Experiment - 1

TYPES OF REACTIONS ——————

Combination, Decomposition, Displacement & Double Displacement.

AIM :

- Perfoeming and observing the actions of :-

1) Water on quickline
2) Heat on ferrous sulphate crystals.
3) Iron nails dipped in copper sulphate solutions
4) Reaction between sodium sulphate and barium chloride solution

on the following reactions :-

1) Combination Reaction
2) Decomposition reaction.
3) Displacement reaction.
4) Double displacement reaction.

a) Combination reaction

→ Materials Required.

1) Quick lime (calcium & oxide)
2) Borosil beaker
3) Glass rod.
4) Distilled water
5) Dropper
6) Test tube
7) Litmus paper strips

theory:

→ When calcium oxide is mixed in water it dissolves and forms calcium hydroxide (basic in nature). During this reaction, a lot of heat is liberated and therefore, it is called an exo-thermic reaction.

$$CaO(s) + H_2O(l) \longrightarrow Ca(OH)_2(aq) + HEAT \text{ ——} ①.$$

→ Due to the basic nature of calcium hydroxide, it turns red litmus paper to blue in colour. When carbon dioxide gas is passed through the calcium hydroxide the solution turns milky white.

$$Ca(OH)_2(aq) + CO_2 \longrightarrow CaCO_3 + H_2O.$$

→ In the reaction (1) slaked lime is formed by combining two products viz, quick lime and water. Therefore, when two or more than two substances combine to give a single product it is termed as combination reaction. The reactions accompanied by the evolution of heat are called exothermic reactions.

PROCEDURE:

1) Wash a borosil beaker with distilled water and dry it.
2) Take a small amount of calcium oxide (quick lime) and slowly add water to it.
3) Wash and take a clean glass rod to stir the mixture of quick lime and water.
4) Touch the beaker carefully from outside.
5) Observe the change.
6) With the help of dropper take a few drops of the mixture from the beaker and place it on red and blue litmus paper stripes.
7) Wait and observe.

Observation:

experiment	observation
mixture in beaker	A hissing sound is heard during the reaction when water is added to the beaker containing quick lime. Due to the evolution of heat during the reaction the temperature increases & makes the solution hot.
Solution on litmus paper	Drops on the red litmus paper stripes change the colour of the paper to blue whereas there is no colour change observed on the blue litmus paper.

Result and Conclusion:

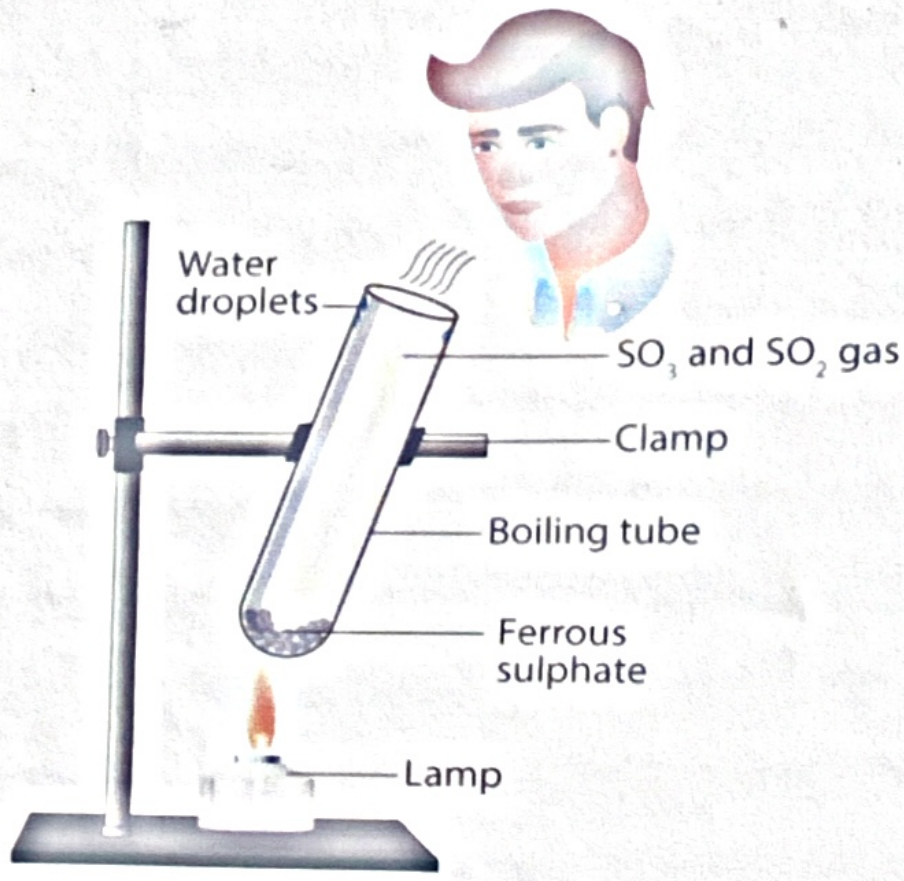
→ From the above experiment we can conclude that the reaction occurred between calcium oxide (quick lime) and water combine to produce one single product slaked lime ($Ca(OH)_2$) is called combination reaction as well as an exothermic reaction.

