AIM

To Prepare of:

1. **A true solution of common salt, sugar, and alum in water.**
2. **A suspension of soil, chalk powder and fine sand in water.**
3. **A colloidal solution of starch in water and egg albumin in water and distinguish between these based on:**
   (i) Transparency
   (ii) Filtration criterion
   (iii) Stability

MATERIALS AND APPARATUS REQUIRED

Test tubes, beakers, test tube rack, a glass rod, three funnels, filter papers, a small torch, common salt, tripod stand, chalk powder, china dish, dil. HCl, starch, alum, sugar, soil, sand, egg albumin and distilled water.

THEORY

The concentration of a Solution

1. It is the amount of solute present in a given amount of solution. Amount of solute

   $$\text{Consentration of a soloution} = \frac{\text{Amount of solute}}{\text{Amount of solution}}$$

2. A solution is always transparent, light passes through it without scattering as the solute particles are very small in size. The solution is homogeneous and does not settle. A solution cannot be filtered but can be separated using the process of distillation. For example, a solution of sugar in water.
3. **True solution:** A solution that has solute particles of size smaller than 1 nm (10^{-9} metres) in diameter and cannot be seen with the naked eye. They do not scatter a beam of light; the particles do not separate by filtration and the particles do not settle down.
4. **Suspension:** It is a heterogeneous mixture in which solute particles do not dissolve but remain suspended, particles can be seen with the naked eye, scatters a beam of light, and particles can be separated from the mixture by filtration.
5. **Colloidal solution:** The solution appears to be homogeneous; the particles can scatter a beam of light, they do not settle down when left undisturbed, it is stable and particles cannot be seen by the naked eye. The particles cannot be filtered. The size of particles is between 10^{-7} cm to 10^{-4} cm in diameter.

PROCEDURE

A. To prepare true solution of common salt (NaCl), sugar and alum in water.

Take a pinch each of common salt (1g), sugar and alum in three test tubes. Pour about 10mL of distilled water in each test tube. Shake the test tubes well by placing your thumb at the mouth of the test tube.

The common salt (NaCl), sugar and alum dissolve completely to form true solutions.

B. To prepare a suspension of chalk powder, soil and fine sand in water.

Take a pinch of chalk powder (about 1g), soil and fine sand in three test tubes. Pour about 10mL of distilled water in the test tubes. Shake the test tubes well by placing your thumb at the mouth of the test tube. The chalk powder, soil and fine sand do not dissolve in water but gets suspended in water, so as to form suspensions.

C. To prepare a colloidal solution of starch in water.

Take about 1g of starch (Maida) in a China dish. Pour 10mL of water in the China dish. Stir the contents with a glass rod till a milky suspension is formed. Heat 20mL of water in a boiling tube on Bunsen flame and bring it to its boiling point. Stir the contents of China dish continuously and pour boiling water in it slowly. Allow the contents to cool. The product so formed is the colloidal solution of starch in water.

D. To prepare a colloidal solution of egg albumin in water.

Take 1g of egg albumin (colourless part of the egg) and 5mL of distilled water in a beaker. Mix it well. Slowly add 95mL of distilled water while stirring continuously. After mixing, add a few drops of dil. HCl and stir well. The clear solution of albumin is formed with turbidity.

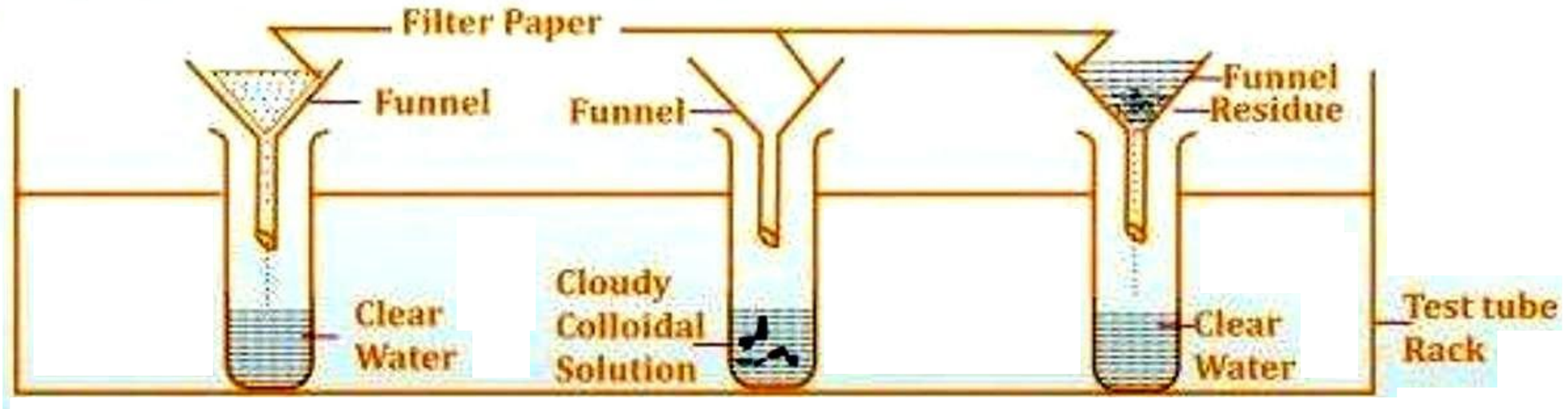
(i) To distinguish between a true solution, a suspension and a colloidal solution on the basis of transparency.

