

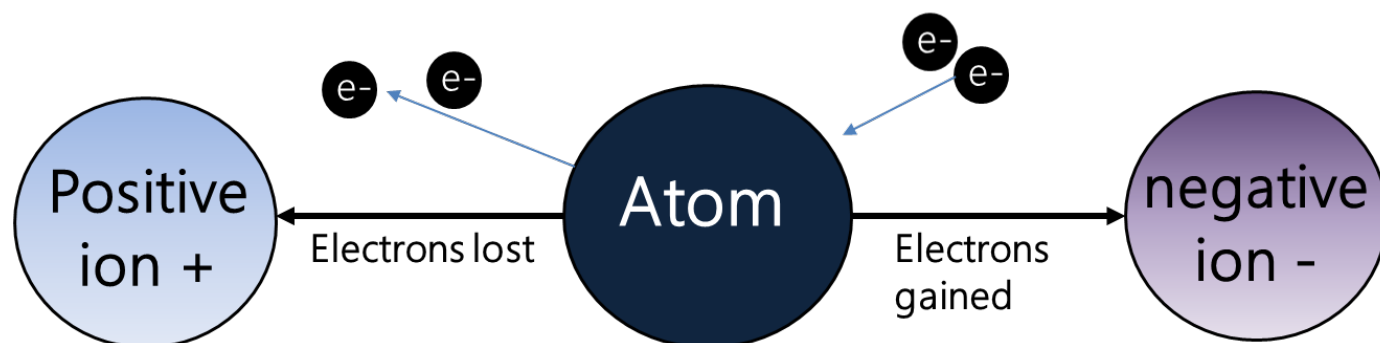


Ions

An ion is an atom or group of atoms, which has gained or lost electrons.

Elements are most stable when the outer energy level (valence shell) is full. The first energy level needs 2 electrons to be stable. The other energy levels need 8 electrons to be stable.

Elements can lose or gain electrons when they react with other chemicals to form ions and achieve stability.



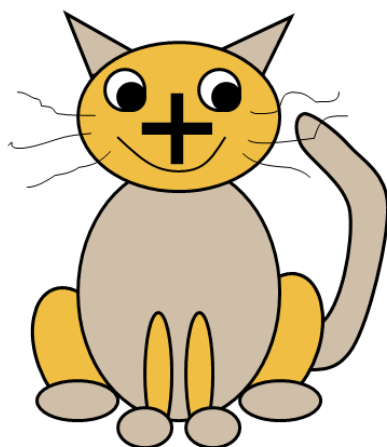
Ions form when atoms gain or lose electrons.

Ions are atoms or groups of atoms with electrical charges. Ions normally form in pairs of atoms when one or more electrons are passed between them. Depending on how many electrons are present in the outside energy level or how many are "missing" determines the total number of electrons transferred.

Atoms that lose electrons form positively charged ions, or cations.

Atoms that gain electrons form negatively charged ions, or anions.

Cation (Cat)



Metals lose electrons to form Cations. They have 1-3 electrons in their outside energy level

Anion (an Iron)



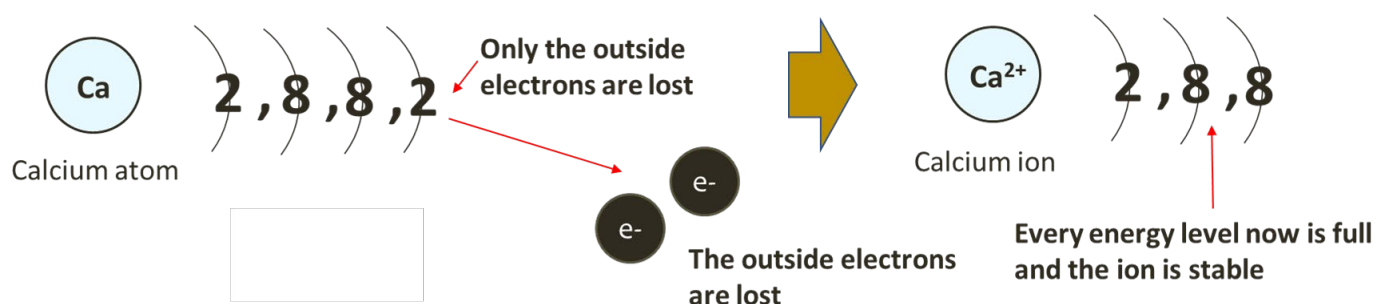
Non-Metals gain electrons to form Anions. They have 5-7 electrons in their outside energy level.

