

→ CHEMISTRY POST LAB QUESTIONS :-

→ Experiment 1 :-

AIM: To determine total hardness of water by EDTA method.

* POST LAB QUESTIONS :-

Q.1 Explain the significance of determination of hardness of water.

Ans:- Determination of hardness of water helps a lot in its classification into groups and categories so that they can be applied and used for various purposes depending on the measure of their hardness. It also helps in designing water softening systems depending on the measure of divalent cations present to prevent damage that may occur to the boiler because of formations in the form of scale and sludges. They help in maintaining balance for marine life and as well.

Q.2 Why is the end point of titration wine red to blue?

Ans:- Complimentary titration using Eriochrome Black T (EBT) as an indicator is the reason for the end point of titration being wine red to blue. EBT forms a

less stable wine red complex with metal ions.
But when Na_2EDTA is added to it, the complex dissociates setting the metal ions. And when Na_2EDTA is this immediately forms a stable colourless complex with EDTA \rightarrow which is a stronger ligand that replaces EBT making the solution blue due to the presence of free indicator ions.

Q.3

Why and how is the pH value adjusted to about 10?

Ans:-

At decreasing(\downarrow) pH : EDTA is insoluble in water as H_4Y formate predominates at $\text{pH} < 2$.

With increasing pH : each hydrogen ion starts dissociating in the EDTA carboxyl group.

Since we need Y^{4-} to react with metal ions present in the titration solution, we use a pH 10 buffer.

The Na_2EDTA complex remains stable around that pH and the complex in the basic medium can be set using an alkaline buffer of NH_4OH or NH_4Cl .

[Q.4]

As per the WHO norms, what is the standard value of hardness of drinking water?

Ans:-

The WHO norms commonly express hardness as milligrams (mg) of calcium carbonate equivalent per litre. Water containing calcium carbonate at concentrations below 60 mg/l is generally considered soft, 60 - 120 mg/l moderately hard, while 120 - 180 mg/l considered hard. Above 180 mg/l will be termed as very hard. Overall: (120 - 170) mg/l should ~~be~~ not be exceeded.

[Q.5]

What is potable water, deionized water, saline water, brackish and mineral water?

Ans:-

PORABLE WATER :-

Water which originates from surface and ground sources and is labelled as "drinking water." It is treated for micro-organisms, bacteria, toxic chemicals, virus, faecal matter etc. to meet met federal and state standards of consumption.

DEIONIZED WATER :-

water with all mineral salts removed → that is all ions typically removed by boiling distilled water and then recondensing it to leave impurities behind.

→ SALINE WATER:

Water with very high concentration of dissolved salts [mainly NaCl] and commonly referred to as "salt water"

→ BRACKISH WATER:

Salt water & fresh water mixed together → an intermediate of saltiness, more salty than fresh water but way lesser than sea water.

→ MINERAL WATER:

Water containing large amount of dissolved minerals, sourced from natural springs : with high contents of CaCO_3 , potassium, MgSO_4 , Na_2SO_4 etc.. It could be still or sparkling depending upon the presence / absence of gases.

→ EXPERIMENT - 2 :

→ AIM : To determine the alkalinity of given water sample of water.

→ QUESTIONS :-

Q1

What are the adverse effects of acidic and alkaline water?

Anc:-

Excess alkalinity in the body causes gastro-intestinal issues and skin irritation. It can also lead to health conditions like alkalosis, which results from the blood stream losing too much acidity. Symptoms of alkalosis include confusion, nausea. Acidic water also has similar health risks.

Q2

Explain the significance of alkalinity determination.

Anc:-

Measuring alkalinity is important in determining a stream's ability to neutralize acidic pollution from rainwater or waste-water. It is the acid-neutralising capacity. The alkalinity in stream is influenced by rocks and salts, soils, certain

plant activities and certain industrial wastewater discharges. The alkalinity measurements are used in the interpretation and control of water and wastewater treatment process.

Q:3

What is the effect of temperature on determination of alkalinity?

Ans:- Higher temperature shifts the equation to the right, slightly increasing the carbonate to bicarbonate ratio. At the same time, the acid (H^+) concentration increases slightly which causes a slight drop in pH . This means that a warmer solution can have better buffering capacity than ^{despite} a lower pH.