Prepare the solutions of salt/sugar/alum, chalk powder/soil/sand and starch powder/egg albumin separately in beakers and label them A, B, C. Take three white pieces of papers and put an 'X' mark on each. Keep the beakers on these papers and observe ' X ' mark on the papers from top of the beakers. Keep the beakers undisturbed for some time. Observe carefully and record your observations.

OBSERVATIONS

- In beaker A mark X is seen clearly. This shows that solution of common salt/sugar/alum in water is transparent.
- In beaker B mark X is not visible. This shows that a suspension of chalk powder/soil/fine sand in water is opaque.
- In beaker C mark X appears faint. This shows that colloidal solution of starch/egg albumin in water is translucent.

(ii) To distinguish between a true solution, a colloidal solution and a suspension on the basis of filtration.



No residue is left during filtration of true solution of common salt

No residue is left during filtration of true solution of Starch in water

Clear water collects during filtration of suspension of chalk in water

OBSERVATIONS

- In case of true solution of salt/sugar/alum in water, no residue is left on filter paper and clear solution collects as filtrate.
- In case of colloidal solution of starch/egg albumin in water, no residue is left on filter paper and the turbid colloidal solution collects as filtrate.
- In case of suspension of chalk/soil/fine sand in water, the particles are left as residue on the filter paper and clear water collects as filtrate.

(iii) To distinguish between a true solution, a colloidal solution, and a suspension on the basis of stability.

Pour 5mL each of true solution, the colloidal, and suspension in separate test tubes. Shake each of the test tube well and then allow its contents to stsand for 5 minutes.

OBSERVATIONS

In case of true solution, no sediment settles down and solution remains clear.

In case of colloidal solution, no sediment settles down and there is no change in its consistency.

In case of suspension, the sediment of chalk settles down and clear water collects above it.

RESULTS

From the above experiment we find that:

1. The true solution of common salt/sugar/alum in water is clear, transparent and stable. Their components cannot be separated by filtration or sedimentation.
2. The colloidal solution of starch/egg albumin in water is translucent and stable. Their components cannot be separated by ordinary filter papers.
3. The suspension of chalk powder/soil/fine sand in water is opaque and unstabe. Their components can be separated by filtration and sedimentation.

PRECAUTIONS

1. Use test tube holder for heating/boiling water.
2. Do not waste chemicals and distilled water. Use it wisely.
3. Always stir the contents in the test tube nicely and gently.
4. Use only distilled water to make solutions.

VIVA VOCE

Q1. Define the term solute.

Ans. Solute is the dissolved component of a solution, e.g., in a solution of common salt in water, common salt is solute.

Q2. What does the term solvent mean?

Ans. A solvent is a substance in which the solute is dissolved to get a solution.

For example: In a solution of sugar in water, water is the solvent.

Q3. Are colloids homogeneous or heterogeneous?

Ans. Colloids seem to be homogeneous, but they are heterogeneous.

Q4. Give two examples of colloids.

Ans. Blood, jelly.

Q5. Classify as a solution, suspension and colloid.
Chalk powder in water, Sulphur in water, Sulphur in CS_2, sugar in water, $CUSO_4$ in water, milk, cloud.

Ans. Sulphur in CS_2, $CuSO_4$ in water, sugar in water.
Suspension: chalk powder in water.
Colloid: Sulphur in water, milk, and cloud.

Q6. What is the Tyndall Effect?

Ans. The scattering of light by colloidal particles making the path of light visible is called the Tyndall effect.

Q7. Give an example of a solution in which gas is solute and liquid is solvent.

Ans. Aerated drinks.

Q8. What is the dispersed phase?

Ans. The solute-like component or dispersed particles in the colloid form a dispersed phase.

Q9. What is a dispersion medium?

Ans. The medium in which the dispersed phase is suspended is called the dispersion medium.

Q10. What are the dispersed phase and dispersion medium in milk?

Ans. Fat is the dispersed phase and water is the dispersion medium in milk.

Q11. How can fat and water in milk be separated?

Ans. By centrifugation.

Q12. Why is the sky blue?

Ans. Because of the scattering of light.

Q13. What is a gel?

Ans. A gel is a colloid in which the dispersed phase is a liquid, and the dispersion medium is a solid.

Q14. Is the formation of a true solution from its components a physical or a chemical change?

Ans. It is a physical change.

Q15. What is a soul?

Ans. A soul is a colloid in which the dispersed phase is a solid and the dispersion medium is a liquid.
For example: paints, milk of magnesia, etc.

Q16. What are aerosols?

Ans. A colloid in which the dispersed phase is either solid or liquid and the dispersion medium is gas is called aerosol.

Q17. What is Brownian motion?

Ans. The zig-zag motion of colloidal particles is called Brownian motion.