Ion configuration

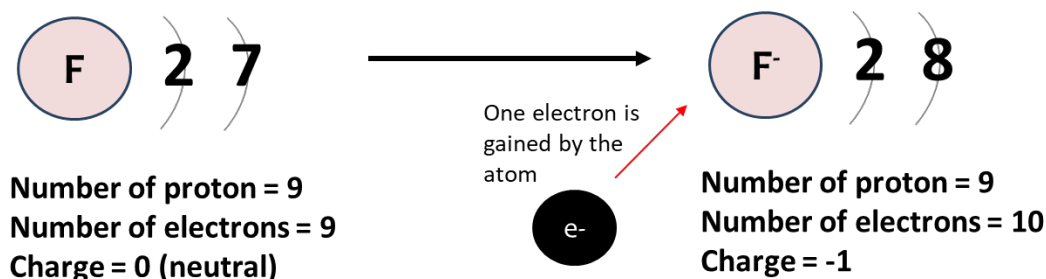
If an atom has the same number of electrons as it does protons, then it will be neutral. A negative ion will have more electrons than protons. A positive ion will have less electrons than protons.

	Atomic Number	Number of protons	Number of electrons	Electron arrangement
F ⁻	9	9	10	2,8
Ne	10	10	10	2,8
Mg ²⁺	12	12	10	2,8

Positive ions

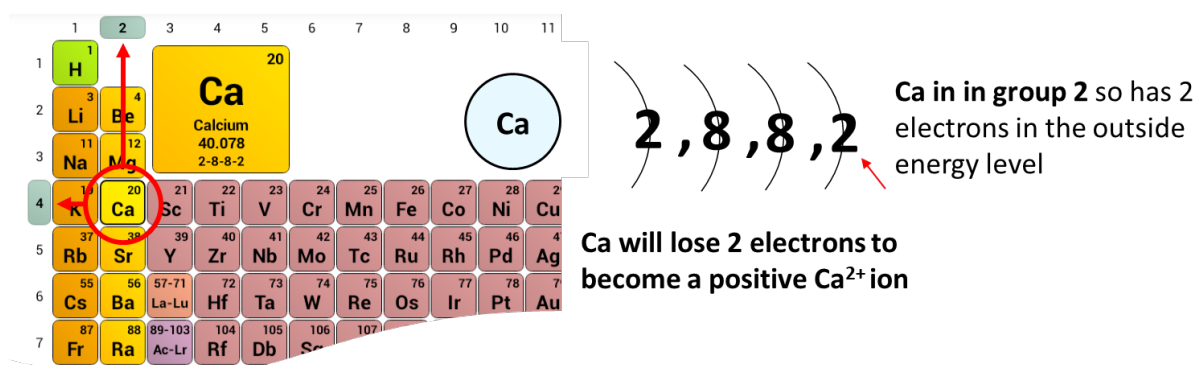


Negative ions



The (last) number of the group on a periodic table gives the number of electrons in the outside Energy Level. If there is 3 or less, in groups 1, 2 or 13 then electrons will be lost to form positive ions.

If there is 5, 6 or 7, in groups 15, 16 or 17 then electrons will be gained to form negative ions



