GOVT CO-ED POLYTECHNIC

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LAB MANUAL

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PUBLIC HEALTH ENGINEERING

(Lab)

CONTENTS

Experiment No: 1

AIM: To determine PH value of water.

THEORY:

Determination of pH is one of the important objectives considered in evaluation of quality of water source to be used for drinking water supply. The pH level of water measures how acidic it is (pH stands for potential hydrogen, referring to how much hydrogen is mixed with the water.) 7 is a balanced pH for water. pH is important in various treatment processes of water i.e. coagulation and chlorination. It is also important for corrosion control, removal of Iron and Manganese as well in softening of water.
pH value shows the potential of hydrogen ion concentration present in water sample. The term pH refers to the measure of hydrogen ion concentration in a solution and defined as the negative log of H ions concentration in water. It is an indicator of acidity and alkalinity of water sample. The value of pH is inversely proportional to the temperature.

pH-log (H)

Where H is the concentration of hydrogen ions in moles per liter of water.

The value of pll, 0 to little less than 7 are termed as acidic and values of pH little above 7 to 14 are termed as alkaline. When the concentration of H and Ollare equal then it is termed as neutral (pH-7)

Acceptable limit of pH for drinking water is 6.5 to 8.5 as per WHO. For pll values

greater than pH 10, the rusting rate seems to fall as pll is increased. Low pH value

will cause acidosis of kidneys and lungs

EXPERIMENTAL SETUP:

Digital ph meter

RESOURCES REQUIRED :

S.No	Particular	Specification	Quantity	Remark
1	Digital pH meter	4 Digit display (LED), 0 to 1000 mV. Resolution: 0.01 pH manual temp, compensation: 0 to 80 °C	1 NO.	Per Batch
2	Beaker	Standard glassware beaker of 500 ml.	1NO.	Per Batch

PROCEDURE

1.Preparation of Buffer solution.

- Take 100 ml of distilled water in a beaker.
- Put the buffer tablet in the distilled water.

- Disperse the buffer tablet in the distilled water by continuously stirring Action
- Prepare the buffer solution of pH 4.0, 7.0 and 9.2

2. Calibration of the instrument.

The instrument should be calibrated before beginning the measurement

- First rinse the electrode with distilled water and dries its bulb by using tissue paper.
- Dip the electrode in a buffer solution of pH 7.

- Set the temperature (C) control to the room temperature.

- Set the function selector to pH position and adjust the CALIBRATE control until the meter displays the precise pH of buffer solution.

- Now the set the function selector switched to STAND BY position.
- Remove the electrode from buffer solution. Wash it with distilled water and wipe out with tissue paper. Repeat the above procedure for calibration with buffer solution of 4.0 and 92 pH values,

3. Operation of Instrument

- Calibrate the pH meter with two standard buffer solutions as per the above procedure.
- Clean and rinse the electrode thoroughly with distilled water and carefully wipe with tissue paper
- Dip the electrode into the sample of solution. Stir the solution by keeping on magnetic stirrer or stir it manually. . .
- Wait up to 1 minute for steady reading +0.1 pll units.
- Record reading in steady condition after one minute.

OBSERVATION:

S.NO.	**Particulars**	**Sample NO.**		**Average value of pH water**
	Type of sample	**1**	**2**	
1	Tap water (treated water)			
2	Bore well water			
3	Surface water (lake ,river etc)			

Sample Calculation

For Observation No...........

Average pH=pH (1) +pH (2)/2=..

Average pH of Tap water

Average pH of Bore Well water Average pH of surface water-..

Results

The pH value of untreated or raw water is observed as

Experiment No.2

AIM: To determine the turbidity of given water sample.

THEORY:

Turbidity is the degree to which a transparent liquid scatters light, usually a measure of the amount of suspended material in the liquid. Even after settlement of heavy particles, small tiny particles remain in suspension and water appears turbid. These suspended solid and colloidal particles cause turbidity in water. Turbid water can indicate the presence of high bacteria levels, pathogens, or particles that can shelter harmful organisms. To decide quantum of further treatments i.e. chemical coagulation, clariflocculation, filtration, disinfection; turbidity of water is important. Therefore water treatment plants constantly monitor turbidity levels to ensure that the water does not exceed permissible limit.

