Metals And Non-metals

Assess Yourself

Q. 1. Element 'M' forms a chloride with the formula MCl_2 which is sold with high melting point. To which group of the Periodic table does the element 'M' belong?

Answer: Element M should belong to group 2 of the periodic table.

Reason: Since the chloride formula formed by the metal is of the form MCl_2, the valency of the metal is +2. Also, it is high melting solid so it has to be an ionic compound and so metal should be definitely from 1st or 2nd group. But since metals of group 1 can show only +1 valency, the metal cannot be from group 1 then it is definitely from group 2. Ex: Ca, Mg etc. are 2nd group metals and satisfy this situation.

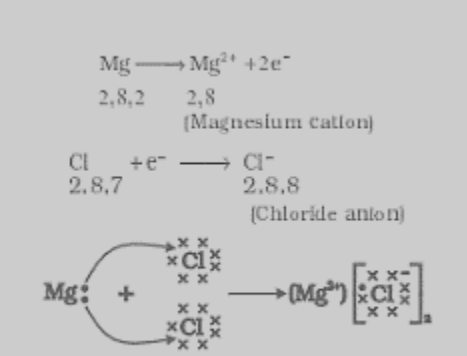


Figure 3.6 Formation of magnesium chloride

Q. 2. Show the electronic transfer in the formation of MgCl2 form its elements.

Answer: Mg >> Electronic configuration= 2,8,2 Stable form>> 2,8 hence valency= +2

Cl>> Electronic configuration= 2,8,7 Stable form>> 2,8,8 hence valency= -1

Formation of $MgCl_2$

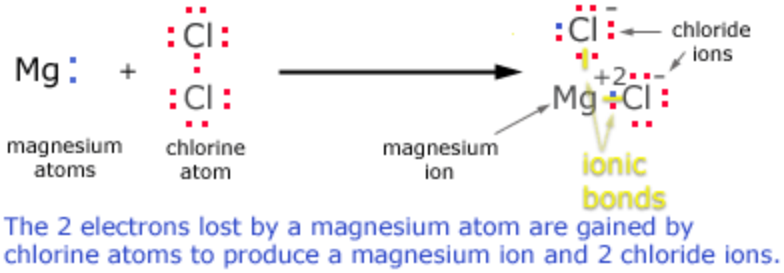
Formation of magnesium ion by donating an electron

$Mg(2,8) \rightarrow Mg^{+2} + 2e^-$

Formation of chlorine ion by accepting an electron

$Cl(2,8,7) + e^- \rightarrow Cl^-$

When 2 free chlorine atoms accept the electrons given by single magnesium ion the compound $MgCl_2$ is formed.



The 2 electrons lost by a magnesium atom are gained by chlorine atoms to produce a magnesium ion and 2 chloride ions.

Q. 3. Give reason for the following:

(a) Aluminium oxide is considered as an amphoteric oxide.

(b) Ionic compounds conduct electricity in molten state.

Answer: (a) Aluminium oxide reacts with both acidic and basic substances to give neutralization reaction and hence cannot be called a true acid as well as base. Hence it is called Amphoteric oxide.

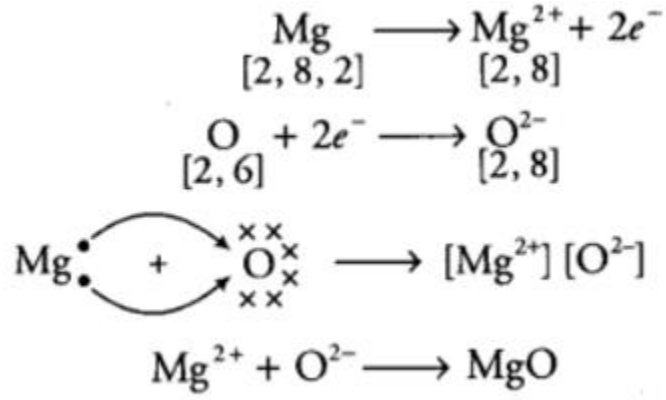
$Al_2O_3 + 6HCl \rightarrow 2AlCl_3 + 3H_2O$ ≫ Neutralisation Reaction with hydrochloric acid (behaves like a base)

