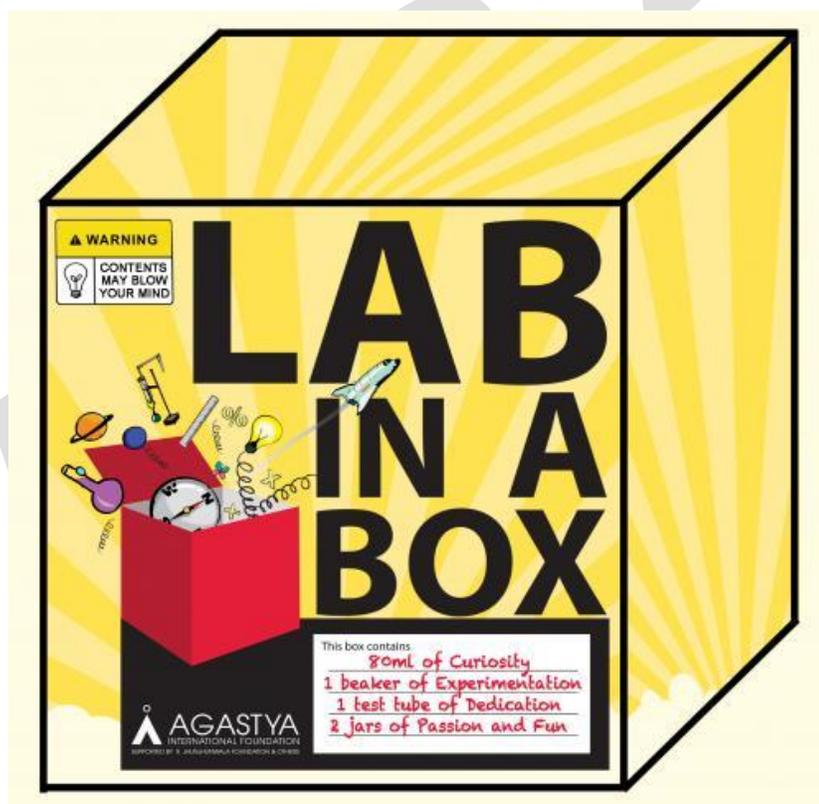


Lab in a Box

8

CHEMISTRY



Inventory

S.No	Materials	Quantity
Glassware		
1	Test tubes	4
2	Beaker (glass) 250 ml	4
3	Glass rod	3
4	Petri dish (glass)	2
5	Funnel	1
6	Dropper (small)	1
Equipment		
7	Tongs	2
8	Goggles	3
9	Spatula (plastic)	1
10	Spirit lamp	1
11	Tripod stand	2
12	Wire gauge	2
13	Test tube holder	2
14	Test tube cleaning brush	1
15	Burette stand	1
16	Test tube stand	1
17	China dish	1
18	Deflagrating spoon	2
19	Gloves	1 pair
20	Mask	2
21	Gas jar (plastic)	1
22	Filter paper	1 packet
Chemicals and Reagents		
23	Hydrochloric acid	500 ml
24	Potassium permanganate	100 gm
25	Potash alum	100 gm
26	Sodium hydroxide solution	250 ml
27	Sulphur powder	100 gm
28	Calcium bi carbonate	100 gm
29	Calcium carbonate	100 gm
30	Magnesium ribbon	1
31	Zinc metals	1
32	Calcium chloride	100 gm
33	Sodium carbonate	100 gm
34	Distill water	500 ml
35	Magnesium sulphate	100 gm
36	Copper sulphate	100 gm
37	Spirit	1 liter
Consumables		
38	Coconut oil	250 ml

39	Match box	1
40	Cotton	1 packet
41	Incense sticks	1 packet
42	Iron nails	10
43	Salt	½ kg
44	Thread	1 roll
45	Pencil	2
46	Permanent marker	1

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Content

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Chemical reactions

The simple chemical reactions are of the following types based on the nature of reactants and products.

- Combination
- Decomposition
- Displacement
- Displacement

Chemical combination

Aim

To demonstrate the chemical reaction with sulphur powder

Materials Required

Deflagrating spoon, sulphur powder, gas jar, spirit lamp, match box.

Procedure

Step 1

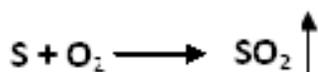
Take a little sulphur powder in the deflagrating spoon and heat it. When it starts to burn, place it in the gas jar.