Turbidity is the cloudiness or haziness of a fluid caused due to large numbers of individual particles that are generally invisible to the naked eye, similar to smoke in air. Some examples of the problems caused by high turbidity include. When there are more particles in the water, temperature increases. Warmer water holds less dissolved oxygen. If water has high turbidity, it shows its less transparency on turbidity meter in respective unit. Turbidity is usually measured in Nephelometric Turbidity Units (NTU) or Jackson Turbidity Units (JTU), depending on the method used for measurement.

EXPERIMENTAL SETUP:

Digital Turbidity meter

RESOURCES REQUIRED:

S.NO	Particulars	Specification	Quantity	Remark
1	Digital turbidity meter	Range 0 to 200NTU, Resolution INTU Accuracy: 3% FS, 1Digit, Display3 Digit 7 Segment LED Light Source6V, 0.3Amp Tungsten Lamp, Detector: Photodiode, Sample System:30 mm Clear Glass Test Tubes, Power230 V 10% AC, 50 Hz,Accessories Test tube Set of 5,Operation Manual, Dust Cover	1 No.	Per batch
2	Beaker	Standard glassware beaker of 500 ml.	3 No.	Per batch

PROCEDURE:

Calibration and Standardization

Turbidity Meter calibration: The manufacturer's operating instructions should be followed. Measure standards on the turbidity meter covering the range of interest If the instrument is already calibrated in standard turbidity units, this procedure will check the accuracy of the calibration scales. At least one standard should run in each instrument range to be used. Some Instruments permit adjustments of sensitivity so that scale values will correspond to tabalities Solid standards, such as those made of Lucite blocks, should never be used due to potential calibration changes caused by surface scratches. If a pre-calibrated scale is not supplied. calibration curves should be prepared for each range of the instrument

Measurement

a. Turbidities less than 40 units: If possible, allow samples to come to room temperature before analysis. Mix the sample to thoroughly disperse the solids present in it. Wait until air bubbles disappear and then pour the sample into the turbid meter tube. Read the turbidity directly from the instrument scale or from the appropriate calibration curve.

b. Turbidities exceeding 40 units: Dilute the sample with one or more volumes of turbidity-free water until the turbidity falls below 40 units. The turbidity of the original sample is then computed from the turbidity of the diluted sample and the dilution factor. For example, if 5 volumes of turbidity-free water were added to 1 volume of sample, and the diluted sample showed a turbidity of 30 units, then the turbidity of the original sample was 180 units.

c. Some Turbidity Meters are equipped with several separate scales. The higher scales are to be used only as indicators of required dilution volumes to reduce readings to less than 40 NTU.

OBSERVATION:

S.NO.	**Particulars**	**Sample NO.**		**Average turbidity value NTU/JTU**
	Type of sample	**1**	**2**	
1	Standard water (distilled water)			
2	Bore well water			
3	Surface water (lake ,river etc)			
4	Tap water			

Sample Calculation

Average Turbidity = Reading (1)++ Reading (2)/2=

Average Turbidity of water sample 1=..................................NTU

RESULTS

The turbidity of given water sample is observed as .... NTU

Experiment No.3

AIM: To determine residual chlorine in water.

THEORY:

Chlorine and chlorine-based disinfectants are used worldwide to destroy germs in drinking water and swimming pools. One of the reasons for the widespread use of chlorine disinfectants is that they provide a "residual level of protection against waterborne pathogens. Chlorine residual is a low level of chlorine remaining in water after its initial application. It constitutes an important safeguard against the risk of subsequent microbial contamination after treatment-a unique and significant benefit for public health.

The presence of free residual chlorine in drinking water is correlated with the absence of disease-causing organisms, and thus is a measure of the potability of water.

Chlorination is the process of adding chlorine to drinking water to disinfect it and kill germs. Different processes can be used to achieve safe levels of chlorine in drinking water.

