

## TOPICS

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# CHEMICAL REACTION AND EQUATION

## INTRODUCTION OF PERIODIC TABLE

- Total number of elements in periodic table are 118
- 18 groups in periodic table.
- 7 periods in periodic table.
- 18<sup>th</sup> group called noble or inert gas family.
- 17<sup>th</sup> group is called halogen family.
- 14<sup>th</sup> group is called carbon family.
- First group is called alkali metal group.
- Second group is called alkali earth metal group.
- d block elements of periodic table are also called transitional element that have more than one valency Such as  $\text{Cu}^+$  &  $\text{Cu}^{2+}$ ,  $\text{Fe}^{2+}$  &  $\text{Fe}^{3+}$

## PERIODIC TABLE

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Those elements which have 3 valence electron in their outermost shell will be member of 13<sup>th</sup> group.

## SOME EXTRA VALENCY

- $\text{Ag}^{+1}$  = silver
- $\text{Ca}^{2+}$  = Calcium
- $\text{Br}^{+1}$  = Bromine
- $\text{Ba}^{2+}$  = Barium

# CHEMICAL REACTION AND EQUATION

- $\text{Cl}^{-1}$  = Chlorine
- $\text{SO}_4^{2-}$  = Sulphate
- $\text{CO}_3^{2-}$  = Carbonate
- $\text{NO}_3^{-1}$  = Nitrate
- $\text{OH}^{-1}$  = Hydroxide
- $\text{Cu}^{2+}$  = Copper cupric
- $\text{Pb}^{2+}$  = lead
- $\text{NH}_4^{+1}$  = Ammonium
- $\text{Cu}^{+1}$  = Cuprous copper
- $\text{PO}_4^{3-}$  = Phosphate
- $\text{NO}_2^{-1}$  = Nitrite
- $\text{N}^{3-}$  = Nitride
- $\text{Zn}^{2+}$  = Zinc
- $\text{K}^{+}$  = Potassium
- $\text{Hg}^{2+}$  = Mercurous mercury
- $\text{Sr}^{2+}$  = Strontium
- $\text{CaO}$  = Quick lime
- $\text{CaCO}_3$  = lime stone
- $\text{Ca(OH)}_2$  = Slaked lime

## COLOUR OF SOME COMPOUND

- $\text{CuO}$  = Copper oxide = black
- $\text{Cu}$  = Copper = red brown
- $\text{PbI}_2$  = lead iodide = yellow ppt
- $\text{Al(OH)}_3$  = Aluminum hydroxide = white ppt
- $\text{CuS}$  = Copper Sulphate = black ppt
- $\text{BaSO}_4$  = Barium Sulphate = white ppt
- $\text{AgCl}$  = silver chloride = white ppt
- $\text{CuNO}_3$  = copper nitrate = blue solution
- $\text{AgNO}_3$  = Silver nitrate = Colorless
- $\text{CuCl}_2$  = copper chloride = green Colour
- $\text{ZnSO}_4$  = Zinc Sulphate = colorless

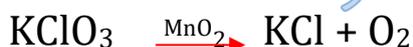
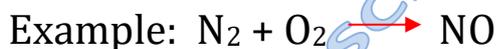
# CHEMICAL REACTION AND EQUATION

- $\text{FeSO}_4$  = Ferrous Sulphate = green solution
- $\text{CuSO}_4$  = Copper Sulphate = blue solution
- $\text{AgCl}$  = Silver chloride = white
- $\text{Ag}$  = silver = grey
- $\text{PbO}$  = lead oxide = yellow Colour
- $\text{Fe}_2\text{O}_3$  = Ferric oxide = brown Colour
- $\text{NO}_2$  = nitrogen dioxide = brown fumes
- $\text{CaCO}_3$  = calcium carbonate = white

## CHEMICAL REACTION

The process in which new substance are formed due to rearrangement of atoms between reactants

- The substance which take part in a chemical reaction are called reactants
- The new substances which produced as result of chemical reaction are called as products



Magnesium is silvery white metal mg metals is available in a science laboratory in the form of magnesium ribbon or say magnesium wire. When a magnesium ribbon is heated it burns in air with a dazzling white flame to form a white powder called as magnesium powder  $\text{MgO}$  on heating magnesium combine with oxygen present in air to form  $\text{MgO}$ .