$Al_2O_3 + 2NaOH \rightarrow 2NaAlO_2 + H_2O$ ≫ Neutralisation reaction with Sodium hydro oxide (behaves like an acid)

(b) Ionic compounds are bound to each other with strong attraction force. Hence they are in solid form and their ions are not mobile. When in molten state the ions become mobile and act as carriers for charge and hence conduct electricity.

Q. 4.A. Show on a diagram the transfer of electrons between the atoms in the formation of MgO. Write symbols of cation and anion present in MgO.

Answer: Cation present in MgO >>> Mg^{2+} Anion present in MgO >>> O^{2-}



Q. 4.B. Name the solvent in which ionic compounds are generally soluble.

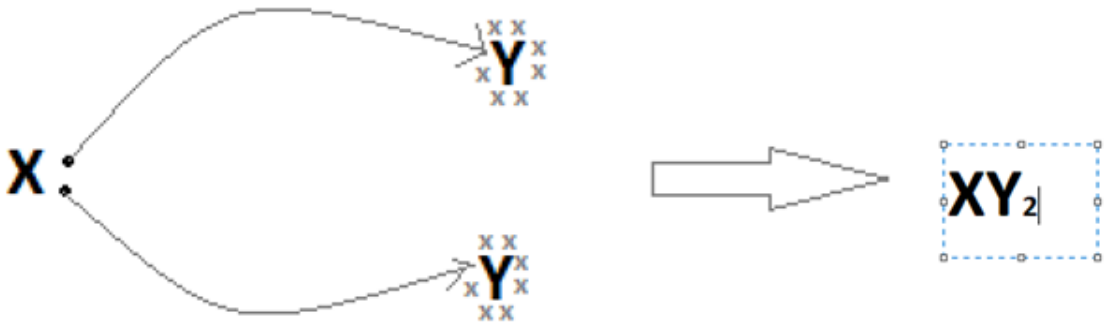
Answer: Ionic compounds are soluble in polar solvents like water.

Q. 4.C. Why are aqueous solutions of ionic compounds able to conduct electricity?

Answer: Aqueous solution of ionic compounds contains ions in mobile form which carry charge and hence help in conduction of electricity.

Q. 5. A metal 'X' loses two electrons and a non-metal 'Y' gains one electron. Show the electron dot structure of compound formed between them. Is it ionic or covalent? Does it have high melting point or low? Will it conduct electricity in solid state or in aqueous solution and why? Will it be soluble in water?

Answer: Since X loses two electrons, its valence becomes +2 and it forms the ion of the form X^{2+}. Similarly, valency of Y is -1 and its ionic form is Y^-.



Formation of compound with X and Y

Since compound is formed by ions it is ionic. Ionic compounds are High melting points, are soluble in aqueous solutions because of mobile ions and are soluble in water.

Q. 6. State reasons for the following observations:

(a) The shining surface of some metals becomes dull when exposed to air for a long time.

(b) Zinc fails to evolve hydrogen gas on reacting with dilute nitric acid.

(c) Metal sulphides occur mainly in rocks but metal halides occur mostly in sea and lake waters.

Answer: (a) Metals react with the things like moisture, oxygen, carbon dioxide to form a layer of substance like rust in iron which hides their shiny surface. This is what we call corrosion.

