CHEMISTRY CLASS -X

CHAPTER -1
MODULE 1/4

CHEMICAL REACTIONS
AND EQUATIONS

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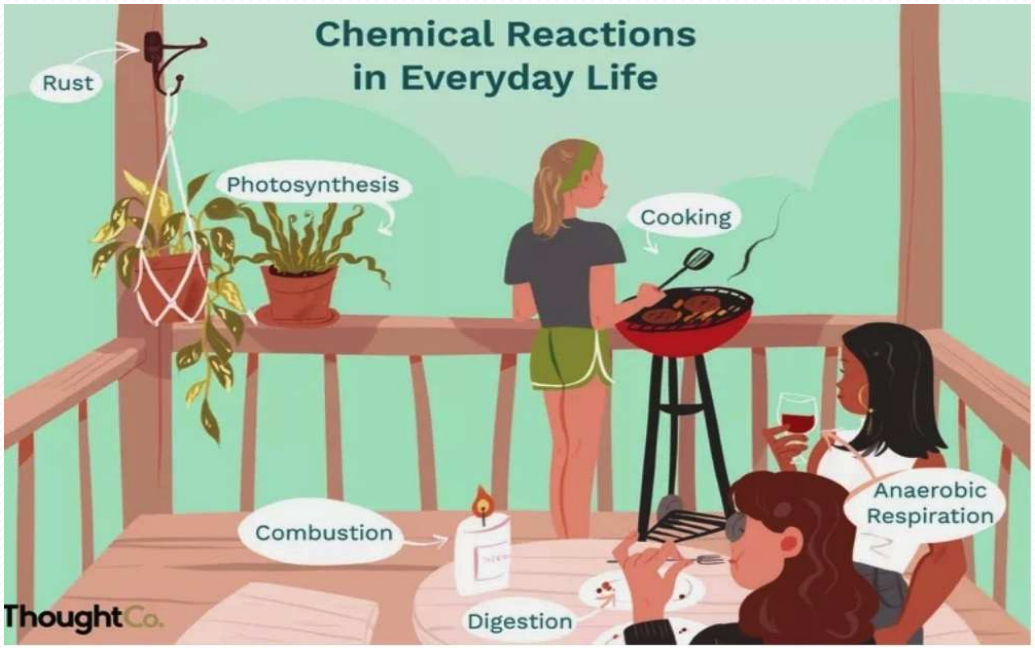
OUTLINE

- CHEMICAL CHANGE
- SOME IMPORTANT CHEMICAL REACTIONS
- CHEMICAL EQUATION
- WRITING A CHEMICAL EQUATION
- BALANCING THE CHEMICAL REACTION

CHEMICAL CHANGE

- Chemistry happens in the world around you, not just in lab.
- Matter interacts to form new products through a process called a chemical reaction or chemical change.
- Everytime you cook or clean , it's chemistry in action.
- Your body lives and grows, thanks to chemical reactions
- There are reactions when you take medications, light a match , take a breath.There are thousands of reactions we experience as we go about our day.
- Chemical change always leads to formation of a new substance



Characteristics of chemical change

Chemical change is accompanied by-

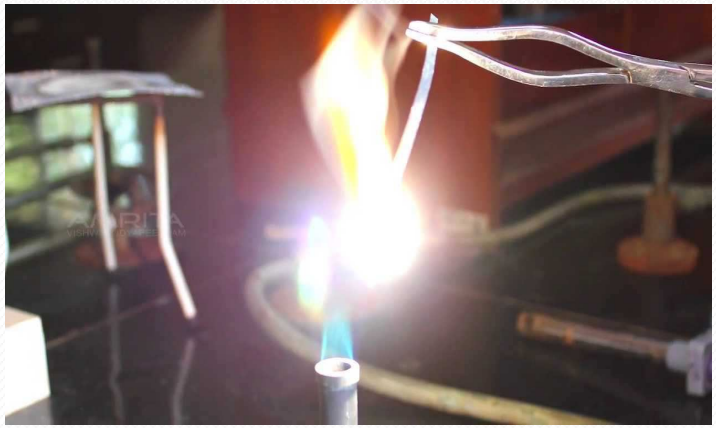
- Formation of new substance
- New substance differ in it's properties from the constituents of which it is formed.
- Heat released or absorbed will be in large amount.
- New force of attraction will form between the constituent particles during a chemical change.
- Chemical change is accompanied by evolution of heat,light ,change in colour

Some Important Chemical Reactions

- Activity 1.1(NCERT Text)

  Experiment-Clean a magnesium ribbon about 2 cm long by rubbing it with sandpaper.Hold it with a pair of tongs. Burn it using a spirit lamp or burner and collect the ash so formed in a watch-glass.
- **Observation**-magnesium ribbon burns with a dazzling white flame and changes into a white powder.
- **Inference**-The white powder formed is magnesium oxide. It is formed due to the reaction between magnesium and oxygen present in the air. Reaction is exothermic. Magnesium oxide is basic in nature.

