

CHEMICAL REACTIONS AND EQUATIONS

CHEMICAL REACTIONS are the processes in which new substances with new properties are formed.

- In chemical reaction, atoms of one element do not change into those of another element, only a rearrangement of atoms takes place i.e. breaking and formation of bonds between atoms. The substance which react or undergo chemical change are called REACTANTS whereas the new substances formed are known as PRODUCTS.

- The conversion of reactants into products in a chemical reaction is often accompanied by some features which can be observed easily. These are summarized as follows -

1. CHANGE IN STATE - e.g. on burning of wax (of candle), water and  $\text{CO}_2$  is formed. Here wax is solid, water is liquid and  $\text{CO}_2$  is gas. Thus during combustion of wax, physical state changes from solid to liquid and gas.

2. CHANGE IN COLOUR - Some reactions are characterized by change in colour e.g. sulphur dioxide when reacts with potassium dichromate, the colour of the solution changes from orange to green.

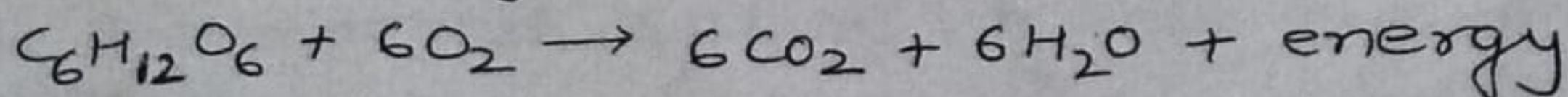
3. EVOLUTION OF GAS - e.g. zinc on reaction with dilute sulphuric acid gives hydrogen gas.

4. FORMATION OF A PRECIPITATE - e.g. when potassium iodide solution is added to lead nitrate, a yellow coloured precipitate of lead iodide is formed.

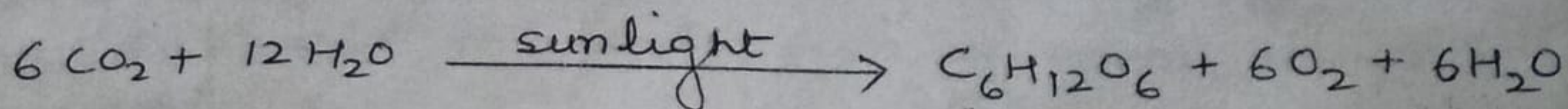
- when dilute sulphuric acid is added to barium chloride solution, white coloured precipitate of barium sulphate is formed.

5. CHANGE IN TEMPERATURE - Some chemical reactions are characterized by a change in temperature e.g. the chemical reaction between quick lime and water to form slaked lime is characterized by increase in temperature (EXOTHERMIC REACTIONS). In few cases, the temperature is decreased (ENDOTHERMIC REACTIONS) e.g. when ammonium chloride is added to barium hydroxide to form barium chloride, ammonia and water is characterized by decrease in temperature.

RESPIRATION is an exothermic process because energy is produced during the



while PHOTOSYNTHESIS is an endothermic process as sunlight is absorbed to form glucose from carbon dioxide and water -





BALANCED CHEMICAL EQUATION - A balanced chemical equation have equal number of atoms of different elements in the reactants and products.

- balancing of chemical equation is done to satisfy the law of conservation of mass in a chemical reaction i.e. mass can neither be created nor destroyed.

TO MAKE EQUATIONS MORE INFORMATIVE - The chemical equation can be made more informative in three ways -

1. Indicate physical state of reactants and products -

- solid state is indicated by the symbol (s).
- liquid state is indicated by the symbol (l)
- aqueous solution (solution made in water) is indicated by the symbol (aq)
- gaseous state is indicated by the symbol (g).

2. Indicate heat changes in an equation - For exothermic reaction "+ Heat" is written on the product side while for endothermic reactions "+ Heat" is written on the reactant side.