When chlorine is added to water, it forms hypochlorous acid and hypochloric acids within few seconds at temperature between 49°F and 212°F.

$$Cl_2 + H_2O \ \text{pH>5} \longrightarrow \underset{\text{(Hypochlorous acid)}}{HOCI} + HCI$$

The hypochlorous acid is unstable and may break into hydrogen ion and hypochlorite ions.

$$HOCI \ \underset{\text{pH <7}}{\overset{\text{pll>8}}{\rightleftarrows}} \ \underset{\text{Hydrogen ions}}{H} + \underset{\text{(Hypochlorite ions) Ph}}{OCI}$$

The above reaction is reversible and depends upon the pH value of water, which controls the amount of dissociation at pH > 5; Chlorine exists as elemental or molecular chlorine and does not react with water at pH < 5. At pH value between 5 to 7. HOCI will generally exist without dissociating into OCI ions and at pH greater than 10 only OCI7ions are found. As the hypochlorous acid is destructive hence pH value of water during chlorination is generally maintained slightly less than 7, so as to keep the dissociation of HOCI to minimum. The chlorine will immediately react with ammonia present in water to form various chloramines.

$$NH_3 + HOCI \longrightarrow \underset{\text{Mono-chloramines}}{NH_2CI} + H_2O$$

$$NH_2CI + HOCI \longrightarrow \underset{\text{Di chloramines}}{NHCI_2} + H_2O$$

$$NHCI_2 + HOCI \longrightarrow \underset{\text{Nitrogen-Trichloramine}}{NCI_3} + H_2O$$

EXPERIMENTAL SETUP:

Chloroscope

RESOURCES REQUIRED:

S.NO	Particulars	Specification	Quantity	Remark
1	Chloroscope	Orthotolodine test kit (free andtotal chlorine testing for EPA reporting over the range of 0-4 mg/L.)	1 No.	Per batch
2	Beaker	Standard glassware beaker of 500 ml.	3 Nos.	Per batch

PROCEDURE:

1. Fill the three test tubes in the front row of the comparator box with the given water sample up to the given marking.

2. Add 6 drops or 5ml of standard orthotolidine solution in middle test tube and mix with stirrer.
3. A yellow color will be developed in first 5 seconds indicating the presence of free chlorine.
4. Fill distilled water in central tube of the back row,
5. Take two standard color samples in side tubes of back row.
6. Observe from front side against sufficient white or natural light.
7. Compare the color developed in the water sample with standard color, after 5 minutes of addition of orthotolidine solution.
8. The standard colors in two sides of back row may be replaced to obtain a good matching.
9. The known value of chlorine in mg/lit contained in standard colour, which matches with colour developed in water sample, will indicate the contained residual chlorine in given water sample.

OBSERVATION:

S.NO	Sample Detail	Residual chlorine (mg/l)
1		
2		
3		

RESULT:

The residual chlorine for given water sample is observed as

Experiment no.4

AIM: To determine suspended solid, dissolve solid and total solid of given sample of water.

THEORY:

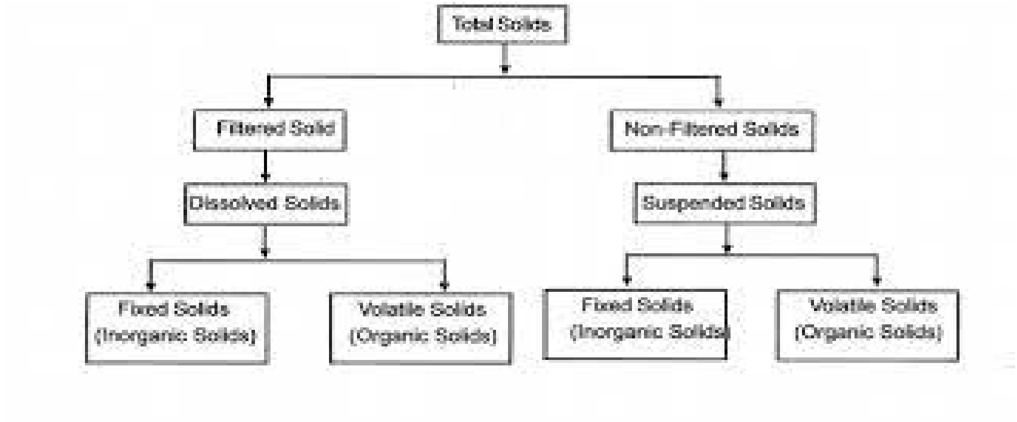
Estimation of total dissolved solids is useful to determine whether the water is suitable for drinking purpose, agriculture and industrial purpose. The term "solids" is generally used when referring to any material suspended or dissolved in water that can be physically isolated either through filtration or through evaporation. Total solids are dissolved solids plus suspended and settleable solids in water. Dissolved solids consist of calcium, chlorides, nitrate, phosphorus, iron, sulfur, and other ions particles. Suspended solids include silt and clay particles, plankton, algae, fine organic debris. and other particulate matter.