Observation

Fumes are observed in the gas jar.

Inference

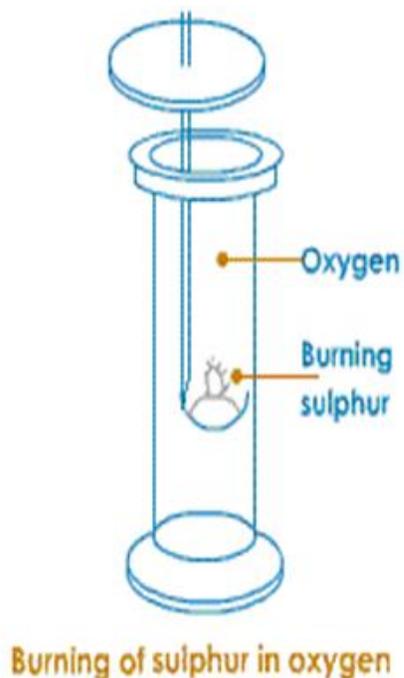
When sulphur is ignited in air, it burns with pale blue flame, producing sulphur dioxide gas.



This is an example for the reaction between Sulphur and Oxygen

Chemical combination is a reaction in which two or more elements or compounds combine to form a new product.

Note: Avoid sulphur contact with eyes, mouth or mucous membrane



1.1 Burning of magnesium

Aim

To demonstrate chemical combination with magnesium ribbon

Materials Required

Magnesium ribbon, spirit lamp, tongs, china dish, test tube

Procedure

Step 1

Hold the magnesium ribbon at the tip of the flame using a pair of tongs.

Step 2

When it begins to burn in presence of oxygen, collect the ash in china dish. Transfer the ash into a test tube.



Observation

Magnesium burns with a brilliant flame

Inference

Magnesium metal burns in presence of oxygen to produce magnesium oxide.



Safety Precautions:

- ☞ Wear goggles;
- ☞ Do not expose your eyes directly at the light emitted by the metal
- ☞ Hold the metal with pair of tongs.
- ☞ Keep away from combustible materials

1.2 Chemical decomposition

Aim

To demonstrate chemical decomposition

Materials Required

Potassium permanganate, test tube, spirit lamp, burette stand, burette clamp

Procedure

Step 1

Take an empty test tube and clamp it to the burette stand.

Step 2

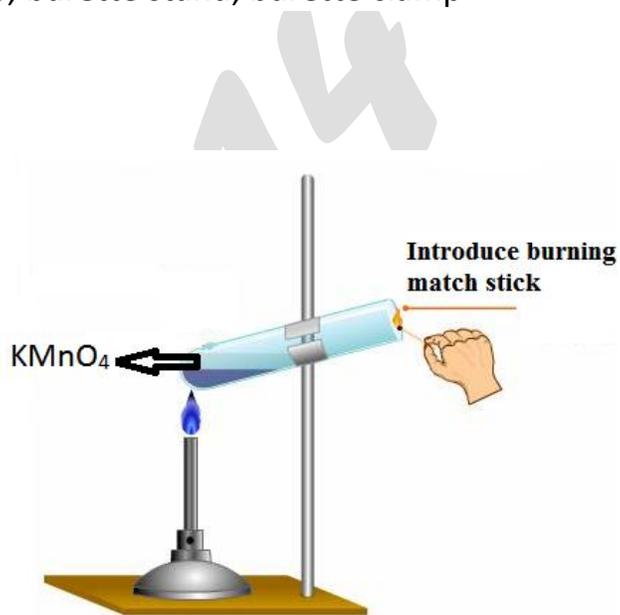
Take two spatulas full of potassium permanganate in the test tube.

Step 3

Heat the potassium permanganate till you observe purple fumes.

Step 3

Now introduce a burning incense stick in the test tube as shown in the figure.



Action of heat on potassium permanganate

Observation

The incense stick glows brighter.

Inference

When heated, the potassium permanganate decomposes into potassium manganate, manganese di oxide with the liberation of oxygen gas. The incense stick glows brighter in the presence of oxygen. The reaction is as follows.



The reactions in which a compound splits up into two or simpler substances or molecules are known as decomposition reaction.

Safety Precautions

Wear safety goggles, gloves and mask. Sometimes we need to take extra precautions as it may explode.