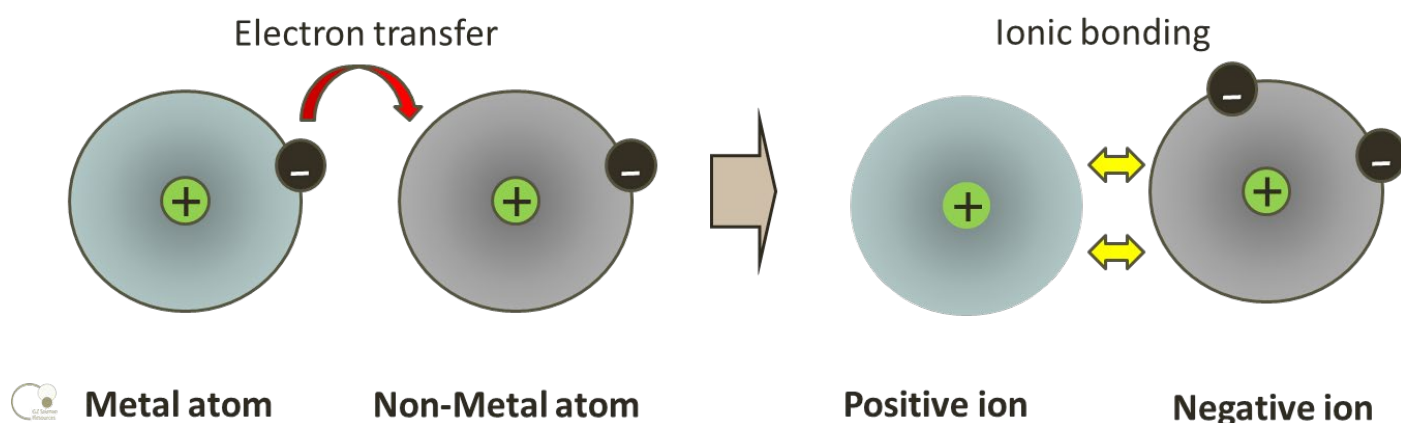
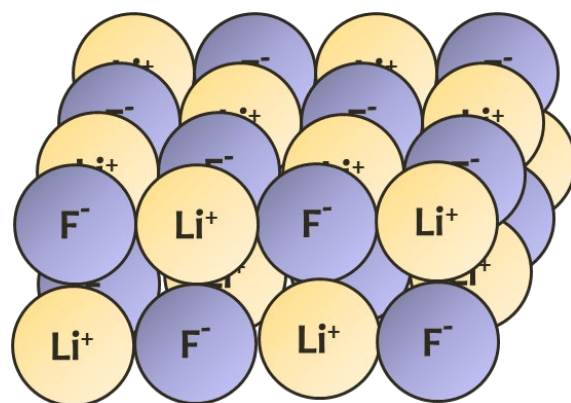
Compounds

Compounds form from two or more different elements bonded together (in the form of atoms or ions)

Ionic compounds are the product of chemical reactions between metal and non-metal ions. Ionic compounds are made up of a fixed ratio of cations and anions. They exist in huge structures in a lattice structure. We call these structures crystals.

Compounds are neutral substances. For ionic compounds, the charges of the positive ions are balanced by the charges of the negative ions.

Ionic Bonding occurs when electrons transfer from one atom to another to form ions and the resulting negative and positive ions hold together with **electrostatic attraction**. This type of bonding occurs when a **metal** and **non-metal** react and there is a **transfer of electrons** to form ions. The ions then combine in a set ratio to form a neutral compound with negative and positive charges balanced out.



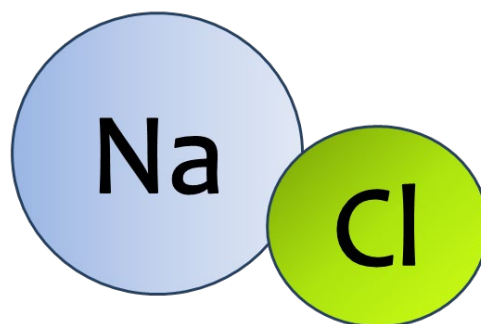
Naming Compounds

A compound is named after the atoms or ions that make it up. Many compounds are made up of ions, a positive and negative ion bonded together known as ionic compounds. Other compounds are made up of atoms bonded together.

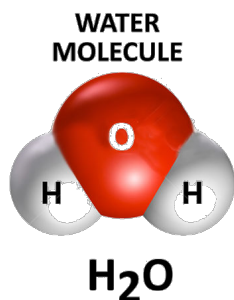
All compounds are neutral and have the same total number of protons as the total number of electrons. Some compounds have common names such as water.

Ionic compounds (made of ions bonded) have names of two parts. The positive ion (Metal) is first then followed by the negative ion (non-metal). The compound sodium chloride is made of a sodium ion bonded to a chloride ion.