- Total Solids (TS): This is the matter that remains as residue upon evaporation and drying of water sample at 103° C-105°C in an oven. This is called Total solids.
- Suspended Solids (SS): These are the solids in raw water/wastewater that remain present on filter paper after filtering the sample through a fine filter.(Whatman's Filter paper No.42).The suspended solids contain much of the organic matter.

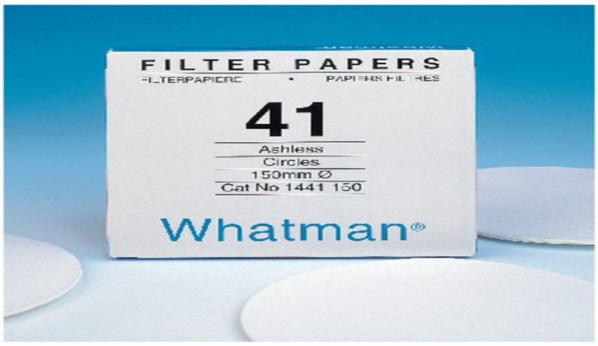
- Dissolved Solids (DS): The filtrate remaining in beaker after filtering the samplethrough filter contains dissolved solids. It includes mainly inorganic salts, small amount of organic matter and dissolved gases.

- Fixed Solids: The residue remain after the ignition of the sample in muffle furnace at 550°C represents the fixed solids. These represent the organic matter in water

- Volatile Solids: The difference between the suspended solids and fixed solidsrepresent the amount of organic matter present in water.



EXPERIMENTAL SETUP



Whatman filter paper

Evapourating dish

Hot Air Oven

RESOURCES REQUIRED:

S.NO	Particular	Specification	Qauntity	Remark
1	Hot Air Oven	Electric Oven with digital control(Tempertature:300°C. 25 kgcapacity)	1 No	Per batch
2	Filter Paper	Whatman's filter paper No.42	3Nos.	Per batch
3	Evapourating dish	Standard glassware or Porcelain dish of 90 mm diameter and 100 ml capacity.	1No.	Per batch
4	Weighing machine	Electronic weighing balance of accuracy 0.01 g	1No.	Per batch

PROCEDURE:

For Total Solids:

1. Weigh the given porcelain dish (clean & dry) and record its weight (W_1)gm.
2. Take 100 ml of sample in porcelain dish.
3. Place the dish in an oven.
4. Evaporate to dryness in an oven at 103°C to 105°C for about 24 hrs.
5. Cool the dish and weight it (W).

For suspended solids.

1. Take a whatman's filter paper no. 42 and record its weight (W) gm.
2. Filter 100 ml sample of water by using above filter paper.
3. Place the filter paper with residue in an oven and evaporate it to dryness
4. Read the weight of the filter paper and residue (W.)

OBSERVATION:

For total solid

S.NO	Type of sample/ Name of water	Vol. Of sample(ml)	Weight of dish(gm)		
			Initial w1	Final w2	W2- W1

For suspended solid

S.NO	Type of sample/ Name of water	Vol. Of sample(ml)	Weight of filter paper(gm)		
			Initial w3	Final w4	W4- W3

Sample calculation

1.Concentration of Total Solids,(mg/L)= (W_2-W_1) X 1000 X 1000/ Volume of Sample in mL

= ....