  $2Mg + O_2 \longrightarrow 2MgO$
- **Note**- Magnesium ribbon should be cleaned(rubbed with sand paper) to remove undesirable substances formed at the surface of the metal due to oxidation.
- Wear glasses while performing the experiment because white bright light is harmful to eyes.



- Activity (1.2) NCERT Text

EXPERIMENT

- Take lead nitrate solution in a test tube. Add potassium iodide solution to this.

OBSERVATION

- Yellow precipitate is formed

INFERENCE

- Yellow precipitate(insoluble mass formed during a reaction) is Lead Iodide. It's a double displacement reaction.

$Pb(NO_3)_2 + 2KI \rightarrow PbI_2$ (yellow precipitate) $+ 2KNO_3$

Reaction of lead nitrate and potassium iodide

- Activity 1.3NCERT text
- **EXPERIMENT**

  Take a few zinc granules in a conical flask or a test tube. Add dilute hydrochloric acid or sulphuric acid to this.
- **OBSERVATION**-Colourless and odourless gas is evolved. Gas burns with pop sound. Temperature rises.
- **INFERENCE**- Zinc reacts with dilute acid to release hydrogen gas which burns with pop sound. Reaction is exothermic(heat is released).

Zn +2dilHCl → ZnCl2 + H2 (colourless odourless gas)

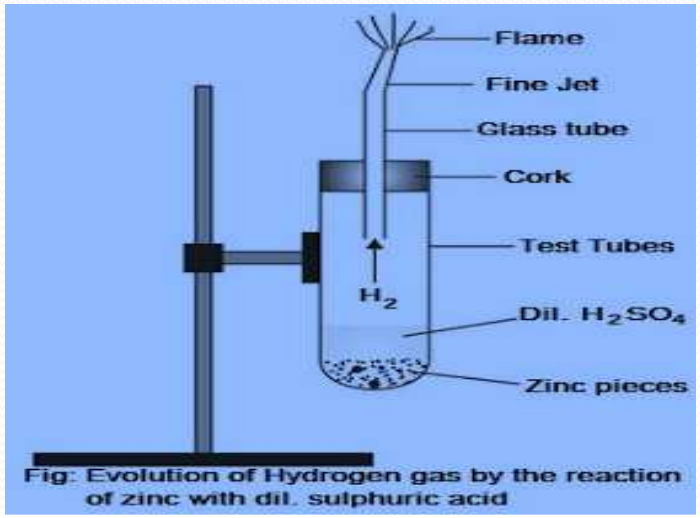
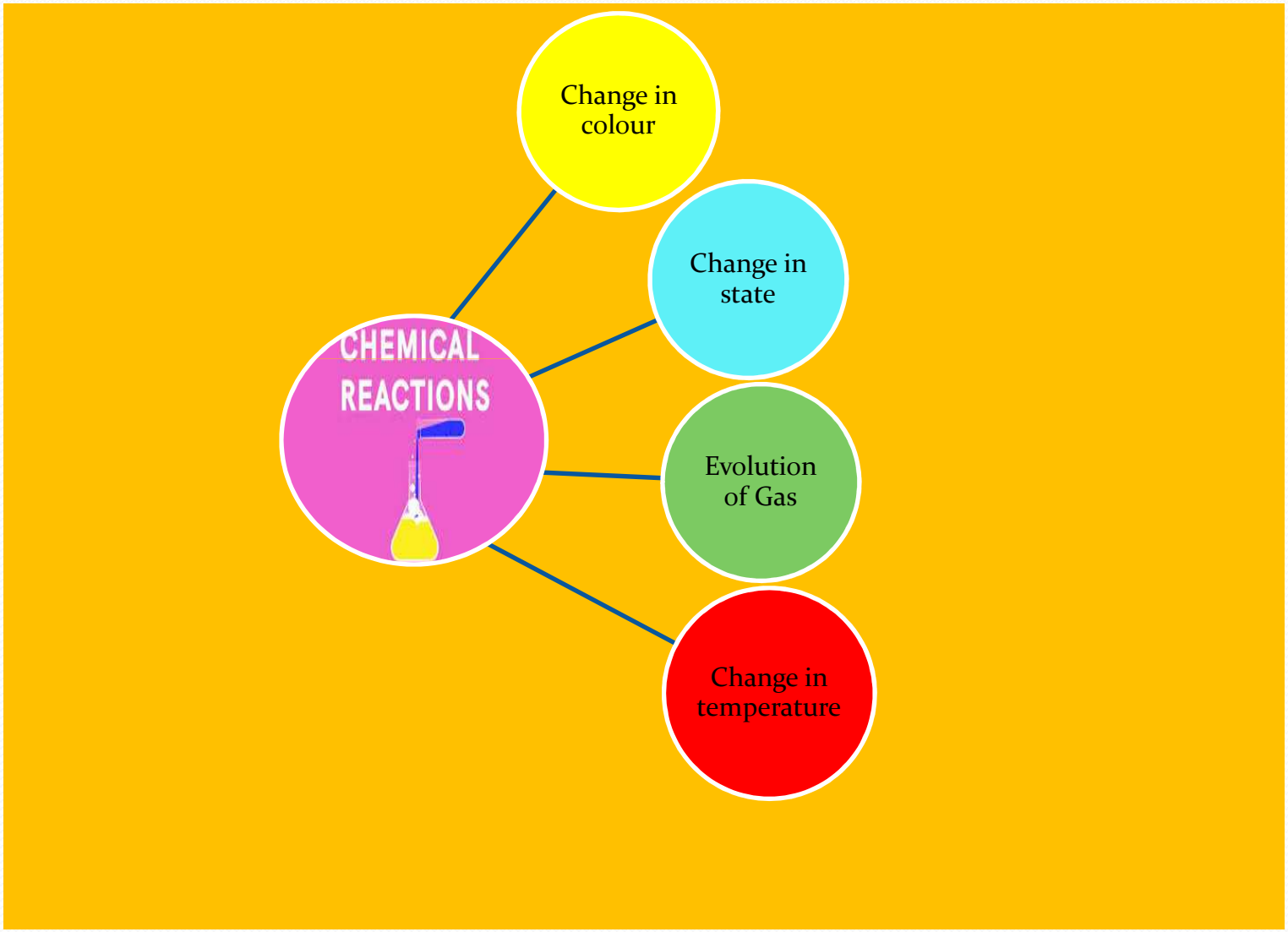


