

What compounds will palladium form with oxygen?

The following two gold compounds have been found. What charges does gold have in each compound?

AuCl		
AuN		

What compounds could you make with the following ions?

	Cl^{-}	O^{-2}
Fe^{+2}		
Fe^{+3}		

How will we name these compounds?

-
-

  What's wrong?

  Solution:

-
-

Give the formula for the following compounds.

copper (I) oxide

copper (II) oxide

manganese (II) fluoride

manganese (IV) fluoride

Give the names of the following compounds.

$FeBr_2$

$FeBr_3$

AgS

Ag_2S

What will always stay the same?

What compounds could you make with the following ions?

	NO_3^-	SO_4^{-2}
Fe^{+2}		
Fe^{+3}		

What would these compounds be called?

-
-
-
-

What names would the following compounds have?

$HgSO_4$

Hg_2SO_4

$Co(NO_3)_2$

$Co(NO_3)_3$

What formulas would the following compounds have?

chromium (III) nitrate

chromium (II) carbonate

nickel (II) nitrate

nickel (III) carbonate