1.3 Displacement reaction

Aim

To demonstrate a displacement reaction

Materials Required Beaker, copper sulphate solution, iron nail, thread, supporting rod (pencil), and petri dish

Procedure

Step 1

Clean an iron nail by rubbing it with a piece of sand paper to remove the corrosion products and get a shiny surface. Step 2 Take 200 ml copper sulphate solution in a beaker.

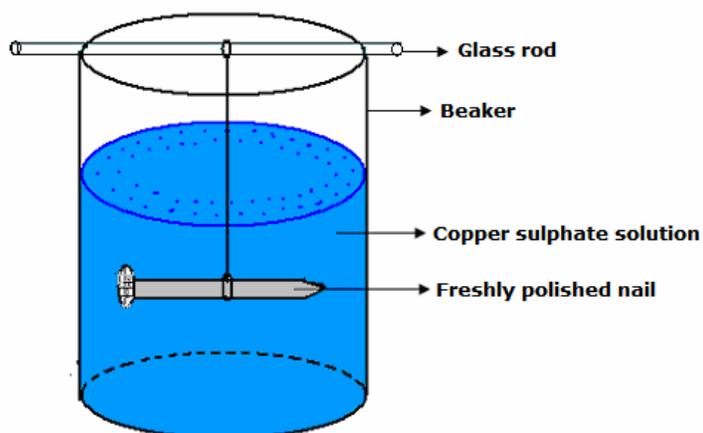
Step 3

Suspend the cleaned iron nail in the copper solution.

Step 4

Do not disturb the beaker for about 15 minutes.

Step 5 Remove the iron nail from the copper sulphate solution and keep it in the Petri dish.



Observations

- Shiny iron metal surface is converted into brown in colour. This shows that copper gets deposited on the iron nail.
- Blue colour of copper solution changes to pale greenish due to deposition.

Inference

- The brown coating on the iron nail shows that copper got deposited
- After the deposition, greenish colour of the solution shows that Fe^{2+} ions are present in the solution.
- Iron metal is more reactive than copper due to which Fe^{2+} ions displaced Cu^{2+} from the copper sulphate solution
- This is called single displacement reaction because copper is displaced by iron
- The reactions in which one element takes the place of another element in a compound is called displacement reaction.
- This can be shown as.



Note:

$\text{Fe} \rightarrow \text{Fe}^{2+} + 2\text{e}^-$ (Oxidation) – Loss of electrons

$\text{Cu}^{2+} + 2\text{e}^- \rightarrow \text{Cu}$ (Reduction) – Gain of electrons

$\text{Fe} + \text{Cu}^{2+} \rightarrow \text{Fe}^{2+} + \text{Cu}$

1.4 Reaction between acid and metal

Aim

To demonstrate the displacement reaction between acid and metal

Materials Required

Test tubes, burette stand, zinc metal pieces, dilute hydrochloric acid and match box

Procedure

Step 1
Take a test tube and clamp it to the burette stand. Put few zinc metal pieces in to the test tube.

Step 2

By means of dropper add dilute hydrochloric acid into the test tube

Step 3

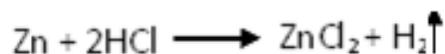
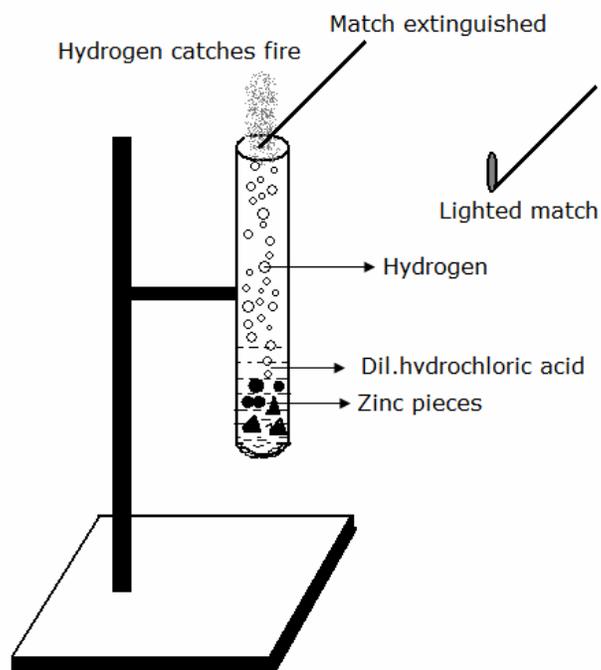
Light a matchstick and bring it near the mouth of the test tube.

