



**RMK SENIOR SECONDARY
SCHOOL
THIRUVERKADU, CHENNAI-77**

ACADEMIC YEAR: 2017-'18

INVESTIGATORY PROJECT IN CHEMISTRY

TOPIC:

**TESTING HARDNESS, PRESENCE OF IRON,
FLUORIDE, CHLORIDE IN DRINKING WATER**

UNDER THE SUPERVISION OF:

Mrs.Renusha Chandran

SUBMITTED BY:

K.V.PRADEEP

Reg. No.....

CERTIFICATE

TO WHOMSOEVER IT MAY CONCERN

This is to certify that K.V.PRADEEP is a student of class XII 'A' of RMK Senior Secondary School for the academic year 2017-'18 under Reg No.had worked on the project TESTING HARDNESS, PRESENCE OF IRON, FLUORIDE, CHLORIDE IN DRINKING WATER under my supervision.

During this period he was found to be sincere and hardworking.

PRINCIPAL

Internal Examiner

Submitted during practical examination in Chemistry of the AISSCE held on.....at.....

External Examiner

ACKNOWLEDGEMENT

It is customary for me to acknowledge the contributions and suggestions received from various sources.

First of all I would like to thank god almighty for giving me wisdom and knowledge to showcase my talent.

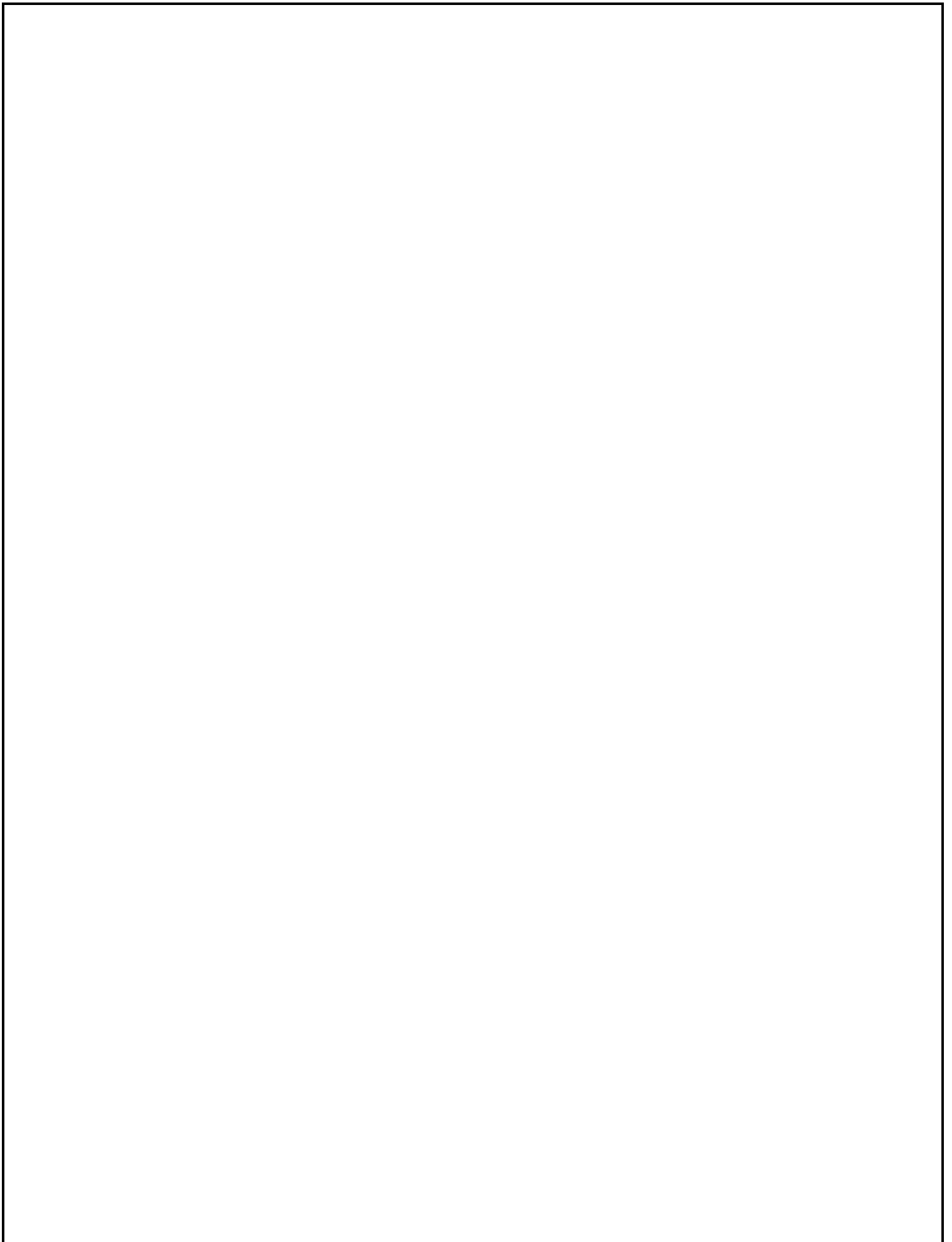
I am very thankful to our Principal Mrs. Indira Rangan for giving me the golden opportunity to do this wonderful project.