3. Indicate the conditions under which reaction takes place -

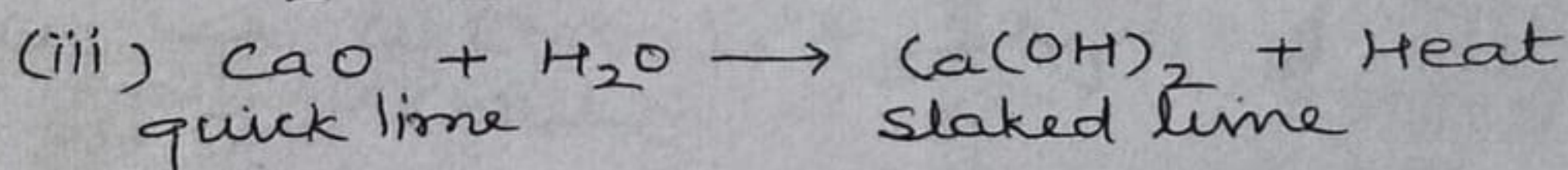
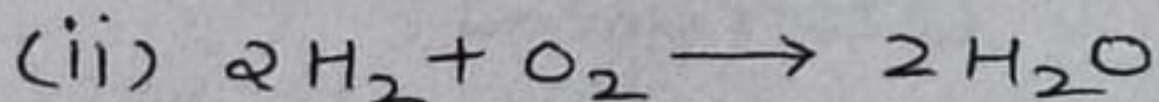
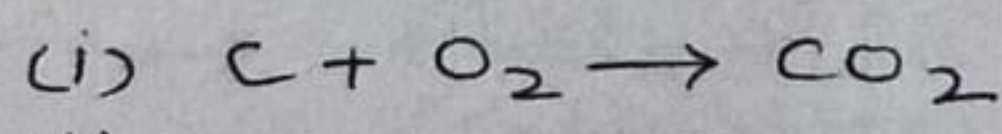
If heat is required for a reaction to take place, then delta ( $\Delta$ ) is put over the arrow of equation.

- if the reaction takes place in the presence of catalyst, the formula or symbol of catalyst is also written above or below the arrow of equation.

- the temperature and pressure at which the reaction takes place can also be mentioned above or below the arrow.

## TYPES OF CHEMICAL REACTIONS -

1. COMBINATION REACTIONS - are those reactions in which two or more substances combine to form a single substance e.g.



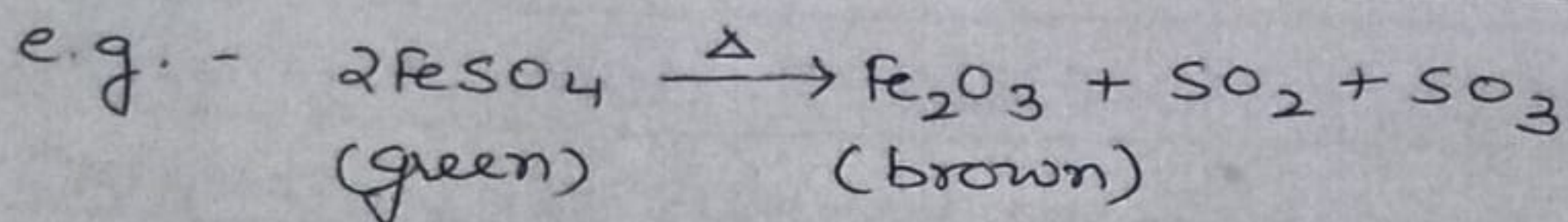
- Solution of slaked lime is applied on the wall for white washing. Calcium hydroxide slowly reacts with  $CO_2$  in air to form a thin layer of calcium carbonate which gives a shiny finish to walls -