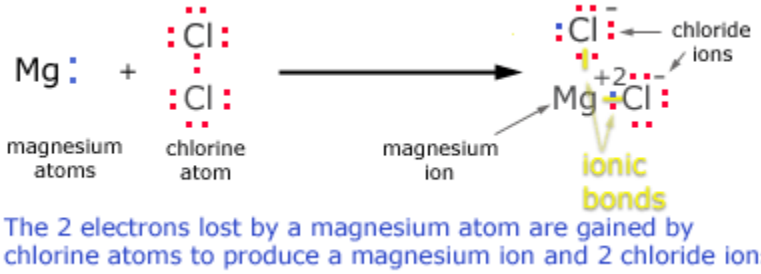
(b) Nitric acid is a strong oxidising agent and Zinc is not a very reactive metal according to the reactivity series. Hence the nitric acid oxidises the hydrogen gas which is

produced may be in the first step if reaction between acid or metal had taken place. So the hydrogen gas does not evolve.

(c) Metal sulphides are insoluble in water and halides are soluble so they get washed away in spite of getting deposited over the crust.

Q. 7. With the help of a suitable example, explain how ionic compounds are formed State any three general properties of ionic compounds.

Answer: Let us take the example of an ionic compound $MgCl_2$.it consists of cation Mg^{2+} and anion Cl^-. Mg in its pure form consists two extra electrons on of the other hand chlorine is sort of one electron to complete its octet. Hence one magnesium and two chlorine come together to transfer electrons between them and form the ionic compound. Formation of all ionic compounds take place in similar fashion.



The 2 electrons lost by a magnesium atom are gained by chlorine atoms to produce a magnesium ion and 2 chloride ions.

Three general properties of ionic compounds are as follows:

1) Soluble in polar solvents and insoluble in organic solvents.

2) Good conductor in molten form but non-conductor in solid forms.

3) Generally found in crystalline solid forms due to strong force of interaction.

Q. 8. Four metal A, B, C and D are added to the following aqueous solutions one by one. The observations made are tabulated below:

Metal	Iron (II) sulphate	Copper (II) sulphate	Zinc sulphate	Silver nitrate
A	No reaction	Reddish brown deposit	_____	_____
B	Grey deposit	_____	No reaction	_____
C	No reaction	No reaction	No reaction	White shining deposit
D	No reaction	No reaction	No reaction	No reaction

Answer the following questions based on the above observations:

(a) Which is the most active metal and why?

(b) What would be observed if B is added to a solution of copper (II) sulphate and why?

(c) Arrange the metal A, B, C and D in order of increasing reactivity.

(d) The container of which metal can be used to store both zinc sulphate solution and silver nitrate solution?

(e) Which of the above solutions can be easily stored in a container made up of any of these metals?

Answer: (a) The most reactive metal is metal B because it can react with iron and all the metals which come below in reactive series than iron. Hence in the table, it can react with all metal sulphates except zinc sulphate.

(b) A reddish brown deposit of copper will be formed as B will react with all other metal sulphates except zinc.

(c) B>A>C>D

Reason: The more reactive metal sulphates with which it can react the more reactive it is.

(d) Container of metal D will be appropriate because it doesn't react with any of the two.

(e) Zinc sulphate can be stored in any container made from these metals because it doesn't react with any of them.

Table 3.2 Activity series : Relative reactivities of metals

K	Potassium	Most reactive
Na	Sodium	
Ca	Calcium	
Mg	Magnesium	
Al	Aluminium	
Zn	Zinc	Reactivity decreases
Fe	Iron	
Pb	Lead	
H	Hydrogen	
Cu	Copper	
Hg	Mercury	
Ag	Silver	
Au	Gold	Least reactive

Q. 9. Sample of five metals 'A', 'B', 'C', 'D' and 'E' was taken and added to the following solution one by one. The results obtained have been tabulated as follows.

Metal	$FeSO_4$	$CuSO_4$	$ZnSO_4$	$AgNO_3$	$Al_2(SO_4)_3$	$MgSO_4$
A	No reaction	Displacement	No reaction	Displacement	No reaction	No reaction
B	Displacement	Displacement	No reaction	Displacement	No reaction	No reaction
C	No reaction	No reaction	No reaction	Displacement	No reaction	No reaction
D	No reaction	No reaction	No reaction	No reaction	No reaction	No reaction
E	Displacement	Displacement	Displacement	Displacement	No reaction	No reaction

Use the above table to answer the following questions about the given metals.

