Lab-2

1.1 Preparations for Analytical Techniques

A. Acid-Base Reactions

Using concentrated H_2SO_4, HCl and HNO_3 available in the lab,

- Prepare 500 mL of 0.1 N H_2SO_4 solution
- Prepare 500 mL of 0.1 N HCl solution
- Prepare 500 mL of 0.1 N HNO_3 solution

Prepare 1000 mL of a solution containing 0.01 moles of H_2SO_4, 0.005 moles of HCl and 0.003 moles of HNO_3 by mixing appropriate volumes of the above solution and diluting to 1000 mL.

B. Oxidation – Reduction Reactions

- Prepare 500 mL of 0.0417 M $K_2Cr_2O_7$ solution. What is normality of this solution if it is to be used for the following reaction:

$$Cr_2O_7^{2-} + 6Fe^{2+} + 14H^+ \rightarrow 6Fe^{3+} + 2Cr^{3+} + 7H_2O$$

How many grams of ferrous ammonium sulphate (FAS), $Fe(NH_4)_2(SO_4)_2.6H_2O$ needs to be dissolved in 1000 mL of water such that 10 mL of the solution prepared will require exactly 10 mL of $K_2Cr_2O_7$ solution for complete reaction as shown above.

1.2 Taste

The "Flavour Threshold Number" (FTN) is calculated corresponding to the greatest dilution of the sample with taste–free water yielding a definitely perceptible change in taste. FTN is defined as:

$$FTN = \frac{A + B}{A}$$

Where: A = mL of sample
B = mL of taste free water

Procedure:

- A sample of water was diluted as shown in the table below and eight aliquots of different dilutions were prepared.
- Taste the individual samples in ascending order starting from sample no 8.
- Determine the sample for which a perceptible taste is first noticed.
- Report the corresponding FTN.

Sample No	Sample Volume, mL	Diluent Volume, mL	FTN
1	100	0	1
2	50	50	2
3	25	75	4
4	20	80	5
5	10	90	10
6	5	95	20
7	4	96	25
8	2	98	50

Answer the following questions:

- How FTN is related to taste of water?
- After you have found out the preliminary FTN value for a sample, what kind of experiment will you design to determine this value more accurately? Also state precautions that need to be taken for eliminating individual bias from the above test.

1.3 Odour

The "Threshold Odour Number" (TON) is calculated corresponding to the greatest dilution of the sample with odour-free water yielding a definitely perceptible odour.

TON is defined as:

$$TON = \frac{A + B}{A}$$

Where: A = mL of sample
B = mL of odour free water

Procedure:

- A sample of water was diluted as shown in the table below. The eight aliquots of different dilutions were prepared.
- Smell the individual samples in ascending order starting from sample No. 8.
- Determine the sample for which a perceptible odour is first noticed.
- Report the corresponding TON.

Sample No	Sample Volume, mL	Diluent Volume, mL	TON
1	100	0	1
2	50	50	2
3	25	75	4
4	20	80	5
5	10	90	10
6	5	95	20
7	4	96	25
8	2	98	50

Answer the following questions:

- How is TON related to odour of water?
- After you have found out the preliminary TON value for a sample, what kind of experiment will you design to determine this value more accurately? Also state precautions that need to be taken for eliminating individual bias from the above test.

1.4 Colour

- Colour is generally determined by the visual comparison method
- The Standard used is a mixture of Potassium chloroplatinate (K_2PtCl_2) and Cobaltous chloride ($CoCl_2.6H_2O$)
- The colour in natural waters is due to the presence of natural organic matter, i.e., dissolved extracts of rotting leaves, trees, branches, animals, etc., picked up by water flowing over the ground as runoff.
- Colour in wastewaters is due to the presence of human wastes.
- Colour in industrial wastewaters may be due to specific chemicals, i.e. dyes etc.
- The method described is valid for the colour from naturally occurring sources, i.e., natural organic matter or human wastes.

Measurement of Colour:

- Colour standards are prepared by the following methods
    - Dissolve 1.246 g of Potassium Chloroplatinate (K2PtCl2) and 1.0 g of Cobaltous Chloride (CoCl2.6H2O) in 500 mL of distilled water containing 100 mL of concentrated HCl.
    - Dilute to 1000 mL. This solution has strength of 500 colour units.

- Dilute this standard suitably to produce standards with the strengths of 5, 10, 15, 20, 25, 30, 35, 40, 45, 50, 60 and 70 colour units. Store in 50 mL Nessler tubes

- Take 50 mL of filtered sample, whose colour needs to be determined, in a similar tube. Compare with the standards visually and select the standards bracketing the colour of the sample.
- If it is determined that the colour of the sample is more than 70 colour units, dilute the sample suitably with the distilled water, and repeat the procedure.
- Report results as follows:

• Colour:	1-50:	Report to nearest 1
• Colour:	51-100:	Report to nearest 5
• Colour:	101-250:	Report to nearest 10
• Colour:	251-500:	Report to nearest 20

What you must know after this laboratory:

- To measure colour of a given sample by the visual comparison method. Each student in the class must do this exercise individually.

Lab Exercise – 2

2A: Preparations for Analytical Techniques I (30 Marks)

1. Conc. H_2SO_4 has a density of 1.98 g/mL and is 98% H_2SO_4 by weight. Calculate the normality of this concentrated solution. What is the volume of acid required to make 1 L of 0.1M solution?
2. Conc. HNO_3 has a density of 1.41g/mL and is 69% H_2SO_4 by weight. Calculate the normality of this concentrated solution. What is the volume of acid required to make 1 L of 0.1M solution?
3. Conc. HCl has a density of 1.19 g/mL and is 36.5% H_2SO_4 by weight. Calculate the normality of this concentrated solution. What is the volume of acid required to make 1L of 0.1M solution?

2B: Preparations for Analytical Techniques II (25 Marks)

For preparing the solution, 10.5 mL, and 0.2452 g of $K_2Cr_2O_7$ were used. If this solution is to be used for the following reaction, what is its normality?

$Cr_2O_7^{2-} + 6Fe^{2+} + 14H^+ = 6Fe^{3+} + 2Cr^{3+} + 7H_2O$

2C: Taste: (15 Marks)

Q.1 FTN of given sample: 8, How is FTN related to taste of water?

Q.2 What precautions would you take to remove individual bias from the result?

2D: Odor: (15 Marks)

Q.1 TON of given sample: 2, How is TON related to odor of water?

Q.2 What precautions would you take to remove individual bias from the result?

2E: Color: (15 Marks)

Q.1 Why colour is measured on Pt-Co Scale? Can you measure any other colour in an industrial effluent on the same scale? Provide justification for your answer.