Observation

When the match stick is placed at the mouth of the test tube, the evolved gas catches a fire and gives a bursting sound while the match stick gets extinguished.

Inference

Zinc metal is highly reactive with hydrochloric acid, it displaces hydrogen to form zinc chloride with the release of hydrogen gas.



1.5 Double displacement reaction

Aim

To demonstrate the double displacement reaction

Materials Required

Calcium chloride, sodium carbonate, test tubes, test tube holder and dropper.

Procedure

Step 1

Hold the test tube using test tube holder.

Step 2

Take calcium chloride solution in the test tube. (Calcium chloride solution is prepared by dissolving a pinch of calcium chloride salt in water)

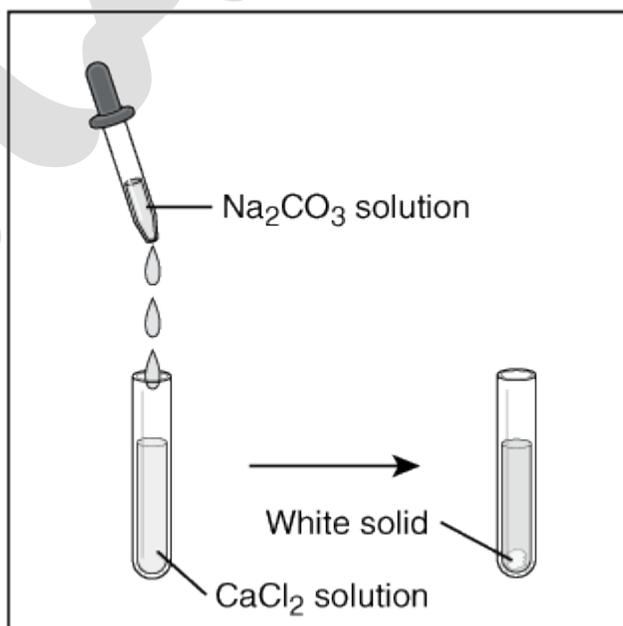
Step 3

Take sodium carbonate solution in another test tube (sodium carbonate solution is prepared by dissolving a small amount of sodium carbonate salt in water)

Step 4

Using a dropper, add the sodium carbonate solution to the calcium chloride solution

Observe what happens.



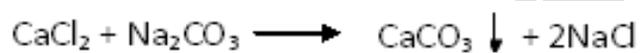
Observation

A white precipitate is formed in the test tube.

Inference

Double displacement reaction is defined as the chemical reactions in which two compounds react by exchange of ions to form two new compounds.

In the above reaction the cations and anions of two different compounds switch places forming entirely two different products. The reaction can be written as



2.Preparation of soap

Aim

To demonstrate soap preparation

Materials Required

10 ml of coconut oil, 60 ml of 20% sodium hydroxide solution, 50 ml of saturated common salt solution, beaker, glass rod, spirit lamp, tripod stand, wire gauge.

Procedure

Step 1 Take about 10 ml of coconut oil in the beaker and add about 60 ml of 20% sodium hydroxide solution.

Step 2

Heat slowly and stir constantly till to boil the mixture.

Step 3

After boiling the mixture for about 5 to 10 minutes, add 50 ml of salt solution with constant stirring. This process is called salting out. It increases the density of the solution and causes the soap to precipitate and float on the surface of the solution.

Step 4

Cool the reaction mixture with constant stirring.

What do you observe?

Step 5

Filter the mixture and separate soap that floats as the precipitate and dry it.



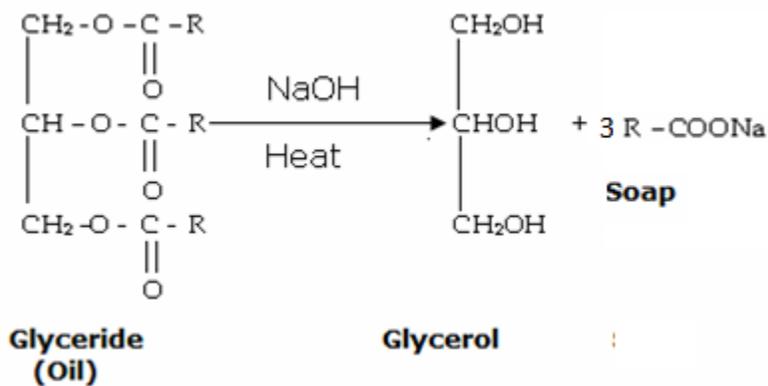
Observation

On adding the salt solution, the soap separates out in the form of small lumps.