(a) Which of them is most reactive and why?

(b) What would you observe if 'B' is added to $CuSO_4$?

(c) Arrange 'A', 'B', 'C', 'D' and 'E' in the increasing order of reactivity.

(d) Container of which metal can store zinc sulphate and silver nitrate solution?

(e) Which of the above solution(s) can be stored in a container made of any of these metals and why?

Answer: (a) E is most reactive. Because it react with most substances.

(b) Reddish brown deposit of copper will be formed since displacement has taken place.

(c) E>B>A>C>D reason: The more it reacts the more reactive it is. Just count a number of displacements a metal will give.

(d) Container of metal D can be used for this purpose as it does not react with any of them.

(e) Aluminium and magnesium sulphates can be used to store in any container because the react with none.

Q. 10. What are alloys? How are they made? Name the constituents and uses of brass, bronze and solder.

Answer: Alloys are the solid mixture of two or more metals. They are made by first melting the constituent metals and then mixing them thoroughly in fixed proportions.

Brass: Made of copper and zinc

Bronze: Made of copper and tin

Solder: Made of lead and tin

Q. 11. (a) What is meant by corrosion? Name any two methods used for the prevention of corrosion.

(b) Suppose you have to extract metal M from its enriched sulphide ore. If M is in the middle of the reactivity series, write various steps used in extracting this metal.

Answer: (a) What is meant by corrosion? Name any two methods used for the prevention of corrosion.

The unwanted reaction of any metal with its surroundings that deteriorate its qualities is called corrosion. Two methods to prevent corrosion is Painting the metal or alloying it with some other metal in an appropriate ratio.

(b) The first step is to separate dust like and other such physical impurities from the ore. The process is called concentration of the ore. Then following steps are carried out:

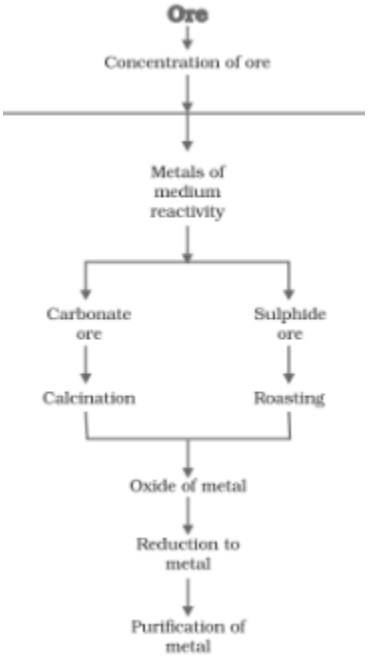
First of all sulfide ores are subjected to roasting which converts them into metal oxides.

$MS + O_2 \xrightarrow{\Delta} MO + SO_2$ >>> Roasting (heating in excess air)

The metal oxide is then heated with carbon or coke which is a good reducing agent and converts oxide into pure metal.

$MO + C \xrightarrow{\Delta} CO_2 + M$ >>>> Reduction with coke

The pure metal is then refined to get an ultra-pure metal.



Extraction of moderate reactive metals

Q. 12. Reema's maid fainted in her house. Reema took her maid to doctor. After check-up Doctor fond she suffered from anaemia Doctor advised her to take vegetables and fruits rich in iron. Doctor gave her some folic acid tablets which contain iron (II) sulphate. Reema helped her maid financially also.

(a) What values are possessed by Reema?

(b) Deficiency of which metal cause anaemia?

(c) What is a formula of folic acid?

Answer: (a) Reema has good human values. She is a person who likes to help poor.

(b) Deficiency of metal iron in our blood causes anaemia.

(c) $C_{19}H_{19}N_7O_6$ is the formula of folic acid.