I wish to acknowledge the tremendous amount of help received from my Chemistry teacher Mrs. Renusha Chandran, without whose help and encouragement it would not have been possible for me to complete this project.

I wish to express my gratitude to all non-teaching staff who helped me to complete my project.

Whatever words I choose cannot sufficiently express my deep sense of gratitude towards my parents for their constant understanding, assistance, inspiration and moral support in completing this project.

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OBJECTIVE:

To determine the hardness, presence of iron, fluoride, chloride depending upon the regional variation in drinking water and study of causes of presence of these ions.

INTRODUCTION:

Hardness of water is determined by concentration of multivalent cations present in water. Hard water contains Ca^{2+} , Mg^{2+} ions. Hardness of water can be removed by adding sodium carbonate to hard water. Sometimes salts are dangerous for human health. Therefore, it is necessary to detect presence of these ions and remove them to stay on safer side.

TYPES OF HARDNESS IN WATER:

- 1) Temporary hardness
- 2) Permanent hardness

TEMPORARY HARDNESS:

Temporary hardness is due to the presence of bicarbonates of calcium and magnesium. It can be easily removed by boiling.

PERMANENT HARDNESS:

Permanent hardness is due to the presence of chlorides and sulphates of calcium and magnesium. This type of hardness cannot be removed by boiling.

SALTS PRESENT IN WATER

Sulphate in groundwater is caused by natural deposits of magnesium sulphate, calcium sulphate or sodium sulphate. Concentrations should be below 250 ppm. Higher concentrations are undesirable because of their laxative effects.

Iron as it exists in natural groundwater is in the soluble (ferrous) state but, when exposed to oxygen, is converted into the insoluble (ferric) state with its characteristic reddish brown or rusty color.

Chlorides in groundwater can be naturally occurring in deep aquifers or caused by pollution from sea water, brine, or industrial or domestic wastes.

Chloride concentration above 250 mg/l can produce a distinct taste in drinking water.