Inference

Soaps are carboxylate salts with very long hydrocarbon chains. Soaps can be made from the base (alkaline) hydrolysis of fats or oils. This hydrolysis is called saponification.

An example of saponification reaction.



Safety Precautions

- Wear your safety goggles. This is important in this experiment, since NaOH can cause permanent eye damage.
- Wear gloves
- Observe the reaction mixture on heating. Do not boil the solution continuously.

3.Filtration

Aim

To make a simple water filter

Materials required

1 liter water bottle, cotton, sand, charcoal, fine and coarse gravel.

(Sand, gravel, jelly, charcoal are to be collected locally)

Procedure

step 1

Take 1 liter water bottle and cut the bottom of the bottle.

Step 2

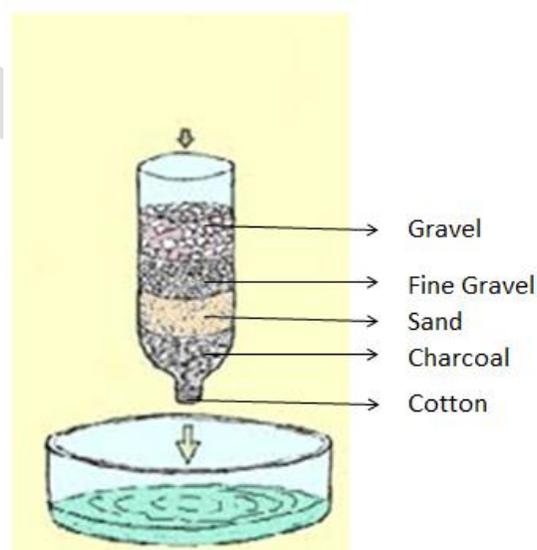
Plug the cotton at the mouth of the bottle and invert the bottle as shown in the figure

Step 3

Fill the bottle with layers of charcoal, then sand, then fine gravel and then coarse gravel, as shown in the figure.

Step 4

Pour muddy water in to the bottle and hold it over a clean trough. Wait for some time.



Observation

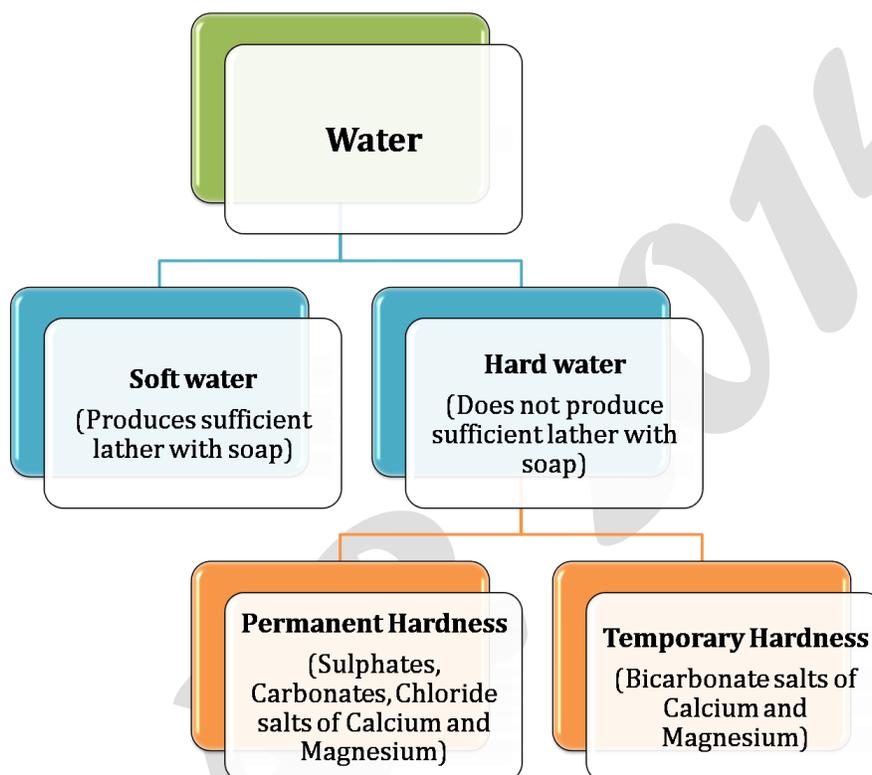
Pure and clean water is collected.

