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TDS value of KCl solution at different temperature.

Molecular weight of KCl = 74.56

Temperature	0.1N	0.01N	0.001N
20	7.46 ppm	0.746 ppm	0.0746 ppm
25	8.15 ppm	0.815 ppm	0.0815 ppm
30	9.03 ppm	0.903 ppm	0.0903 ppm

S.NO	Samples	TDS (ppm)
1	RO DRINKING WATER	321 ppm
2	Tap water	153 ppm
3	Without RO Dation	163 ppm

H Aim

To determine the TDS (Total dissolved salt) content of given water sample.

* Apparatus Required

→ TDS meter , Beaker , Stirrer

* Chemicals

→ KCl Solutions , Distilled water , Sample water

* Introduction of Instruments

→ Digital Digital TDS meter is an unique instrument for measuring TDS value of solutions. digital display with automatic polarity indication.

* Theory

→ TDS indicates total dissolved salt in any sample of water. It includes Chloride , Sulphate , Carbonate , Bi-Carbonate of Ca, Mg, Fe & Al.

Total dissolved solid is a major of the impurities present in a sample of water. Various kinds of minerals salt present in water also contribute to TDS of a given sample.

The permeable limit of TDS in drinking water sample as per S.S is 500 ppm . If TDS of sample increases beyond permissible limit , the water sample is not considered



to be safe.

* Procedure

- ① Shorten on the instrument and allow at least 15 minutes for warm up.
- ② Connect the lead of the cell to the TDS meter.
- ③ Rinse the conductivity cell first with double distilled water and then with the standard KCl solution in which you are going to calibrate.
- ④ Adjust Reading in respective T.D.S range with the help of Calibrate Knob as per the standard KCl solution chart in measurement / T.D.S Selector Range.
- ⑤ It is advisable to Calibrate with the value of nearby standard KCl Solution to obtain better accuracy and then testing of samples.
- ⑥ Clean and rinse the electrode thoroughly and the instrument. Electrode is ready for testing the sample.

* Result

- Value of given water sample is 32.1 ppm, 293 ppm and 163 ppm respectively.

✓ 32.1
✓ 293
✓ 163



* Precautions

- To avoid cross contamination between sample never immerse the electrode in next sample without proper washing and cleaning.

* Implications

- High TDS level generally indicate hard Water.
- TDS effect can be seen in aquariums, seas and swimming pools and reverse osmosis.
- TDS is often maintained in order to create a water quality environment favourable for organism productivity.

Experiment no.-02

* Observation and Calculations

Aim
→ To estimate the moisture content in the given soil sample.

* Apparatus Required
→ Weighing balance, Tongs, Petri dish, Hot air oven, Spatula, Desiccator.

* Theory

Water plays a very significant role in soil growth relationship, it forms major part of plant itself, essential for physiological activities, acts as a solvent and nutrient carrier and maintains turgidity of the plants. In fact, water is a regulator of physical, chemical and biological activities in the soil. Moisture content varies with the climatic conditions.

Moisture is of two types external and internal moisture. External moisture evaporates in atmosphere when soil is exposed to atmosphere.

$$\text{Wet weight moisture \%} = \frac{\text{Loss in weight}}{\text{Initial wt. of soil sample}} \times 100$$

* Procedure

- Take the weight of the empty petri dish.
- Put some soil sample in petri dish and weight it immediately to avoid moisture loss.



- Calculate the weight of Soil Sample.
- Place the dish in pre heated oven for drying at 105° for about an hour.
- Take the petri dish out with the pair of tongs and keep it in a desiccator for cooling.
- Measure the weight.
- Evaluate the weight of dried soil sample.
- The difference of the wet weight and dried weight of soil sample will be the quantity of moisture content present in the soil sample.

* Result

→ The amount of moisture present in soil sample is 10.5%.

* Precautions

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- Petri dish should be perfectly dry.
 - Petri dish should be taken out carefully by using a pair of tongs.

Observations

Normality of Na₂SO₃ solution = N₁NO

\rightarrow Burette, pipette, conical flask and beakers

S.NO	Volume in titration flask (ml)	Burette		Titration used
		Initial (ml)	Final (ml)	
1	25	45	55	?
2	25	—	—	?

* Calculation

$$\text{N}_1\text{V}_1 = \text{N}_2\text{V}_2$$

$$\frac{\text{N}_1}{100} \times \frac{\text{L}}{15} = \text{N}_2$$

$$\text{N}_2 = 0.0008$$

Strength = $N \times \text{molarity}$

$$= 0.0008 \times 35.5 \times 1000$$

$\cancel{1000}$

$\cancel{35.5}$

$\cancel{1000}$

The liberated I₂ is treated against hypo solution, using starch as indicator.

$$\text{I}_2 + 2\text{Na}_2\text{S}_2\text{O}_3 \longrightarrow 2\text{NaI} + \text{Na}_2\text{S}_4\text{O}_6$$

$$\text{I}_2 + \text{starch} \longrightarrow \text{Deep blue complex}$$

The end point is disappearance of blue colour.

* Procedure

- Pipette 25 ml water sample and add few I₂ and Na₂SO₃

Aim

Determination of total residual chlorine in water.