Sodium chloride (NaCl)



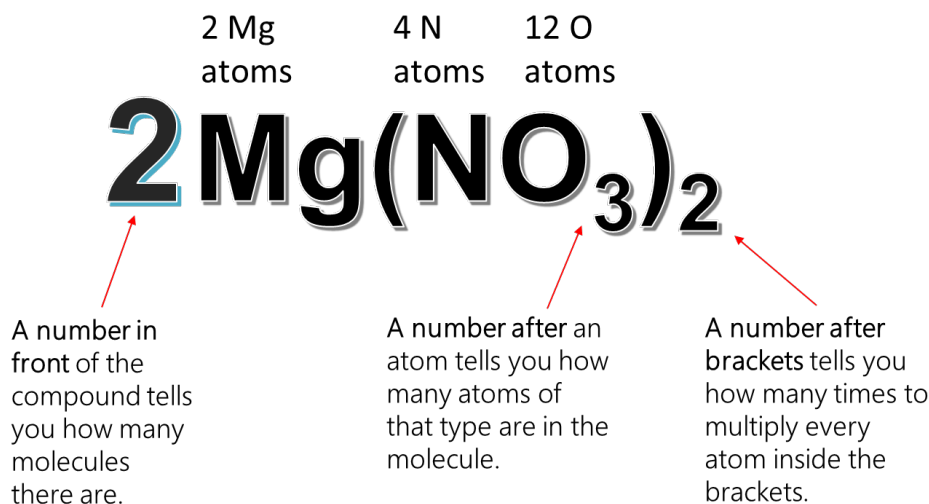
Chemical compound formula



Elements in a compound combine in fixed amounts. It is possible to write a **formula** for a compound. Each compound has a chemical formula indicating the proportions of each combined element.

This formula for water (H₂O) tells us that there are 2 Hydrogen atoms and 1 Oxygen atom in a molecule of water

Elements in a compound combine in fixed amounts. It is possible to write a formula for a compound. A formula tells you the type of atoms that are in a compound and the number of each atom.




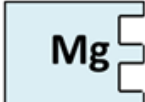




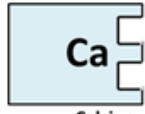
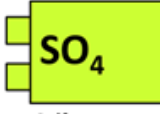
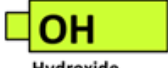

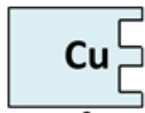
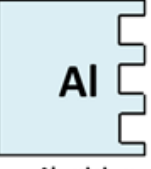
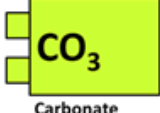
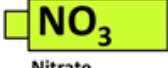
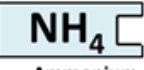
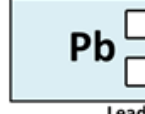



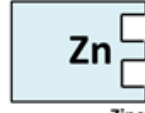



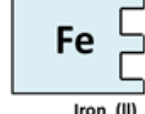
Positive Ion chart - Light shaded ions will be more commonly used in class

1+		2+		3+	
sodium	Na ⁺	magnesium	Mg ²⁺	aluminium	Al ³⁺
potassium	K ⁺	iron (II)	Fe ²⁺	iron (III)	Fe ³⁺
silver	Ag ⁺	copper (II)	Cu ²⁺	NOTE: while most positive ions in this group are made up from only one type of original element some ions are made up from a compound with more than one type of element – they have less total electrons than total protons.	
ammonium	NH ₄ ⁺	zinc	Zn ²⁺		
Hydrogen	H ⁺	barium	Ba ²⁺		
Lithium	Li ⁺	lead	Pb ²⁺		

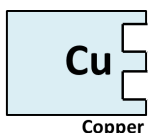
Negative Ion Chart

1-		2-	
chloride	Cl ⁻	carbonate	CO ₃ ²⁻
hydroxide	OH ⁻	sulfide	S ²⁻
hydrogen carbonate	HCO ₃ ⁻	sulfate	SO ₄ ²⁻
fluoride	F ⁻	NOTE: while many negative ions in this group are made up from only one type of original element some negative ions are made up from a compound with more than one type of element – they have more total electrons than total protons.	
bromide	Br ⁻		
nitrate	NO ₃ ⁻		

Visual ion Chart

Cation			Anion	
1+	2+	3+	2-	1-
 Hydrogen	 Magnesium	 Iron (III)	 Oxide	 Chloride
 Sodium	 Calcium		 Sulfate	 Hydroxide
 Potassium	 Copper	 Aluminium	 Carbonate	 Nitrate
 Ammonium	 Lead		 Sulfide	 Hydrogen Carbonate
 Silver	 Zinc	 Iron (III)		 fluoride
 Lithium	 Iron (II)			