Fig: Evolution of Hydrogen gas by the reaction of zinc with dil. sulphuric acid

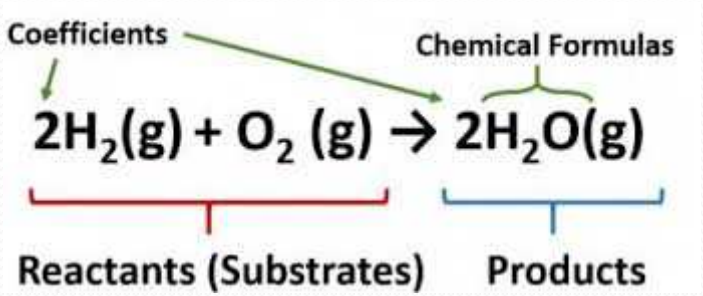
Signs of a chemical Reaction



Signs of a chemical reaction

CHEMICAL EQUATION

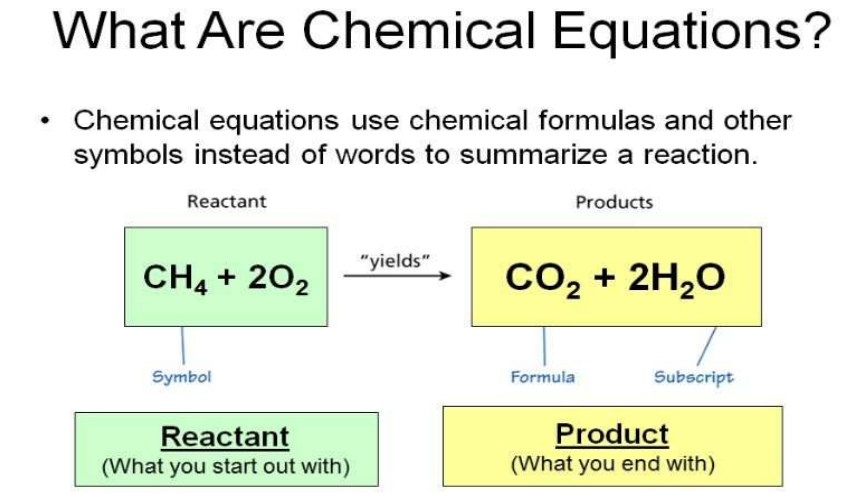
- A **chemical equation** is the symbolic representation of a chemical reaction in the form of symbols and formulae, wherein the reactant entities are given on the left-hand side and the product entities on the right-hand side. The first chemical equation was diagrammed by **Jean Beguin** in 1615.