= ....-mg/L

2.Concentration of Total Suspended Solids, (mg/L)=(W-W) X 1000 X 1000/ Volume of Sample in mL

=-----------------------------

=----------------------------mg/L

3. Concentration of Total Dissolved Solids,(mg/L) = (Conc. of TS)-(Conc. of SS)

= -------------------------
= -------------------------mg/L

Experiment no.5

AIM: To determine DO of given water sample

THEORY:

Dissolved oxygen (DO) refers to the amount of oxygen dissolved in water and is particularly important in aquatic ecology. Dissolved oxygen (DO) is one of the most important indicators of water quality. It is essential for the survival of fish and other aquatic organisms. Oxygen dissolves in surface water from atmosphere. Dissolved oxygen concentrations are constantly affected by diffusion and aeration. photosynthesis, respiration and decomposition. While water equilibrates toward 100% air saturation, dissolved oxygen levels will also fluctuate with temperature, salinity and pressure changes.

Dissolved oxygen is used as an indicator of water quality and eutrophication status of surface water. The term Dissolved Oxygen (DO) refers to the amount of free oxygen dissolved in water which is readily available to respiring aquatic organisms. As dissolved oxygen levels in drinking water should be 5.0 mg/l. Aquatic life is put under stress if the lower the concentration. Oxygen levels that remain below 1-2 mg/1 for a few hours can result in large fish kills. For the conclusion, Dissolved oxygen content is direct measure of freshness of water and hence determination of its presence is important.

EXPERIMENTAL SETUP:

RESOURCES REQUIRED

S.NO	Particular	specification	Quantity	Remark
1	Digital Do meter	Range: 0 to 20 ppm, Resolution: 0.1 ppm, Temperature Compensation: 0 to 50 °C.	1 No.	Per batch
2	Beaker	Standard glassware beaker of 500 ml. capacity	3Nos.	per batch

PROCEDURE:

1. Calibration Before measurement

- Disconnect the " OXYGEN PROBE plug" from the main instrument " Input socket"

- Power on the instrument by selects the "On/Off Switch "to the "On " position. Slide the "DO/CAL Switch "to the "CAL" position. Adjust the "ZERO Adj. VR "until the display shows zero value.

- Power off, connect the "OXYGEN PROBE plug "to the main instrument "Input Socket "then power on. Wait 5 minutes at least until the display reading values become stable & no fluctuation. Adjust the "CAL Adj. VR" until the display reading shows the values exact same as 20.9 (As the oxygen in air is 20.9% typically) (Calibration consideration: Please make calibration procedures under wide and ventilating environment for best effect.)

2. Dissolved Oxygen (DO) measurement

- After the meter be calibrated, don't adjust the "CAL Adj. VR " & " ZERO Adj. VR again until next calibration procedures be done

- Slide the "DO/CAL Switch "to the "DO" position.

- Immersed the probe to a depth at least 10 em of the measured liquid in order for the probe to be influenced by the temp. & automatic temperature compensation to take place. As for the thermal equilibrium to occur between the probe & the measurement sample must be allowed to pass, which usually amounts to a few minutes if the temp. Difference between the two is only several C degrees.

- In order to measure the dissolved oxygen content in any given liquid, it is sufficient to immerse the tip of the probe in the solution, making sure that velocity of the liquid coming into contact with the probe is at least 0.2-0.3 m/s or shake the probe. During laboratory measurements, the use of a magnetic agitator to ensure a certain velocity in the fluid is recommended. In this way, errors due to the diffusion of the oxygen present in the air in the solution are reducing to a minimum.

- Rinsed the probe accurately with normal tap water after each series of measurement.

OBSERVATION:

S.NO	Particular	Sample no.		Average DO (mg/l)
	Type of sample	1(mg/l)	2(mg/l)	
1	Tap water			
2	Bore well water			
3	Surface water			

Sample calculation

For Observation No...........
Average DODO (1) + DO (2)/2 =.--------------------------------
Average DO of Tap water ---------------------------------
Average DO of Bore water-------------------------
Average DO of surface water -----------------------

RESULT

The dissolved oxygen in untreated or raw water is observed as ....mmg / L

Experiment no.6

AIM: Determine the total hardness of given water samples.