Following are the effects of temperature :-

- (a) pH and temperature are directly related.
- (b) pH value without temperature is incoherent.
- (c) Solution temp. compensation converts measured pH to pH at 25°C .
- (d) pH values taken at the same temp. or converted to STC can be compared to each other.

4.

Name various ions responsible for alkalinity of water :-

Ans:- Various ions responsible for alkalinity are :

- (a) Carbonates (CO_3^{2-})
- (b) Bicarbonates (HCO_3^-)
- (c) Hydroxyl ions (OH^-)
- (d) Borates, phosphates, silicates (mineraly)

5.

Alkalinity of water cannot be due to simultaneous presence of OH^- , CO_3^{2-} and HCO_3^- ions. Give reasons.

Ans:-

OH^- and HCO_3^- combine together to form CO_3^{2-} ions and thus cannot occur simultaneously for accounting of alkalinity. Hence, we can conclude that all these OH^- , HCO_3^- and CO_3^{2-} ions cannot exist together.

→ EXPERIMENT - 3 :

→ AIM: Demonstration of effect of environmental conditions on metal corrosion.

① A solution is made up to contain 0.01M HCl_3 what is its pH?

Ans:- $\text{pH} = -\log(\text{H}_3\text{O}^+) = -\log(0.01) = 2$

② A solution is made to contain 0.01M NaOH, what is its pH?

Ans:- $\text{pH} = -\log(0.01) = 2$

Now, $\text{p}(\text{OH}) = 14 - \text{pH}$

$\therefore \text{p}(\text{OH}) = 14 - 2 = 12$

③ A pure metal rod, half immersed vertically in water starts corroding at the bottom. Justify.

Ans:- When a rod is immersed vertically in water, the region inside the water is exposed to lesser oxygen as compared to the region in the copper part which is exposed to air. The region exposed to air, being protected by the oxygen acts as a cathode while the portion inside the water behaves as anode experiencing electrochemical corrosion due to the difference in electrochemical potential.

The difference in aeration occurs due to air having more oxygen as compared to water, making the surroundings of both portions of the rod very different.

4) What is the effect of temperature on the rate of wet corrosion?

Ans:- Since wet corrosion are essentially electrochemical in nature, increased temperature tends to speed up the ions taking part in that reaction. Thus the rate of corrosion increases with increase in temperature; due to increase in energy and thus the rate of reactions.

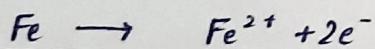
⑤ Whether there will be corrosion in alkaline and neutral medium? Justify.

Ans: Yes, corrosion does occur in alkaline & neutral medium via absorption of O_2 .

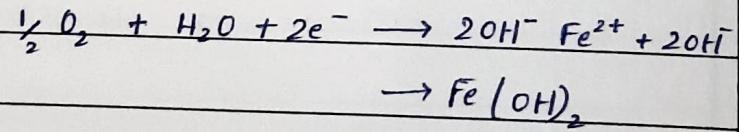
Rusting of iron happens due to dissolved oxygen in water by oxygen absorption mechanism. At the anodic portion, iron gets dissolved due to the oxidation reaction which takes place and electrons flow to the cathodic area, combining with oxygen (if present in enough amount) to form ferrous hydroxide which in turn oxidizes into ferric hydroxide.

Reactions :-

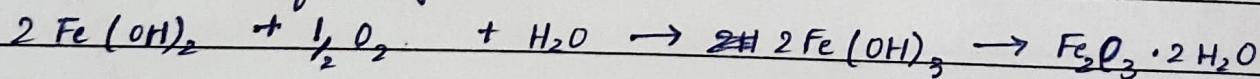
Anode :



Cathode :



In presence of enough $O_2 \rightarrow$



limited supply of $O_2 \rightarrow$ till Fe_3O_4 forms (yellow rust)
(Black unhydrous magnetite)

→ EXPERIMENT 4:

→ AIM : Preparing nylens (threads) and drawing them into threads.

→ QUESTIONS:

Q.1

Explain the terms addition and condensation of polymerisation.

Ans: Addition Polymerization : Involves addition of monomers with double or triple bonds by simple co-linking without the formation of any byproducts.

Condensation Polymerization : Involves repeated condensation reactions between bi/tri functional monomers in a step-growth reaction fashion forming large structural units while releasing small molecules as byproducts such as methanol or water.