Magnesium ribbon which we use has a coating of magnesium carbonate possibly of oxide on its surface that is formed by slow action of moist air on it so before burning magnesium ribbon is cleaned by rubbing with a sand paper to remove carbonate layer from its surface

## CHARACTERISTICS OF CHEMICAL REACTIONS

### 1. An evolution of gas

Those chemical reactions in which gas is evolved such as

- $\text{Zn} + \text{H}_2\text{SO}_4 \longrightarrow \text{ZnSO}_4 + \text{H}_2$
- $\text{C} + \text{O}_2 \longrightarrow \text{CO}_2$
- $\text{FeSO}_4 \longrightarrow \text{Fe}_2\text{O}_3 + \text{SO}_2 + \text{SO}_3$

### 2. Formation of precipitate

Those chemical reactions which are characterized by formation of ppt such as:

- $\text{BaCl}_2 + \text{H}_2\text{SO}_4 \longrightarrow \text{BaSO}_4 + \text{HCl}$
- $\text{CaOH}_2 + \text{CO}_2 \longrightarrow \text{CaCO}_3 + \text{H}_2\text{O}$
- $\text{Pb}(\text{NO}_3)_2 + \text{KI} \longrightarrow \text{PbI}_2 + \text{KNO}_3$
- $\text{AgNO}_3 + \text{NaCl} \longrightarrow \text{AgCl} + \text{NaNO}_3$

### 3. Change in colour

Those chemical reactions which are characterized by the change in colour such as:

- $\text{FeSO}_4 \longrightarrow \text{Fe}_2\text{O}_3 + \text{SO}_2 + \text{SO}_3$
- $\text{Pb}(\text{NO}_3)_2 \longrightarrow \text{PbO} + \text{NO}_2 + \text{O}_2$
- Citric Acid +  $\text{KMnO}_4 \longrightarrow$  Colourless

### 4. Change in temperature

Those chemical reactions which are characterized by a change in temperature such as:

- $\text{CaO} + \text{H}_2\text{O} \longrightarrow \text{Ca}(\text{OH})_2$
- $\text{C} + \text{O}_2 \longrightarrow \text{CO}_2$
- $\text{CaCO}_3 \longrightarrow \text{CaO} + \text{CO}_2$
- $\text{Pb}(\text{NO}_3)_2 \longrightarrow \text{PbO} + \text{NO}_2 + \text{O}_2$

### 5. Change in state

Those chemical reactions which are characterized by a change in state such as:

- $\text{C} + \text{O}_2 \longrightarrow \text{CO}_2$
- $\text{ZnS} + \text{H}_2\text{SO}_4 \longrightarrow \text{ZnSO}_4 + \text{H}_2$

# CHEMICAL REACTION AND EQUATION

- $\text{Ca(OH)}_2 + \text{CO}_2 \longrightarrow \text{CaCO}_3 + \text{H}_2\text{O}$
- $\text{CO} + \text{H}_2 \longrightarrow \text{CH}_3\text{OH}$

## TYPES OF CHEMICAL REACTION ON THE BASIS OF HEAT

### A. Endothermic reaction

Those chemical reactions in which heat is absorbed to complete the reaction are called endothermic reaction.

- $\text{CaCO}_3 \longrightarrow \text{CaO} + \text{CO}_2$
- $\text{Pb(NO}_3)_2 \longrightarrow \text{PbO} + \text{NO}_2 + \text{O}_2$
- $\text{FeSO}_4 \longrightarrow \text{Fe}_2\text{O}_3 + \text{SO}_2 + \text{SO}_3$

### B. Exothermic reaction

That chemical reaction in which heat is released along with the product is called exothermic reaction.