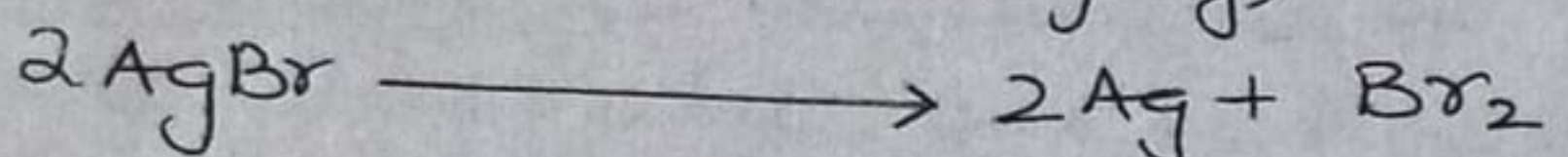
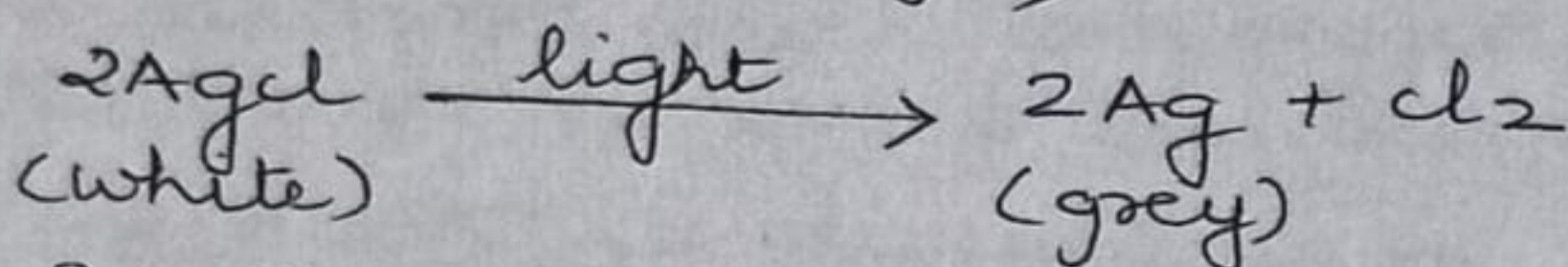
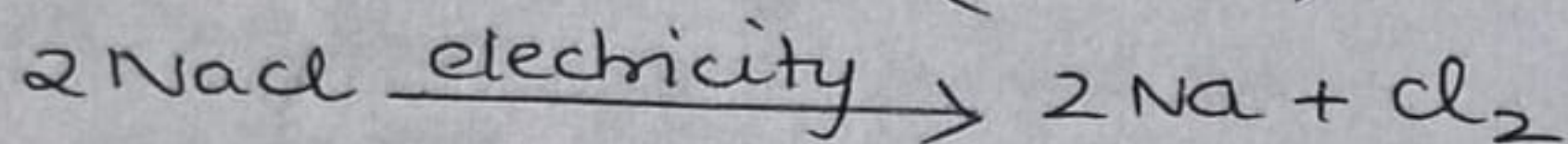
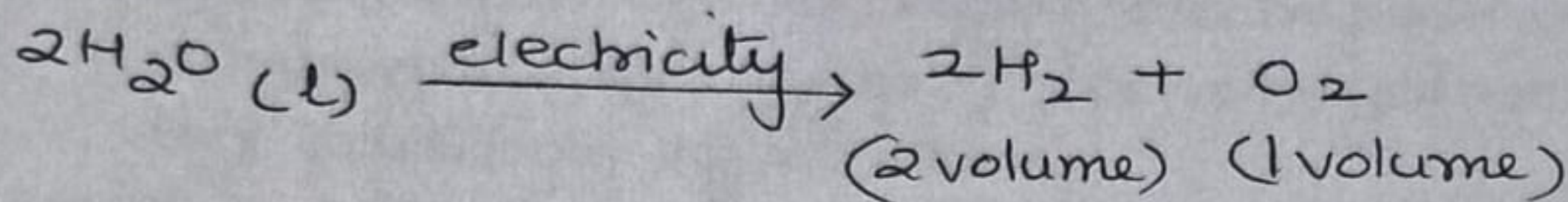
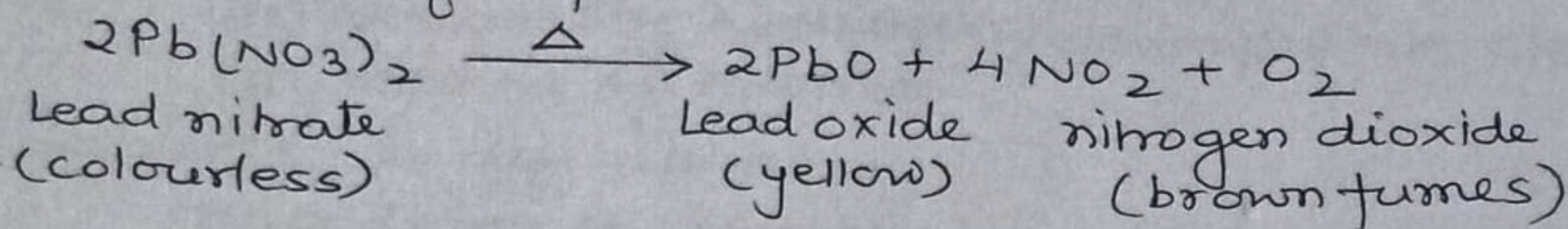
2. DECOMPOSITION REACTIONS - are those reactions in which a compound splits up into two or more simpler substances.