THEORY:

Hardness in water is due to the presence of dissolved salts of calcium and magnesium. It is unfit for drinking, bathing, washing and it also forms scales in boilers. Hence it is necessary to estimate the amount of hardness producing substances present in the water sample. Once it is estimated, the amount of chemicals required for the treatment of water can be calculated. The estimation of hardness is based on complexometric titration. Hardness of water is determined by titrating with a standard solution of ethylene diamine tetra acetic acid (EDTA) which is a complexing agent. Since EDTA is insoluble in water, the disodium salt of EDTA is taken for this experiment. EDTA can form four or six coordination bonds with a metal ion. Two type of hardness is present in water first is temporary hardness and second is permanent hardness. Temporary hardness is due to the presence of bicarbonates of calcium and magnesium ions. It can be easily removed by boiling. Permanent hardness is due to the presence of chlorides and sulphates of calcium and magnesium ions. This type of hardness cannot be removed by boiling

RESOURCES REQUIRED:

Water sample, Burette 25-30ml, Glass funnel ,Pipette ,1ml Flask, Dropper, Measuring cylinder

Reagents: EDTA, Eriochrome Black-T, NH_2CL, Ammonia Buffer, Magnesium Carbonate, 90% ethyl alcohol, Distilled water

Reagent preparation:

1. EDTA solution: 4gm EDTA and 0.1gm magnesium bicarbonate dissolve in 800 ml distilled water.
2. Eriochrome Black-T: 0.4gm Ericrome Black T, 4.5 gm hydroxylmine hydrochloride add in 100ml 95% ethyl alcohol.
3. Ammonia Buffer: Stock A: 16.9gm of NH_4CL in 143ml of conc. NH_4OH, Stock B: 1.25gm magnesium salt of EDTA dissolve in 50 ml distilled water. Mix both stock solutions and dilute to 250ml with DDW. Dilute 10ml of the solution to 100ml with DDW.

PROCEDURE:

1. The burette is filled with standard EDTA solution to the zero level.
2. Take 50ml sample water in flask. If sample having high Calcium content then take smaller volume and dilute to 50ml.
3. Add 1ml Ammonia buffer.
4. Add 5 to 6 drop of Ericrome black – T indicator. The solution turns into wine red colour.
5. Note the initial reading.
6. Titrate the content against EDTA solution. At the end point colour change from wine red to blue colour.
7. Note the final reading and record it. Repeat the process till we get concordant value.
8. Take 50ml sample in another flask and boiled it. (Add distilled water to get final volume of water.)
9. Repeat step 3-7.

CALCULATION:

S.NO	Water sample(50ml)	Initial Value	Final value	Ml of EDTA
1				
2				
3				

Total hardness of water mg/L (CaCO3 Scale) = ml of EDTA used (unboiled) *10^3 /ml of sample

Permanent hardness of water mg/L (CaCO3 Scale) = ml of EDTA used (boiled) *10^3/ml of sample

Temporary hardness of water mg/L (CaCO3 Scale) = Total hardness of water - Permanent hardness of water

Observation:

The colour of soluble distilled water and R.O water instantly changed into blue while tap water and pond water turned wine red when Ericrome black T was added and therefore after turned blue when titrated against EDTA solution. S.No. Water sample (50ml) Initial Value Final Value Ml of EDTA 1 2 3

RESULT

The collected water sample contains

Total hardness = _____ppm

Permanent hardness = _____ppm

Temporary hardness = _____ppm

Experiment no.7

AIM: To determine BOD value for determining biodegradability of solution.