- $\text{CaO} + \text{H}_2\text{O} \longrightarrow \text{Ca(OH)}_2$
- $\text{C} + \text{O}_2 \longrightarrow \text{CO}_2$
- $\text{Mg} + \text{O}_2 \longrightarrow \text{MgO}$
- $\text{CH}_4 + \text{O}_2 \longrightarrow \text{CO}_2 + \text{H}_2\text{O}$

NOTE:  $\text{C}_6\text{H}_{12}\text{O}_6 + \text{O}_2 \longrightarrow \text{CO}_2 + \text{H}_2\text{O} + \text{Energy}$  (Respiration is also an exothermic reaction)

## TYPES OF CHEMICAL REACTION

### 1. Combination Reactions

Those reactions in which two or more than two substances combine to form a single product are called combination reactions such as:

- $\text{H}_2 + \text{O}_2 \longrightarrow \text{H}_2\text{O}$
- $\text{NH}_3 + \text{HCl} \longrightarrow \text{NH}_4\text{Cl}$

### 2. Decomposition Reaction

Those reactions in which a compound splits up into two or more than two substances are called decomposition reactions. The process of decomposition may take place in three forms:

# CHEMICAL REACTION AND EQUATION

## a) Thermal Decomposition



## b) Electric Decomposition



## c) Decomposition by light



These reactions are used in black & white photography

## 3. Displacement Reaction

Those reactions in which one element takes the place of another element in a compound are called single displacement reactions such as:



## 4. Double Displacement Reaction

Those reactions in which two compounds react by an exchange of ions to form two new compounds are called double displacement reaction.



## 5. Redox Reaction

Those reactions in which both oxidation and reduction take place are called Redox reaction.

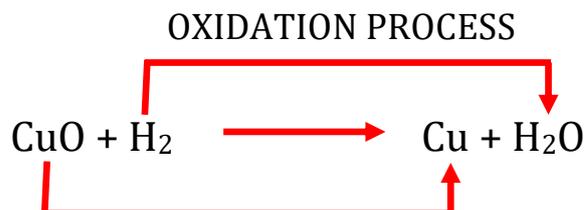
Oxidation: Addition of oxygen/Removal of Hydrogen

Reduction: Addition of Hydrogen/Removal of Oxygen

# CHEMICAL REACTION AND EQUATION

Example:

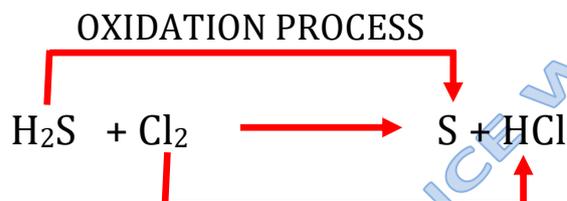
a)



REDUCTION PROCESS

- Oxidising Agent = CuO
- Reducing Agent = H<sub>2</sub>
- Oxidised Substance = H<sub>2</sub>
- Reduced substance = Cu

b)



REDUCTION PROCESS

- Oxidising Agent = Cl<sub>2</sub>
- Reducing Agent = H<sub>2</sub>S
- Oxidized substance = S
- Reduced substance = HCl

Substance present at tail of reduction is called the **Oxidising agent**

## EFFECTS OF OXIDATION

Two common effects of oxidant action are corrosions of metals & rancidity of food

a) Corrosion

Process in which metals are eaten up gradually by action of air moisture or a chemical on their surface are called corrosion.

- Corrosion of iron is called rusting of iron
- Corrosion of other metals called corrode
- $\text{Fe} + \text{O}_2 + \text{H}_2\text{O} \longrightarrow \text{Fe}_2\text{O}_3 + \text{H}_2\text{O}$

## b) Rancidity

The condition in which our food becomes spoils due to Aerial oxidation of food and marked by unpleasant smell.

### PREVENTION METHOD

Rancidity can be prevented by the adding of anti oxidants to food containing fats and oils.