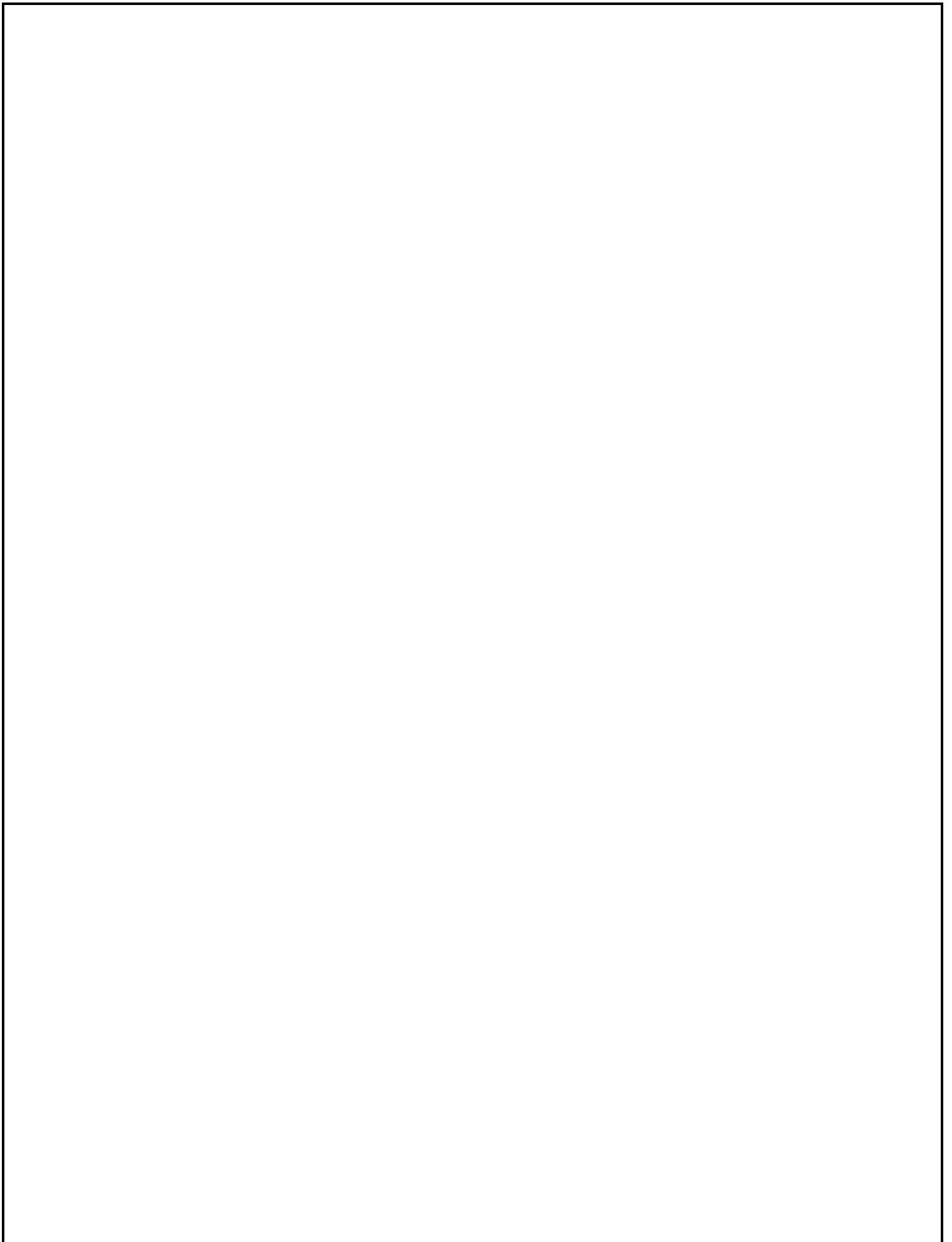
Fluorinated water contains fluoride at a level that is effective for preventing cavities; this can occur naturally or by adding fluoride.



hard water



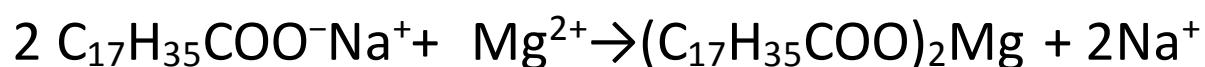
soft water



THEORY:

Hard water : Water with very high mineral content is called hard water. Hard water is when water percolates through deposits of chalk and limestone. We know that limestone and chalk are made up of calcium and magnesium carbonates.