Inference Charcoal is used as an adsorbent. It adsorbs chemical impurities dissolved in the water. Sand and gravel percolates water with the removal of dust and other suspended particles finally we get clean water.

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3.1. Hardness of water

Water is a universal solvent because it is polar in nature, most of the inorganic and organic solutes are soluble in water. Water drawn from ground may contain the some of these unwanted materials dissolved in it, causing hardness.



Aim

To demonstrate hardness of water sample with soap

Materials required

Distilled water (soft water), Hard water sample (containing magnesium sulphate or calcium carbonate), 2 -test tubes, soap solution, dropper.

Procedure

Step 1

Take two test tubes and label them as 1 and 2
Step 2 Fill the test tube 1 with half full of soft water and 2nd test tube with hard water sample.

Step 3

Add few drops of soap solution to both the test tubes, shake the test tubes for about one minute and observe.

Observation

More lather is observed in test tube 1 containing soft water, where as the other test tube does not produce sufficient lather.

Inference In test tube containing soft water, lower is the concentration of dissolved salts, so it produces more lather. In the another test tube containing hard water shaking, does not produce sufficient lather because calcium and magnesium ions react with soap molecule and forms the precipitate instead of forming lather.

Hard water does not clean the clothes as well as utensils effectively



3.2. Temporary hardness of water

Aim

To demonstrate the removal of temporary hardness of water sample on boiling.

Materials required

Distilled water, calcium bi carbonate, spirit lamp, soap solution, funnel, filter paper, beaker, test tubes.

Procedure

Step 1 Prepare the temporary hard water sample by dissolving 10 gm of calcium bicarbonate in 100 ml of water. Step 2 Take two test tubes and label them as 1 and 2. Step 3 Take equal amounts of hard water sample in both the test tubes, to the 1st test tube add 10 drops of soap solution and shake the mixture and observe. Step 4 Boil the hard water sample in the 2nd test tube with the help of test tube holder and filter the solution, take the filtrate in another test tube, to this add 10 drops of soap solution, shake the mixture and observe, compare it with that of 1st test tube.



Heating the sample



Filtration



Adding the soap solution

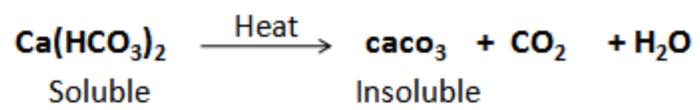
Observation

Sufficient lather is not formed in the 1st test tube, whereas on boiling and filtering, sufficient lather is formed in another test tube.

Inference

Calcium bi carbonate gives temporary hardness to water. On heating calcium bicarbonate decomposes to give an insoluble calcium carbonate precipitate. This is separated by filtration. Thus temporary hardness can be removed by boiling.

The reaction can be shown as,



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3.3.Coagulation

Aim

To demonstrate the coagulation in purification of water sample.

Materials required

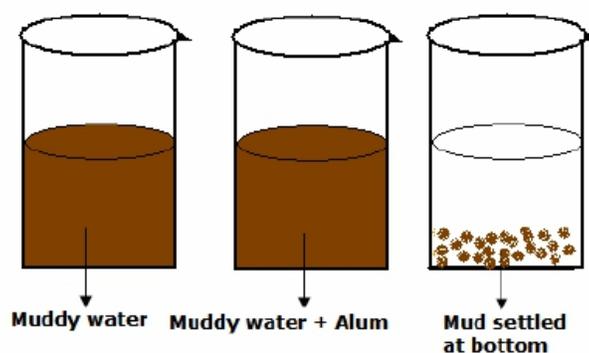
Glass beaker (250ml), water, glass rod, potash alum, mud.

Procedure

Step 1 Take 100 ml water in a beaker and add some quantity of mud. Stir the mixture to get turbid water.

Step 2

Add 25 g of potash alum and observe after 20 minutes.



Observation

Colloidal mud particles distributed through out the water aggregate and settle down at the bottom of the beaker. The upper portion of the water is clean and transparent.

Inference

Potash alum is acting as coagulating agent. Aluminum (Al^{3+}) ions coagulate the mud particles by neutralizing its negative charge due to which mud particles gets settle down at the base of beaker.