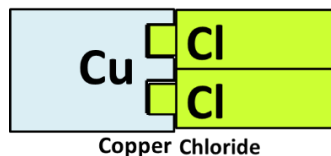
The visual method for balancing compounds



Copper forms a positive copper ion of Cu^{2+} . It loses 2 electrons – shown by the 2 “missing spaces” in the shape



Chlorine forms a negative chloride ion of Cl^- . It gains 1 electron – shown by the 1 “extra tab” in the shape

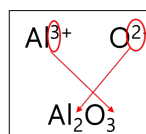


Copper chloride has a formula of CuCl_2

If we want to form a balanced ionic compound, then each space in the positive ion must be filled by a tab from the negative ion. In this case 2 chloride ions are needed for each copper ion to form copper chloride.

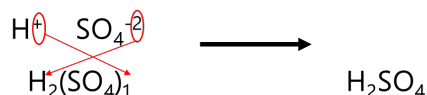
Cross and Drop method for balancing compounds

1. Write down the ions (with charges) that react to form the compound. Cation comes before Anion.



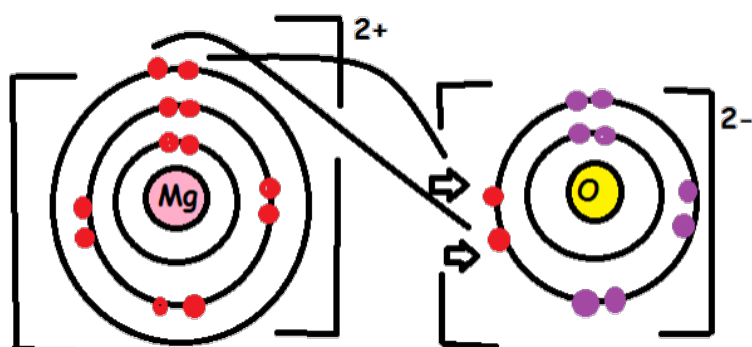
2. Cross and drop the charge numbers.
3. Place brackets around a compound ion.

4. If the numbers are both the same remove.
5. If any of the numbers are a 1 they are removed
6. Remove any brackets if not followed by a number



Charged ions make neutral Ionic Compounds (Extension)

The formula for magnesium oxide is MgO made of Magnesium ion has a charge of +2 and oxide ion has a charge of -2.



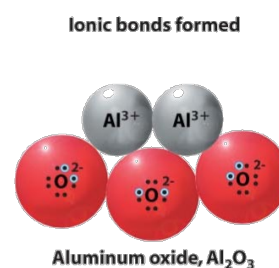
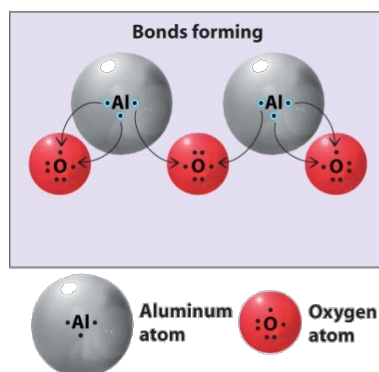
A compound overall must have no charge. Therefore, the +2 charge of magnesium ion cancels out the -2 charge of oxide ion and so the ratio of ions is one to one.

The charge on the ions arises, as magnesium must lose two electrons in order to have a full outer energy level and gets a charge of +2, and oxygen must gain two electrons in order to have a full outer energy level and gets a charge of -2.

The formula for aluminium oxide is Al_2O_3 but the Aluminium ion has a charge of +3, and oxide ion has a charge of -2.