Indicator of hardness in water: Hardness in water indicates an inability to form lather with soap solution. The effect of various dissolved salts, containing several different cations and anions, on the formation on lather, is investigated. Following example of hard water containing calcium and magnesium ions, shows formation of insoluble precipitate.



APPARATUS:

- Test tubes
- Pipette
- Beakers
- Stop watch
- Corks
- Test tube stand



CHEMICALS REQUIRED:

- Soap solution
- Calcium chloride solution

- Sodium sulphate
- Distilled water
- Iron(II)sulphate solution
- Sodium chloride
- Potassium nitrate
- Magnesium sulphate

DETERMINING HARDNESS OF WATER :



- ❖ Take eight test tubes and label them as 1,2,3,4,5,6 and 7

❖ Put about 10 drops of the following in different test tubes:

Test tube 1-distilled or deionised water

Test tube 2-calcium chloride solution

Test tube 3-sodium sulphate solution

Test tube 4-Iron(II) sulphate solution

Test tube 5-Sodium chloride solution

Test tube 6-potassium nitrate solution

Test tube 7-magnesium sulphate

- ❖ Take out 50 mL of soap solution in a small beaker.
- ❖ Pipette out about 5 mL soap solution in each test tube.
- ❖ Close the mouth of each test tube with cork and shake it vigorously.
- ❖ Note which tube contains a foamy lather and which do not.

- ❖ With the help of stopwatch measure the time taken for disappearance of foam in each test tube.

| Test tubes | Solution | Lather formed or not | Time taken for disappearance of foam |
|------------|--------------------|----------------------|--------------------------------------|
| 1 | Distilled water | Yes | 35s |
| 2 | Calcium chloride | No | – |
| 3 | Sodium sulphate | Yes | 28s |
| 4 | Sodium chloride | Yes | 31s |
| 5 | Potassium nitrate | Yes | 29s |
| 6 | Magnesium sulphate | No | – |
| 7 | Iron(II) sulphate | Yes | 32s |



PROCEDURE:

A. TESTING IRON IN WATER:

- Take 5 mL water in a test tube. Add two drops of dilute H_2SO_4 .
- Boil the contents and allow it to cool.
- Now, add 2-3 drops of ammonium sulphocyanide.

OBSERVATION:

Appearance of orange colour indicates the presence of iron in water.

B. TESTING CHLORIDE IN WATER:

- Take 5 mL water in a test tube. Add 2 drops of concentrated HNO_3 in it.
- Boil the contents of the test tube and allow it to cool.
- Now, add 2-3 drops of AgNO_3 solution to it.



OBSERVATION:

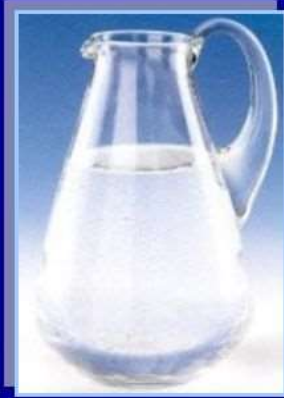
Appearance of curdy precipitate indicates the presence of chloride in water.

C. TESTING FLUORIDE IN WATER:

- Take 5 mL water in a test tube.
- Add water, silver nitrate and dilute nitric acid to it.

OBSERVATION:

No precipitate indicates presence of fluoride ion in water.



DRINKING WATER

Drinking water must have organoleptic, chemical and bacteriologic requirements which make it good to taste and safe for health.

- **Organoleptic requirements:** it must be clear, achromic, unscented and with a good taste due to the mineral salts, oxygen and carbon dioxide content. The best temperature is 12°C.
- **Chemical-physical requirements :** the salt content can't exceed 1,5g per liter and it must not contain ammonia, nitrite or other toxic molecules.
- **Bacteriologic requirements :** water must be bacteriologically pure, it must not contain pathogenic germs like salmonellae, vibrios, coliform bacteria or enterococcus (which indicate faecal contamination).

RESULT: Presence of salt contents in different source of water is detected experimentally.

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