- we use BHA (Butylated Hydroxy anisole) & BHT (Butylated hydroxyl toluene) as antioxidant
- Rancidity can be prevented by packaging food in nitrogen gas
- Rancidity can be prevented by storing food in air tight containers
- Rancidity can be prevented by keeping the food in a refrigerator
- By placing food away from sun light



1. Why is respiration exothermic?
2. What are the products of respiration?
3. Is burning of magnesium exothermic process?
4. Is magnesium oxide acidic, basic or neutral?
5. What is the colour of red litmus paper in  $Mg(OH)_2$ ?
6. Why do we clean magnesium ribbon with sand paper?
7. Why should we balance chemical equation?
8. What happens when iron reacts with steam?
9. Which acids are formed when  $SO_2$  and  $SO_3$  are dissolved separately in water?
10. What is limestone?
11. What is quick lime?
12. What is slaked lime?
13. What is lime water?
14. What is the colour of  $NO_2(g)$  ?

## CHEMICAL REACTION AND EQUATION

15. Which compound of silver is used in photography?
16. What happens when iron nails are put in copper sulphate solution?
17. Which is more reactive, iron or copper?
18. When two compounds exchange their ions to form two new compounds and one of them is insoluble is called.....reaction.
19. What is rancidity?
20. Why do we keep food in refrigerators?
21. Complete the following reactions balance them and classify
  - a)  $\text{CaCO}_3 \xrightarrow{\text{heat}}$
  - b)  $\text{Pb}(\text{NO}_3)_2 \xrightarrow{\text{heat}}$
  - c)  $\text{AgCl} \xrightarrow{\text{sunlight}}$
  - d)  $\text{AgBr} \xrightarrow{\text{sunlight}}$
  - e)  $\text{H}_2\text{O} \xrightarrow{\text{Electrolysis}}$
  - f)  $\text{Zn} + \text{CuSO}_4 \longrightarrow$
  - g)  $\text{Pb} + \text{CuCl}_2 \longrightarrow$
  - h)  $\text{Pb}(\text{NO}_3)_2 + \text{KBr} \longrightarrow$
  - i)  $\text{ZnO} + \text{C} \longrightarrow$
  - j)  $\text{MnO}_2 + \text{HCl} \longrightarrow$
22. What is the colour of  $\text{K}_2\text{CrO}_4$  (Potassium chromate)?
23. What happens when a chemical reaction occurs?
24. What happens when Hydrogen combines with Oxygen in the presence of an electric current?
25. Why do gold and platinum not corrode in moist air?
26. Give an example of a double displacement reaction.
27. What happens when an aqueous solution of sodium sulphate reacts with an aqueous solution of barium chloride? State the physical conditions of reactants in which the reaction between them will not take place. Write the balanced chemical equation for the reaction and name the type of reaction. (Delhi 2010)
28. When the powder of a common metal is heated in an open china dish, its colour turns black. However, when hydrogen passed over the hot black substance so formed, it regains its original colour. Based on the

## CHEMICAL REACTION AND EQUATION

above information answer the following questions: (i) what type of chemical reaction take place in each of the two given steps? (ii) Name the metal initially taken in the powder form. Write balanced chemical equations for both reactions. (AI 2010)

29. A housewife wanted her house to be whitewashed. She bought 10 kg of quick lime from the market and added it to 30 liters of water. On adding quick lime to water she noticed that the water appeared to be boiling even when it was not being heated. Give reason for her observation. Write the corresponding chemical equation and name the product formed. (CBSE Sample Paper 2009)
30. When magnesium ribbon burns in air or oxygen a product is formed. State the type of chemical reaction and name the product formed in the reaction. Write balanced chemical equation of this reaction. (AI 2009C)
31. What is a Redox reaction? When a magnesium ribbon burns in air with a dazzling flame and forms a white ash, is magnesium oxidised or reduced? Why? (Foreign 2009)
32. (a) What is the colour of ferrous sulphate crystals? How does this colour change after heating? (b) Name the products formed on strongly heating ferrous sulphate crystals. What type of chemical reaction occurs in this change? (Delhi 2009)
33. What is an oxidation reaction? Give an example of oxidation reaction. Is oxidation an exothermic or an endothermic reaction? (Delhi 2009)
34. What is observed when a solution of potassium iodide is added to a solution of lead nitrate taken in a test tube?
35. What is an oxidation reaction? Identify in the following reaction; (Delhi 2008)  $\text{ZnO} + \text{C} \longrightarrow \text{Zn} + \text{CO}$  (i) the substance oxidised and (ii) the substance reduced.
36. A solution of a substance X, is used for white washing.
- Name the substance X, and write its formula.
  - Write the reaction of the of the substance X, named in (i) above with water (HOTS)