Q18. Why are the particles of a true solution not visible to the naked eye?

Ans. The particles of the true solution are very small to be seen with the naked eye.

Q19. What is the order of the size of a particle that can be seen by the naked eye?

Ans. The particles with a size order of 1000 nm or more are visible through our naked eye.

Q20. What different techniques of separation can be employed for the separation of components of a homogeneous and heterogeneous mixture?

Ans. **Homogeneous** mixture can be separated by evaporation, distillation, and fractional distillation. **Heterogeneous** mixture can be separated by filtration, centrifugation, sedimentation, and decantation.

Q21. What will be your observation, when a beam of light is passed through a true solution and a suspension respectively?

Ans. A beam of light will pass straight without scattering in case of a true solution. When the suspension is settled it will not disperse the beam of light flashed on it but when the suspension is not settled the beam of light will scatter and the path of light will become visible.

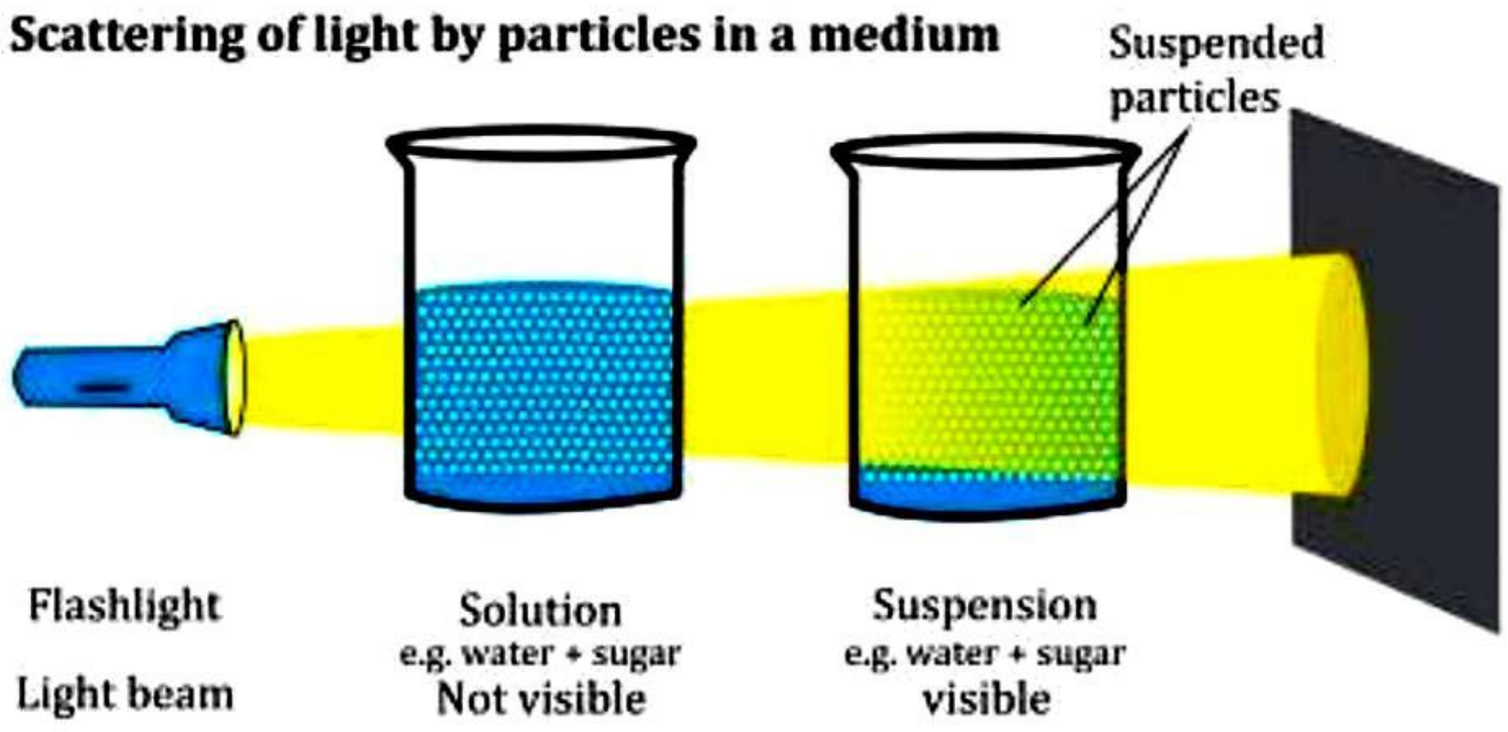
Q22. What will be the effect of passing light through a colloidal solution of sulphur?

Ans. When light is flashed on the colloidal solution of sulphur it will be scattered.

Q23. What is the difference in the particle size of colloid, true solution, and suspension?

Ans. The size of particles in true solution is less than 1nm, the size of colloidal particles is in the range of 1nm to 1000 nm and the size of suspension particles is more than 1000 nm.

Q24. The proper sequence of the contents in the glass beaker is:



Ans. Light doesn't pass through the solution and disperses in the colloid.