- it is just the opposite of combination reactions.
- The decomposition reactions are carried out by applying heat, light or electricity as they provide energy to break the into two or more simpler compounds.





- smell of burning sulphur comes due to formation of sulphur dioxide.

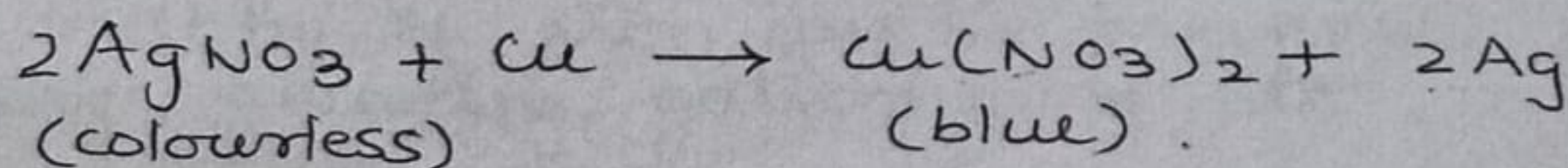
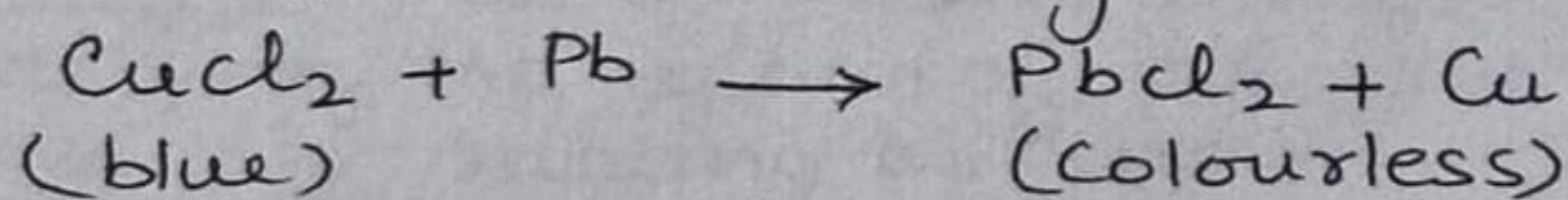
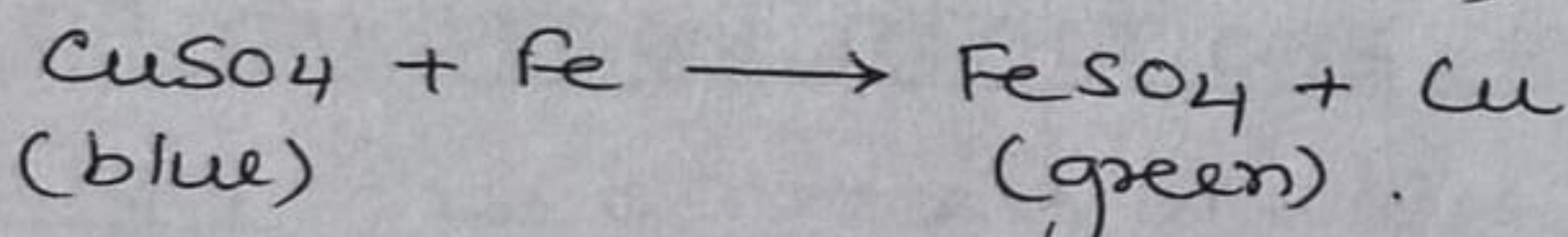
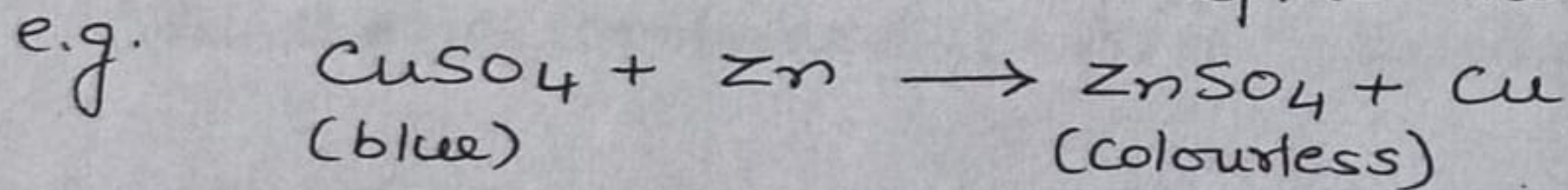