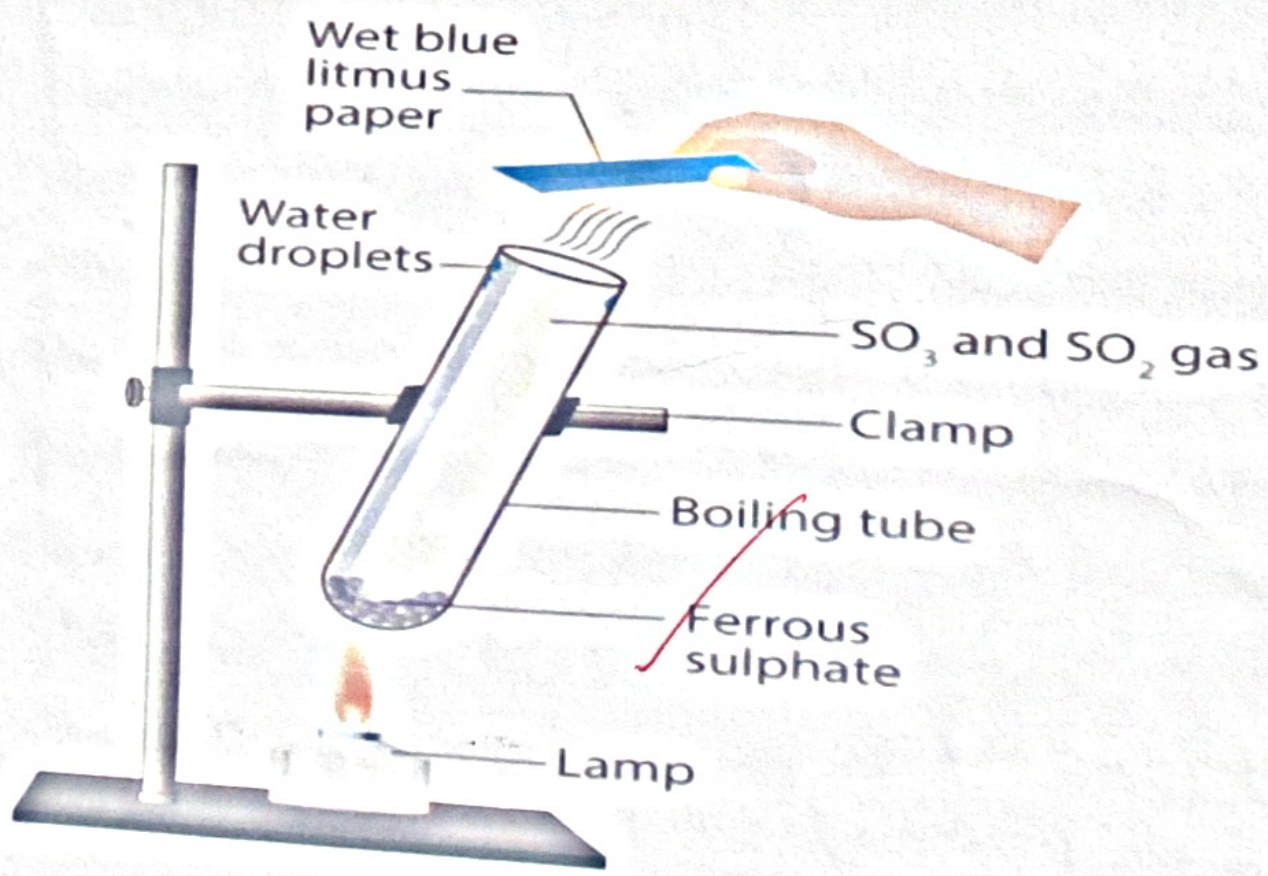
Precautions to be taken during the Experiment.