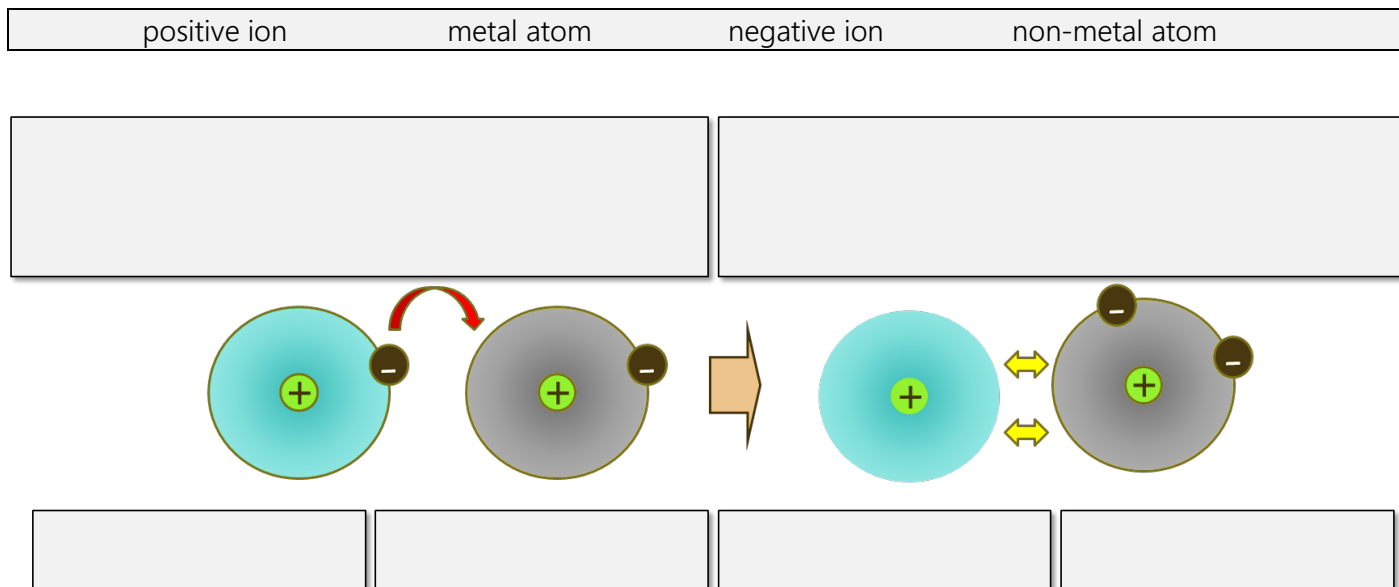
A compound overall must have no charge. Two aluminium ions with a combined charge of +6 are required to cancel out the charge on three oxide ions with a combined charge of -6.

The charge on the ions arises as aluminium must lose three electrons in order to have a full outer energy level and gets a charge of +3, and oxygen must gain two electrons in order to have a full outer energy level and gets a charge of -2





1. The diagram shows an ionic compound forming. In your own words describe what is occurring and label particles.



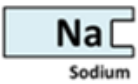

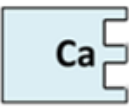
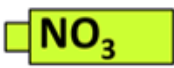
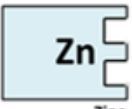

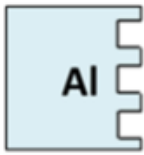
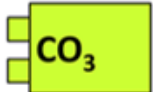
2. Count the number of atoms in each of the following formula and write them down.

K_2CO_3	<input type="text"/> K	<input type="text"/> C	<input type="text"/> O
$Ca(OH)_2$	<input type="text"/> Ca	<input type="text"/> O	<input type="text"/> H
$Zn(NO_3)_2$	<input type="text"/> Zn	<input type="text"/> N	<input type="text"/> O
$Al_2(SO_4)_3$	<input type="text"/> Al	<input type="text"/> S	<input type="text"/> O

3. Name these following ionic compounds

Formula	Name	Formula	Name
$CuSO_4$		$AgNO_3$	
$ZnCl_2$		NH_4^+Cl	
$Pb(NO_3)_2$		$FeCO_3$	
$Mg(OH)_2$		NaS	

4. Combine the following ions and write the compound formula (visual method)

Positive ion	Negative ion	Formula
 Sodium	 Oxide	
 Calcium	 Nitrate	
 Zinc	 Hydrogen Carbonate	
 Aluminium	 Carbonate	

5. Combine the following ions and write the compound formula (cross and drop method)

Cu^{2+}	SO_4^{2-}	Zn^{2+}	CO_3^{2-}	Pb^{2+}	NO_3^-	Al^{3+}	SO_4^{2-}
Mg^{2+}	S^{2-}	NH_4^+	Cl^-	Fe^{3+}	CO_3^{2-}	K^+	O^{2-}
Ca^{2+}	NO_3^-	Al^{3+}	Cl^-	Fe^{2+}	SO_4^{2-}	Mg^{2+}	HCO_3^-