} These reactions are used in black and white photography.

- All the decomposition reactions are endothermic reactions except decomposition of vegetable matter into compost which is an example of exothermic reaction.

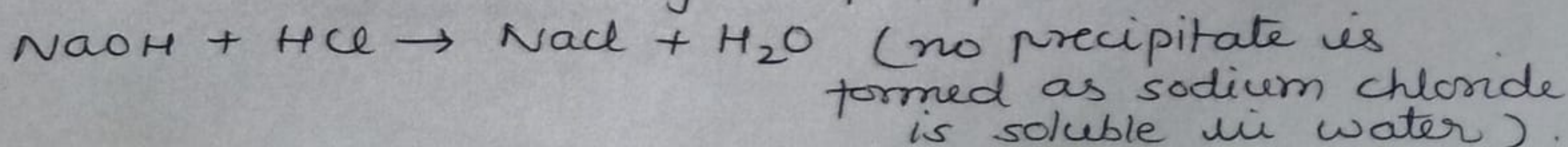
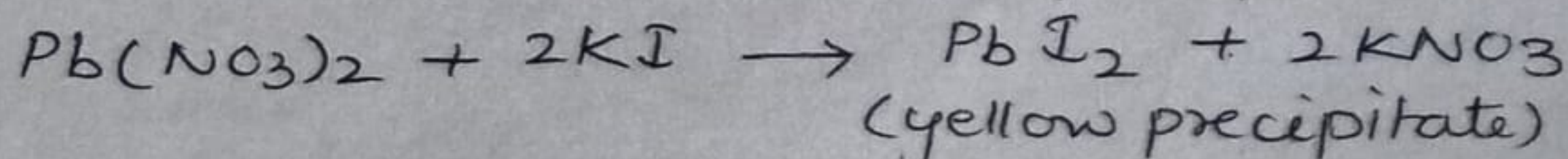
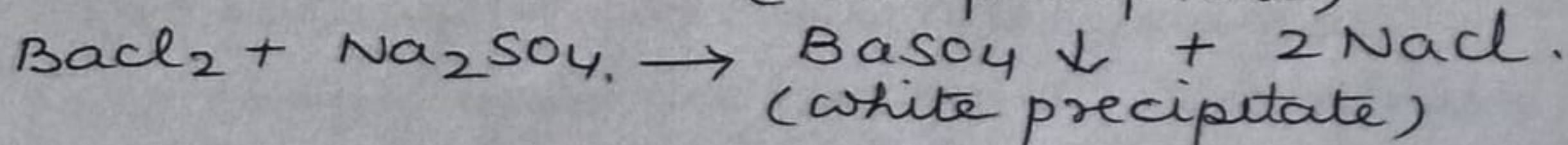
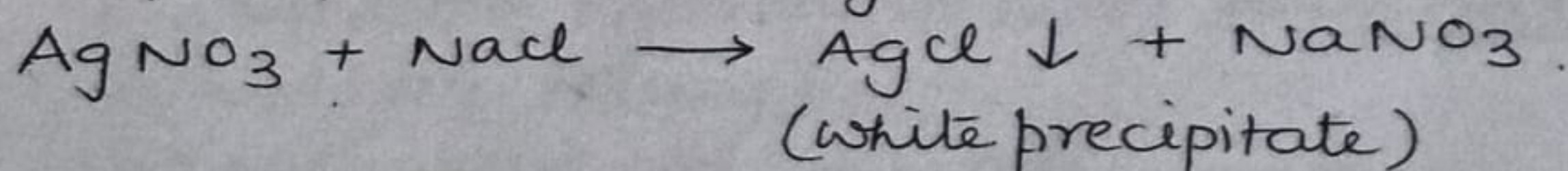
3. DISPLACEMENT REACTIONS - are those reactions in which one element takes the place of another element in a compound.