- Take a small amount of compound such as quick lime to perform the experiment.
- Since the reaction is exothermic avoid touching the mixture directly.
- Carefully pour water into the borosil beaker containing Calciu oxide (quick lime).
- Calcium oxide causes severe burns and therefore it should be handled with a spatula.

Observation:

Experiment	Observation





- Use good quality glass beaker during the experiment because if the beaker is of poor quality then there are chances of crack on the beaker due to the exothermic reaction.

b) decomposition reaction

→ Materials Required

1) Ferrous sulphate crystals
2) Test tube holders.
3) Boiling tube
4) Bunsen burner
5) safety glass.
6) Litmus paper ~~strips~~ strips.

theory

Ferrous sulphate crystals are ferrous sulphate heptahydrate with a chemical formula $FeSO_4.7H_2O$ and are green in colour. On heating the ferrous sulphate heptahydrate it loses ~~even~~ seven water molecules to form anhydrous ferrous sulphate ($FeSO_4$) and is white in colour. The reaction is as follows:

$$FeSO_4.7H_2O \longrightarrow FeSO_4(s) + 7H_2O \quad \text{——— ①}$$

(green colour) (white colour).

Ferrous sulphate when heated is decomposed to ferric oxide, sulphar trioxide, & sulphur dioxide. The reaction is as follows:

$$FeSO_4(s) \longrightarrow Fe_2O_3(s) + SO_2(g) + SO_3(g) \quad \text{——— ②}$$

(white colour) (brown colour) (colourless) (colourless).

In the reaction ② one substance $FeSO_4$ (Ferrous sulphate) splits into three substances ferric oxide (Fe_2O_3), sulphur dioxide (SO_2) and sulphur trioxide (SO_3) due to heat. Therefore, this reaction is called decomposition or thermal decomposition reaction.

We can combine reaction ① & ② and write it as follows:

$2FeSO_4.7H_2O(s) \longrightarrow Fe_2O_3(s) + SO_2(g) + 14H_2O(g)$.

PROCEDURE :

1) Wash a boiling tube with distilled water & dry it.
2) Take 2 grams of ferrous sulphate crystals in the tube.
3) Make a note of the colour of the crystals.
4) Use a test tube holder to hold the boiling tube.
5) Heat the boiling tube on the bunsen burner as shown in the figure
6) Observe the colour of the residue got & smell the odur of the gases evolved.
7) Tiny colourless water droplets are seen near the neck of the tube.
8) Gently turn it towards your nose and smell for any gas evolved.
9) Wet blue & red litmus paper strips.
10) Hold the litmus paper strips near the mouth of the boiling tube.
11) observe the change.
12) classify the type of reaction.