* Apparatus

Burette, pipette, conical flask and beakers

* Theory

The estimation of residual chlorine is based on oxidation of I₂ by residual chlorine i.e. iodimetric titration. When the water sample containing residual chlorine is treated with I₂, residual chlorine (both free and combined) oxidises I₂ and liberate I₂ in equivalent amount.





- Cover the flask and mix the solution well.
- Titrate with hypo ($\text{Na}_2\text{S}_2\text{O}_3$) till yellow pale colour obtained.
- Add starch, the solution will turn blue.
- Titrate further with hypo till blue colour disappear

* Result

- Amount of total residual chlorine in given sample of water
~~✓ 24.5~~ = 28.4 ppm

* Precautions

- The titration should be completed rapidly in order to avoid atmospheric oxidation of iodine.
- first disappearance of blue color may be taken as end point.



Aim

→ Determination of pH in some drinking water samples.

* Apparatus Required

→ pH meter, electrode, thermometer, buffer solutions, beaker, stirrer.

* Theory

→ One of the frequently used tests in water chemistry is to determine the pH of water. The water supplied for drinking purpose has to undergo many processes such as Neutralization precipitation, coagulation etc. All these process are pH dependent. pH of natural water lies in the range 4.4 to 8.5.

For determining the pH of a solution different methods are employed. The most widely used method is by using pH meter

* Procedure

- Connect the pH meter to the power supply. Switch on the instrument.
- Take a standard buffer solution of pH 7 in 100ml beaker
- Set the temperature of pH meter
- Connect the combination electrode to the input socket and dip the electrode in pH 7 buffer solution

* Observation

S.NO	Sample	pH
①	Drinking Water	7.65
②	College Tap Water	7.40

→ Remove the electrode from the buffer solution and wash it with distilled water. Dry with tissue paper.

* pH Measurement

- Connect the combination electrode to the input socket after washing it with distilled water.
- Dip the combined electrode in the solution under test.
- Set the temperature knob to the temperature of the solution.
- Set the 'function selector switch' to pH position.
- Note the pH of solution.
- Repeat the same procedure for other water sample.

* Result

- The pH of the given water samples are 7.65 and 7.40

* Significance

- ① Knowing pH value is varying important parameter for analysis of water / waste water treatment, its suitability for domestic use and for irrigation.
- ② Corrosion of water mains is the main problem associated with acidic water.

* Precautions

- Immediately after testing, the electrodes should be washed off with a gentle stream.



Aim

→ To determine the amount of free CO_2 in given sample of Water.

* Apparatus

→ Burette, pipette, conical flask, beakers etc.

* Chemicals

→ N/100 NaOH, phenolphthalein

* Theory

→ free CO_2 is determined by titrating the sample water with N/100 NaOH or N/100 Na_2CO_3 solution using phenolphthalein as an indicator. CO_2 reacts with NaOH to form HCO_3^- .



The end point is appearance of pink colour.

* free carbon dioxide

→ Varying amounts of CO_2 are present in water. CO_2 can be picked up from the atmosphere or it is generated at the bottom of the lake due to decay of organic matter. Rivers receiving acid waters may also show high CO_2 content.

* Observation

S.N.	Volume of sample (ml)	Burette Reading		N/100 NaOH
		I.R	F.R	
1	25	0	2	2
2	25	0	2	2
3	25	0	2	2

* Calculations

→

Sample NaOH

$$N_1 V_1 = N_2 V_2$$

$$N_1 \times 25 = \frac{1}{100} \times V_2$$

$$N_1 = \frac{1}{100} \times \frac{1}{25} \times 3$$

$$= 0.0012$$

$$= 1.2 \times 10^{-3}$$



* Procedure

- i) Rinse and fill the burette with N/100 NaOH solution.
- ii) Pipette out 10ml of water sample in conical flask and add a few drops of phenolphthalein.
- iii) Titrate the solution with N/100 Na₂CO₃ from the burette, till the pink colour persists for at least 30 seconds.
- iv) Note the reading and repeat to get three concordant readings.

* Result

→ The amount of free CO₂ present in water sample is 1.2×10^{-3} ppm

* Precautions

- i) The reaction mixture should be stirred very gently during titration.
- ii) Same amt. of indicator should be added while taking different readings.

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* Observation

S.No	Vol. of solution (ml)	Burette Readings I.R.(ml)	F.R.(ml)	Vol. of titration end (F-I) (ml)
1.	25 ml	0	1.8	1.8
2.	25 ml	1.8	3.5	1.7
3.	25 ml	3.5	5.2	1.7

Calculations

* Theory
 → Oxygen itself is not a pollutant in water but its deficiency is an indicator of several types of pollution of water.

