C 141 (Experiment No:____)
NAME:_____ BATCH:_____
ROLL NO:_____
SIGNATURE:_____ DATE:_____

TURBIDIMETRIC DETERMINATION OF SULPHATE ION (SO_4^{2-}) IN THE UNKNOWN SOLUTION

AIM
To determine the concentration of SO_4^{2-} in the supplied solution using Nephelo-Turbidity meter.

THEORY
A nephelo-turbidity meter is an instrument used for conducting turbidity measurements of suspended particles and colloids in solution. It does so by employing a light beam (source beam) and a light detector set to one side (usually 90^o) of the source beam.
A beam of light passing through a turbid liquid being tested, scatters the light which, inturn, is collected at right angles by a photocell and indicated on a digital display.
The amount of scattered light is proportional to the turbidity of the solution under test. The turbidity standard unit is called **Nephelometric Turbidity Units (NTU).**
The principle of operation of the nephelo-turbidity meter is based on the **TYNDALL EFFECT**.

The **Tyndall Effect**, also known as **Tyndall scattering** is the scatting of light by colloidal particles or particles in suspension. Named after the 19^{th} century scientist John Tyndall, it is similar to Rayleigh scattering in that the intensity of the scattered light depends on the fourth power of the frequency. Hence, blue light is scattered more strongly than red light. An example in everyday life is the blue colour sometimes seen in the smoke emitted by motorcycles (particularly two stroke engines), where the burnt engine oil provides the particles.

The basis for distinguishing between Tyndall and Rayleigh scattering is the following:
Tyndall scattering is defined as **scattering by particulars in colloids**;
Rayleigh scattering is defined as **scattering by particles much smaller than the wavelength of the light, which may be individual atoms or molecules.**
Colloidal particulars are much bigger than atoms or molecules, and are in the vicinity of the size of a wavelength of light.
Hence, **Tyndall scattering** (by colloidal particles) is **much more intense** than **Rayleigh scattering** (by atoms or molecules).

MATERIALS REQUIRED
Nephelo - Turbidity Meter with flat bottom glass test tubes, formazin, hydrazine sulfate, hexamethylene tetramine (hexamine), volumetric flasks, reagent bottles, graduated pipettes, measuring cylinders, distilled water jets.

PROCEDURE
1. Preparation of Stock solution
   The stock solution is prepared using formazin. Particles of formazin are uniform in size and shape. This solution is used for calibration of the instrument.

2. Preparation of Stock Standard solution
   The Stock standard of 4000 NTU is prepared as follows:
   (a) 2.5 g of reagent grade Hydrazine Sulfate is dissolved in 200 ml of distilled water. This is **Solution A**.
   (b) 25.0 g of pure Hexamethylene Tetramine is dissolved in 200 ml of distilled water. This is **Solution B**.
3. Now, **Solution 'A'** and **Solution 'B'** are mixed and made up to 500 ml by adding distilled water and allow this mixutre to settle for 48 hours at normal room temperature.
4. This is the stock solution of 4000 NTU strength of formazin. From this, the working solutions (given in the table) can be prepared by dilution. **Shake this solution well before dilution**.
5. Switch on the instrument and select the appropriate range.
6. Adjust the calibration controls to maximum.
7. Insert the test tube with distilled water into the cell-holder and cover with the light-shield.
8. The instrument is calibrated using the sample of 500 NTU and 100 NTU, using the cell raiser.
9. Remove the test tube and replace with the test tube containing the different diluted solutions, as prepared in the table.
10. Record the values for each sample and determine the value for the unknown sample.
11. Plot the concentration values (% of the Stock Solution) against the turbidity values.
12. From the graph, obtain the value for the **concentration of the unknown sample**.

Table

S.No.	% of the Stock Solution or Volume of Stock Solution used (4000 NTU)	Observed Strength (Conc.) in NTU	
		Calibrated at 500 NTU	Calibrated at 100 NTU
1.	12.5		
2.	5.0		
3.	2.5		
4.	1.25		
5.	0.50		
6.	0.25		
7.	0.0		
8.	Unknown 1		
9.	Unknown 2		

OBSERVATIONS AND CALCULATIONS

Record your observations as per the details given in the table. Show all the calculations using necessary formulae, units etc.

RESULTS

Concentration of Unknown - Solution 1 : _____ & Solution 2 : _____.