Observation

experiment	observation
Boiling test tube.	• colour of ferrous sulphate crystals change from green to white and later brown. • The gas evolved smells like burning sulphur
litmus paper test	• Blue litmus paper strips turns red when comes in contact with gas.

Results and Conclusion

From the above experiment 3 (B) we can conclude that the reaction occured on heating ferrous sulphate crystals is decomposition reaction which decomposes to produce Fe_2O_3, SO_2, & SO_3. Since this decomposition reaction is carried out by heating it is also known as thermal decomposition reaction.

Precautions to be taken during the experiment.

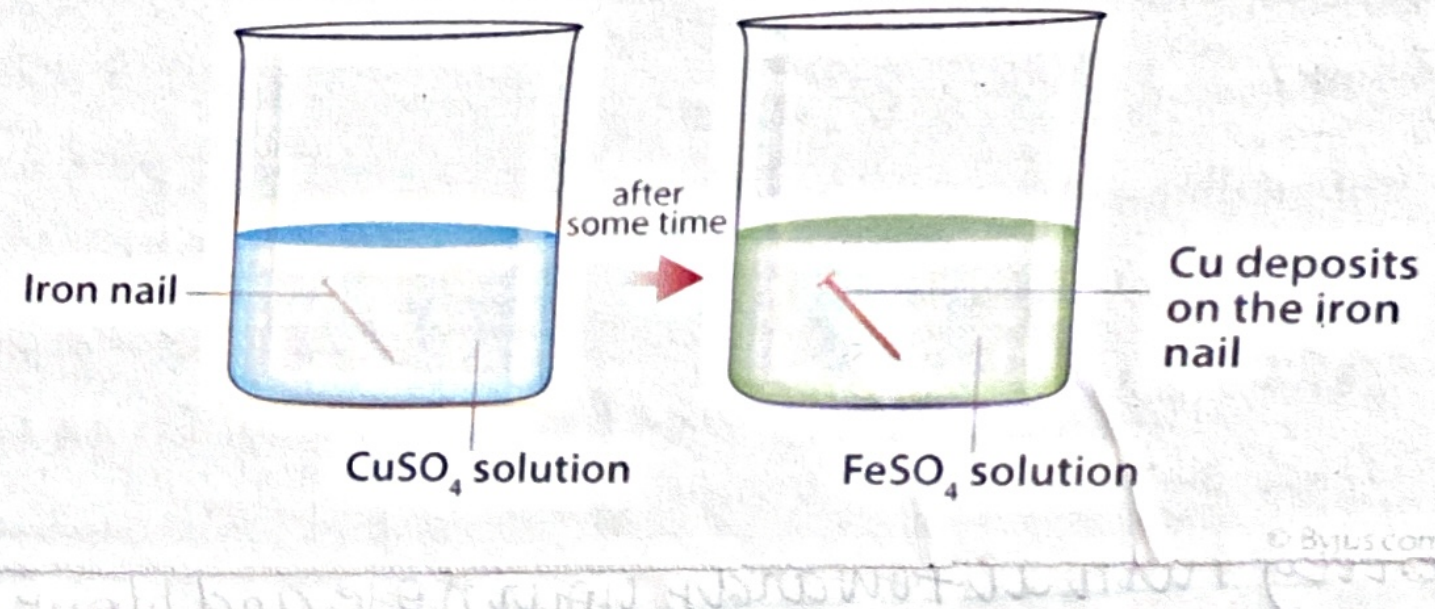
- Do not keep the mouth of the boiling tube towards yourself.
- Do not smell the gas by directly getting it under your nose but gently turn it towards your nose and blow it with your hand.
- Wearing safety glasses is important while you are performing this experiment.
- Thoroughly wash the boiling tube with distilled water and dry it before using it.
- Use good quality boiling tube while heating the ferrous sulphate crystals.
- Take care to keep the sulphur dioxide and sulphur trioxide gas coming in contact with your eyes as they cause irritation to eyes.

c) displacement reaction

→ Materials Required

1) Test tube stand
2) Two test tubes
3) Two iron nails
4) Measuring cylinder
5) Beaker.