Dissolved oxygen is determined by Dinkel's method of iodometric titration. The dissolved oxygen in water oxidises I₂ and an equivalent amount of iodine is liberated. This iodine is titrated against a standard hypo solution. However since dissolved oxygen in water is in molecular state it is not capable of reacting with KI, therefore an oxygen carrier such as manganese hydroxide is used.

$$\begin{aligned}
 \text{Strength of dissolved oxygen} &= N_V \times d \cdot w t \\
 &= 0.06064 \times 8 \text{ g/l} \\
 &= 0.0004848 \text{ g/l} \\
 &= 5.49 \text{ ppm}
 \end{aligned}$$



Aim
 → Determination of dissolved oxygen in the given sample of water

* Apparatus

→ Burette, pipette, conical flask, breakers etc.

* Chemicals

→ Na₂SO₃ (Molar), MnO₄, KI, starch, conc NaOH.

* Procedure:

- ① A known amount of sample water (250ml) is taken in a stoppered bottle avoiding contact with air.
- ② Add 1ml of MnSO_4 solution to it by means of a pipette dipping the end well below the surface of water.
- ③ Stopper the bottle and shake thoroughly. Allow the brown precipitates of MnO(OH)_2 formed to settle down.
- ④ When some portion of the liquid below the stopper is clear add 1ml of H_2SO_4 with the help of pipette.
- ⑤ Pipette out 50ml of the above solution in a 100ml conical flask.
- ⑥ Add 1ml of starch solution and continue the titration till the blue colour disappears.
- ⑦ Volume of the water sample taken for titration = 50ml.

* Result

→ The amount of dissolved oxygen in water = 5.44 ppm.

WPS
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* Precautions:

- ① The water should be taken in the stoppered bottle very carefully without trapping air bubbles.
- ② MnSO_4 and alkaline iodide - azide solutions are added to the water sample just below the surface of water.
- ③ Whole of the precipitate of MnO(OH)_2 should be dissolved in H_2SO_4 .

————— XXXX —————

Experiment - 7



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Aim

→ To determine the turbidity of given water sample.

* Apparatus

→ Turbidity meter, cuvettes (1 set)

* Chemicals

→ Hydrazine sulphate, Hexamethylene tetramine, distilled water, Sample water.

* Theory

→ Clarity of water is important in producing products destined for human consumptions in many manufacturing uses, beverage products, food, processors treatment plants. Drawing of surface water supply commonly rely on coagulation and settling and filtration to ensure an acceptable product.

→ Turbidity in water is caused by suspended matter such as clay, slit finely divided organic or inorganic matter soluble, coloured organic compounds and plankton and other microscopic organism.

→ The Digital Turbidity meter is very accurate and stable instrument for measurement of turbidity up to 100 NTU.

REAGENT Preparation

* Turbidity free water

→ Pass distilled water through membrane filter having precision size hole 0.2 µm, the usual membrane filter used for bacteriological examinations is not satisfactory. Rinse collecting glass at least twice.



* Procedure

- ① Switch ON the instrument and keep it on for some time.
- ② Select appropriate range depending upon the expected turbidity of the sample.
- ③ Set ZERO of the instrument with turbidity free water using a blank solution.
- ④ Now in another test tube take standard suspension just prepared as in section.
- ⑤ Take its measurement and set the display to the value of standard suspension with the Calibrate Knob.
- ⑥ Put the given sample solution in cuvet and measure its turbidity.

* Interference

- Turbidity can be determined for any water sample that is free of debris and rapidly settling coarse sediments.
- Dirty glassware, the presence of air bubble disturb the surface visibility of the sample.
- True colour, i.e. Water colour due to dissolved substances.
- This effect usually is not significant in the case of treated water.



* Precautions

- Sample test tube must be thoroughly cleaned both inside and outside. In case the test tube gets scratched or etched discard it.
- Do not touch the test tube where the light strikes: at the sides of the test tube, so hold the tube only at the top end.

* Result

- Turbidity of given water sample are 117 and 56 NTU.

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Experiment- 8



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* Aim

→ Determination of ammonia in the given water sample.

* Apparatus

→ Burette, pipette, conical flask, beakers etc.

* Chemicals

→ N/50 H_2SO_4 , methyl red.

* Theory

→ Ammonia is found as ammonia hydroxide in solution and reacts with Sulphuric acid according to the following reaction.



* Procedure

- ① Rinse and fill the burette with N/50 H_2SO_4 .
- ② Pipette out 10ml of the unknown sample in titration flask.
- ③ Add two drops of methyl red indicator and mix well.
- ④ Run the acid solution into the flask till the colour changes from yellow to red.
- ⑤ Repeat to get three concordant readings.

* Result

→ The strength of ammonia in water is 323 ppm

✓/S

No.	Vol. of sol.	Sample procedure	Vol. of titrate used
1	10	0.0	9.6
2	10	9.6	9.8
3	10	19.6	9.5

Calculation

Acid Sample

$$N_1 V_1 = N_2 V_2$$

$$\frac{1}{50} \times V_1 = N_2 \times 10$$

$$N_2 = \frac{1}{50} \times \frac{1}{10} \times V_1$$

$$= \frac{1}{500} \times 9.5 = 0.019 N$$

$$\therefore \text{Strength} = N_2 \times 12 \times 1000 \text{ ml/c}$$

$$= 323 \text{ ppm}$$



* Precautions.

- ① The reaction mixture should be stirred very gently during titration.
- ② Same amount of indicator should be added while taking different readings.