## CHEMICAL REACTION AND EQUATION

37. Write a balanced chemical equation with state symbols for the following reactions:
- Solutions of barium chloride and sodium sulphate in water react to give insoluble barium sulphate and the solution of sodium chloride.
  - Sodium hydroxide solution (in water) reacts with HCl solution (in water) to produce sodium chloride and water.
38. Translate the following statements into chemical equations and then balance them:
- Hydrogen gas combines with nitrogen to form ammonia.
  - Hydrogen sulphide gas burns in air to give water and sulphur dioxide.
  - Barium chloride reacts with aluminium sulphate to give aluminium chloride and a precipitate of barium sulphate.
  - Potassium metal reacts with water to give potassium hydroxide and hydrogen gas.
39. What do you mean by exothermic and endothermic reactions? Give examples.
40. What do you mean by a precipitation reaction? Explain giving examples?
41. A shiny brown coloured element X, on heating in air becomes black in colour. Name the element X, and the black coloured compound formed.
42. Why do we apply paint on iron articles?
43. In the refining of silver, the recovery of silver from silver nitrate solution involved displacement by copper metal. Write down the reaction involved.
44. A metal nitrate A, on heating gives yellowish brown coloured metal oxide along with brown gas B, and a colourless gas C. Aqueous solution of A, on reaction with potassium iodide forms a yellow precipitate of compound D. Identify A, B, C, D. Identify the types of both the reactions. Metal present in A, is used in alloy which is used for soldering purposes. (HOTS)

## CHEMICAL REACTION AND EQUATION

45. Why do fire flies glow at night?
46. Which among the following are physical or chemical changes?
- Evaporation of petrol
  - Burning of Liquefied petroleum Gas (LPG)
  - Heating of an iron rod to red hot
  - Curding of milk
  - Sublimation of solid ammonium chloride.
47. Write a balanced chemical equation for each of the following reactions and also classify them. (a) Lead acetate solution is treated with dilute hydrochloric acid to form lead chloride and acetic acid solution. (b) A piece of sodium metal is added to absolute ethanol to form sodium Ethoxide and hydrogen gas. (c) Iron (III) oxide on heating with carbon monoxide gas reacts to form solid iron and liberates carbon dioxide gas. (d) Hydrogen sulphide gas reacts with oxygen gas to form solid sulphur and liquid water.
48. Why do we store silver chloride in dark coloured bottles?
49. What happens when a piece of
- Zinc metal is added to copper sulphate solution?
  - Aluminium metal is added to dilute hydrochloric acid?
  - Silver metal is added to copper sulphate solution?
50. A magnesium ribbon is burnt in oxygen to give a white compound X accompanied by emission of light. If the burning ribbon is now placed in an atmosphere of nitrogen. It continues to burn and forms a compound Y. (a) Write the chemical formula of X and Y. (b) Write a balanced chemical equation, when X is dissolved in water. (HOTS)
51. A silver article generally turns black when kept in the open for a few days. The article when rubbed with toothpaste again starts shining. (HOTS) (a) Why do silver articles turn black when kept in the open for a few days? Name the phenomenon involved. (b) Name the black substance formed and give its chemical formula.

## CHEMICAL REACTION AND EQUATION

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52. What happens when Zinc granules are treated with dilute solution of  $\text{H}_2\text{SO}_4$ ,  $\text{HCl}$ ,  $\text{HNO}_3$ ,  $\text{NaCl}$  and  $\text{NaOH}$ , also write the chemical equations if reaction occurs. (HOTS)
53. On adding a drop of barium chloride solution to an aqueous solution of sodium sulphate, white precipitate is obtained.
- Write a balanced chemical equation of the reaction involved.
  - What other name can be given to this precipitation reaction?
  - On adding dilute hydrochloric acid to the reaction mixture, white precipitate disappears. Why?

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