EXPERIMENTAL SETUP:



6) Sandpaper
7) Copper sulphate solution
8) Laboratory stand with clamp.
9) Distilled water
10) thread.

theory

As per the reactivity series, the more reactive metals displaces the less reactive metals. When iron is compared with copper, it is placed above copper in activity series. Therefore the metals placed above are more reactive whereas the metals placed below are less reactive.

When iron nails are placed in $CuSO_4$ iron displaces copper from copper sulphate to form ferrous sulphate. The iron nails get deposited with a brownish red substance of the copper metal. The action is as follows:

$$Fe(s) + CuSO_4(aq) \longrightarrow FeSO_4(aq) + Cu(s)$$

Metallic iron displaces copper ion (Cu^{2+}) from its salt is an example of a chemical displacement reaction. Metallic iron is converted to ferrous iron, the curpic ion is converted to metallic copper. The reaction is a follows:

$$Fe(s) + Cu^{2+}(aq) \longrightarrow Fe^{2+}(aq) + Cu(s).$$

PROCEDURE:

1) Wash two test tubes with distilled water & dry them.
2) Label the test tube as P & Q.
3) Add 20 ml of distilled water in the test tube and mix copper sulphate crystals in P.
4) Transfer 10ml of solution from P to Q.

5) Take two iron nails by cleaning them with sandpaper.
6) Take one iron nail and dip it in the $CuSO_4$ in test tube P for 15 mins
7) Take another iron nail and dip it in the $CuSO_4$ in test tube Q for 15 mins
8) Observe the intensity of the blue colour of $CuSO_4$ before and after the experiment performed in test tube P & Q.
9) Record your results.

Observation

experiment	Before experiment	After experiment.
colour of $CuSO_4$	blue	green.
colour of iron nail.	silvery grey	Brownish red coating