- more reactive element can displace the less reactive element



4. DOUBLE DISPLACEMENT REACTIONS - are those reactions in which two compounds react by an exchange of ions to form new compound.

- this occurs in solution and one of the product being insoluble precipitates out e.g. -





## 5. OXIDATION AND REDUCTION (REDOX) REACTIONS -

- OXIDATION is defined as -

- (i) addition of oxygen/electronegative element
- (ii) removal of hydrogen/electropositive element
- (iii) removal of electron.

- REDUCTION is defined as -

- (i) addition of hydrogen/electropositive element
- (ii) removal of oxygen/electronegative element
- (iii) addition of electrons.

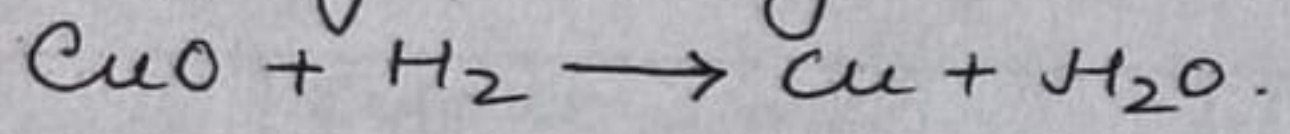
- OXIDISING AGENT is defined as -

- (i) the substance which give oxygen or removes hydrogen
- (ii) the substance which can accept electrons.

- REDUCING AGENT is defined as -

- (i) the substance which give hydrogen or removes oxygen
- (ii) the substance which can give electrons.

- reduction and oxidation always occur simultaneously.  
- the substance which gets oxidised acts as reducing agent, and the substance which gets reduced act as an oxidising agent. e.g. in the following reaction.



Substance oxidised :  $\text{H}_2$  , reducing agent :  $\text{H}_2$   
Substance reduced :  $\text{CuO}$  , oxidising agent :  $\text{CuO}$

## EFFECTS OF OXIDATION REACTIONS IN EVERYDAY LIFE -

(i) CORROSION - is a process in which metals are eaten up gradually by the action of air and moisture on their surface e.g. rusting of iron.

- the rusting of iron can be prevented by painting, oiling, greasing, galvanizing etc.

(ii) RANCIDITY - The condition produced by aerial oxidation of fats and oil is marked by unpleasant smell and taste is called rancidity.

- the rancidity of food can be prevented by -

(a) addition of antioxidants in food e.g. BHA (butylated hydroxy anisole) and BHT (butylated hydroxy toluene).

(b) packaging food in nitrogen gas

(c) storing food in airtight containers.