Jean Beguin

Writing a chemical equation

- In a chemical equation ,the reactants are written on the left, and the products are written on the right.
- The coefficients next to the symbols of entities indicate the number of moles of a substance produced or used in the chemical reaction.
- Reactants and products are separated by an arrow.
- Chemical equation should contain information about the state of products and reactants, whether aqueous(aq),solid(s),liquid(l),or (gas)
- If the reaction requires energy, it is often indicated above the arrow. A capital Greek letter delta (Δ) is written on top of the reaction arrow to show that energy in the form of heat is added to the reaction; *hν* is written if the energy is added in the form of light.
- For any chemical equation in a closed system, the mass of the reactants must equal the mass of the products. Therefore, there must be the same number of atoms of each element on each side of a chemical equation.



Balanced Chemical Equations

- Every chemical equation adheres to the law of conservation of mass, which states that matter cannot be created or destroyed. Therefore, there must be the same number of atoms of each element on each side of a chemical equation.
- Use coefficients of products and reactants to balance the number of atoms of an element on both sides of a chemical equation.
- When an equal number of atoms of an element is present on both sides of a chemical equation, the equation is balanced.
- $Mg + O_2 \longrightarrow MgO$  Skeletal of the equation
- $2Mg + O_2 \longrightarrow 2MgO$  Balanced Equation

Steps involved in balancing the equation

- Let us try to balance the following chemical equation –
- **$Fe + H_2O \rightarrow Fe_3O_4 + H_2$**
- **Step I: To balance a chemical equation, first write the skeletal of the reaction**

  $Fe + H_2O \rightarrow Fe_3O_4 + H_2$
- **Step II: List the number of atoms of different elements present in the** unbalanced equation. To equalise the number of atoms, it must be remembered that we cannot alter the formulae of the compounds or elements involved in the reactions. For example, to balance oxygen atoms we can put coefficient '4' as 4 H_2O and not H_2O_4 or $(H_2O)_4$. Now the partly balanced equation becomes–

  $Fe + 4\ H_2O \rightarrow Fe_3O_4 + H_2$

- **Step III: It is often convenient to start balancing with the compound** that contains the maximum number of atoms. It may be a reactant or a product. In that compound, select the element which has the maximum number of atoms. Using these criteria, we select Fe_3O_4 and the element oxygen in it. There are four oxygen atoms on the RHS and only one on the LHS.
- To equalise the number of atoms, it must be remembered that we cannot alter the formulae of the compounds or elements involved in the reactions.
- $Fe + 4\ H_2O \rightarrow Fe_3O_4 + H_2$ (partly balanced equation)
- **Step IV: Fe and H atoms are still not balanced. Pick any of these elements** to proceed further. Let us balance hydrogen atoms in the partly balanced equation.To equalise the number of H atoms, make the number of molecules of hydrogen as four on the RHS.
- To equalise the number of H atoms, make the number of molecules of hydrogen as four on the RHS.
- The equation would be –
- $Fe + 4\ H_2O \rightarrow Fe_3O_4 + 4\ H_2$ (partly balanced equation)

- **Step V: Examine the above equation and pick up the third element which** is not balanced. You find that only one element is left to be balanced,that is, iron. To equalise Fe, we take three atoms of Fe on the LHS.
- $3\ Fe + 4\ H_2O \rightarrow Fe_3O_4 + 4\ H_2$
- **Step VI: Finally, to check the correctness of the balanced equation, we** count atoms of each element on both sides of the equation.
- $3Fe + 4H_2O \rightarrow Fe_3O_4 + 4H_2$ (balanced equation)
- **Step VII: *Writing Symbols of Physical States*** The balanced becomes
- $3Fe(s) + 4H_2O(g) \rightarrow Fe_3O_4(s) + 4H_2(g)$
- Sometimes the reaction conditions, such as temperature, pressure,catalyst, etc., for the reaction are indicated above and/or below the arrow in the equation. For example –
- $CO(g) + 2H_2(g) \xrightarrow{340atm} CH_3OH(l)$

Let us summarise the important steps for balancing the equation

The 4 steps;

1. Write the reaction down in words. This is often called the word equation

2. Replace each name with the correct symbol or formula. Symbols are used for elements, a formula for a compound

3. Add details about physical state and conditions if known. (s,l,g or aq)

4. Balance the equation (the mass on both sides must be the same)

THANK YOU