THEORY:

The most widely used test indicating organic pollution of both wastewater and surface water is the 5-day BOD (BOD5). This determination involves the measurement of the dissolved oxygen used by microorganisms in the biochemical oxidation of organic matter. BOD5 is the total amount of oxygen consumed by microorganisms during the first five days of biodegradation. Oxygen demand is associated with the biodegradation of the carbonaceous portion of wastes and oxidation of nitrogen compounds such as ammonia. The following equations simplify the process of biodegradation: Organic matter + O2 + microorganisms CO2 + H2O + new microbial cells Ammonia + O2 + microorganisms NO3 + H2O + new microbial cells

APPARATUS:

Apparatus: Incubation bottle 300mL volume; Air compressor, 20°C incubator

PROCEDURE:

Reagents for DO measurement:

1. Manganese sulfate solution: Dissolve 480 g MnSO4.4H2O, 400 g MnSO4.2H2O or 364 g MnSO4.H2O in distilled water, filter, and dilute to 1L. The MnSO4 solution should not give a color with starch when added to an acidified potassium iodide (KI) solution.

2. Alkali-iodide-azide reagent

3. Sulfuric acid: One mL is equivalent to ~ 3mL alkali-iodide-azide reagent.

4. Starch solution: Dissolve 2 g laboratory-grade soluble starch and 0.2 g salicyclic acid as preservative in 100 mL hot distilled water.

5 Standard sodium thiosulfate titrant: Dissolve 6.205 g Na2S2O3 .5H2O in distiller water and add 1.5 mL 6N NaOH or 0.4 g solid NaOH and dilute to 1000 mL. Standardize with bi-iodate solution.

6. Standard potassium bi-iodate solution (0.0021M): Dissolve 812.4 mg KH(IO3) in distilled water and dilute to 1000 mL.

7. Standardization: Dissolve e ~ 2 g KI, free from iodate in an Erlenmeyer flask with 100 to 150 mL distilled water; add 1 mL 6N H2SO4 or a few drops of conc. H2SO4 and 20.00 mL standard bi-iodate solution. Dilute to 200 mL and titrate librated iodine with thiosulfate titrant, adding starch toward end of titration, when a pale straw color is reached. When the solution is of equal, 20.00 mL 0.025M Na2S2O3 should be required. If not, adjust the Na2S2O3 solution to 0.025M.

Steps:

DO measurement:

1. Make dilution water by adding 2mL/L of following reagents in distilled water: a. Phosphate buffer solution b. Magnesium sulfate solution c. Calcium chloride solution d. Ferric chloride solution e. Sodium Sulfite solution

2. For a given sample bottle, add 1 mL of alkali azide and then 1 mL manganous sulfate solution. Shake well the bottle and keep it open for 5 minutes to settle the precipitate. Add 2 mL concentrated H_2SO_4 and place the cap on the bottle. Shake well the bottle till all the precipitate is dissolved.

3. Take 203 mL of sample in conical flask and titrate with standard sodium thiosulfate solution (0.025N) till the colour changes from dark yellow to light yellow. Then add few drops of starch indicator and continue to titrate till the color of the solution becomes either colorless or changes to its original sample colour. Note down volume of 0.025N sodium thiosulfate consumed.

4. Calculate DO value of the sample. Remember that in 200 mL sample, 1 mL of sodium thiosulfate of 0.025N equals to 1 mg/L dissolved oxygen: =>Dissolved oxygen (DO) (in mg/L) = mL of sodium thiosulfate (0.025N) consumed.

BOD:

1. Prepare BOD dilutions. Use dilution water (it contains nutrients, the exact contents are described in Standard Methods):Blank (only dilution water);5 mL sample in 300 mL BOD bottle, fill up with dilution water;15 mL sample in 300 mL BOD bottle, fill up with dilution water;20 mL sample in 300 mL BOD bottle, fill up with dilution water

2. Take 300 mL sample in BOD bottle. Prepare two sets of this sample. Keep one set for DO analysis for day 0 (i.e., Sample0Day) and another sample in BOD incubator for 5 days at 20°C (Sample5Day).
3. Measure DO in different samples at t=0

. 4. Incubate samples in 20oC for 5 days.

5. Come back in the lab after 5 days and record dissolved oxygen.

6. Record data in following manner

OBSERVATION & CALCULATION

Bottle no.	Wastewater sample (mL)	Initial DO (mg/L) (DO0)	DO at 5-day (mL) (DO5)
1			
2			

3			
4			

Calculate

5-day BOD value of the sample at 20°C:

t-day BOD= [DOt-DO0]/(P)

where P= Dilution factor = 300mL/(sample volume in mL)