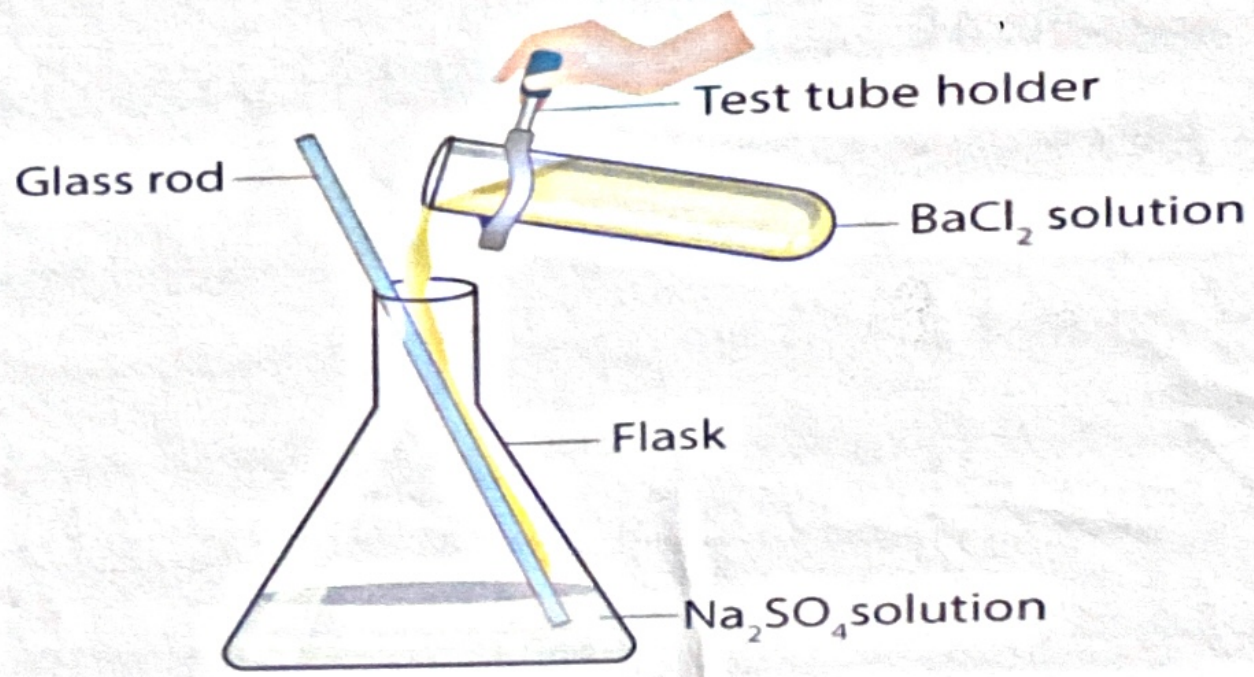
Result and conclusion

From the above experiment 3 (c) we can conclude that the reaction occurred when iron nails were dipped in the copper sulphate solution for 15 mins the colour of the solution changes to green and brownish red copper metal is deposited on the nail. Therefore this is displacement reaction.

$$Fe(s) + CuSO_4(aq) \longrightarrow FeSO_4(aq) + Cu(s).$$

Precautions to be taken during the experiment.

- clean the iron nails by sandpaper before dipping them in a copper sulphate solution.
- Make dilute $CuSO_4$ for the experiment otherwise, the colour


Test tube holder
Glass rod
$BaCl_2$ solution
Flask
Na_2SO_4 solution

change will not be seen in its concentrated form.

- Use good quality boiling tube.

d) double displacement reactions.

→ Materials Required.

1) Test tube stand
2) Measuring cylinder
3) Two Test tubes
4) Glass rod.
5) Conical flask
6) Barium chloride solution
7) Solution sulphate solution.

theory

Reactions occurring in the solution by exchanging ionic compounds to form new compounds are called double displacement reactions. The ionic compounds considered as reactants are water soluble. One of the products is formed as a precipitate or as a gas which is water soluble.

When two solutions viz sodium sulphate and Barium chloride are mixed, double displacement reactions as below occurs:

$Na_2SO_4(aq) + BaCl_2(aq) \longrightarrow BaSO_4(s) + 2NaCl(s)$.

Sulphate ions from the solution of sodium sulphate are displaced by chloride ions and the chloride ions from the solution of barium chloride are displaced by sulphate ions.

PROCEDURE :

1) Take two tubes, wash them with distilled water and dry them.
2) Label the test tube as P and Q.
3) Pour 5ml of barium chloride in the test tube P and observe the colour.
4) Pour 5ml of sodium sulphate in the test tubes Q and observe the colour.
5) Take a conical flask and pour the solutions from both the test tube into it.
6) Stir the mixture added to the conical flask with a glass rod.
7) Keep it undisturbed for sometime.
8) observe the change in colour of the solution.
9) Record your results in the below-given table.

Observation

experiment	observation.
colour of test tube P & Q	Colourless.
mixture of solution in conical flask	Precipitation is formed.

Result and Conclusion

From the above experiment 3 (D) we can conclude that the reaction occurred on mixing the solutions of barium chloride and sodium sulphate produce a white precipitate compound by exchanging their ions. This reactions is known as a double displacement reaction.

Precautions to be taken during the Experiment.

- The test tube, glass rod, and conical flask should be washed with distilled water and dried before the experiment.
- The volume of sodium sulphate and barium chloride should be equal.
- Do not try to taste or touch the chemicals.
- While combining the solutions in the mixture pour sodium sulphate first and then ~~stautt~~ slowly add barium chloride to it.

x ——— x ——— x ——— x