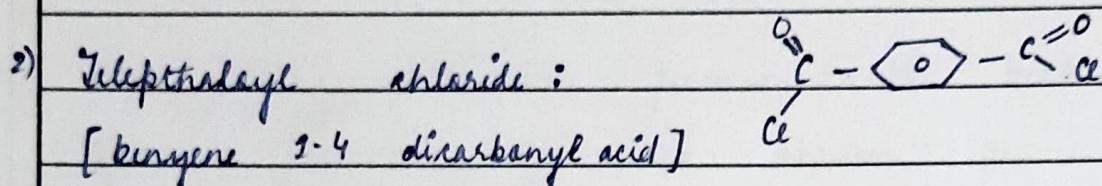
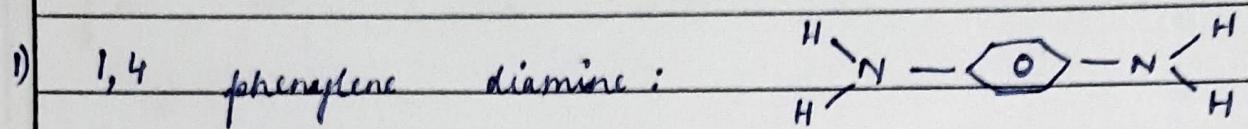
Q.2

What is Kevlar? Name the monomer used for its preparation.

Ans:

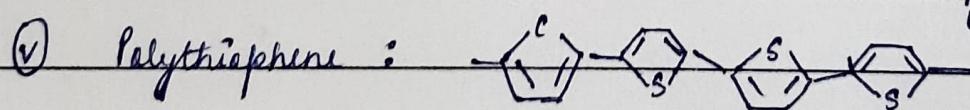
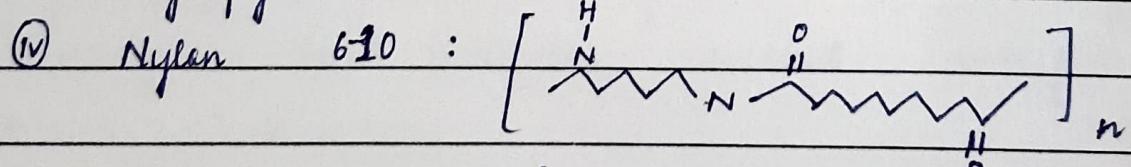
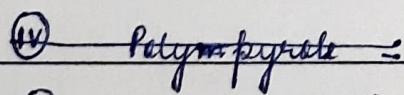
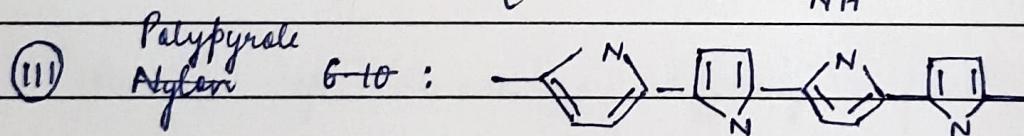
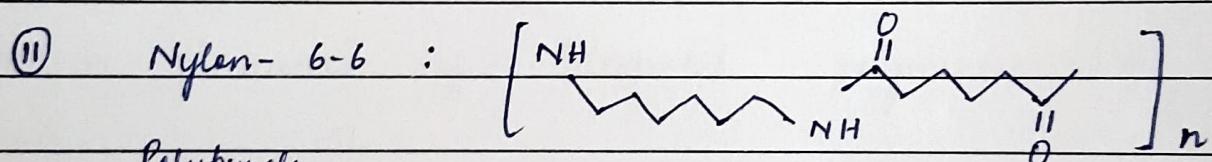
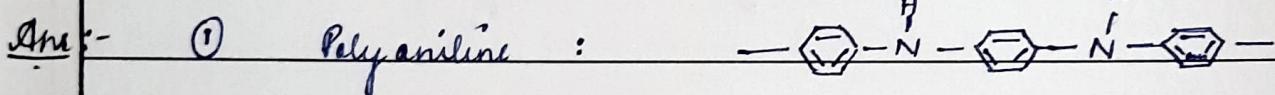
Kevlar: Poly-Paraphenylene Terephthalamide is a heat resistant and strong synthetic fiber

The monomers used to synthesize it are:



[By products formed : HCl]

Q.3 Name the polymers which can be synthesized by interfacial polymerization techniques.



Q.4

Why can the thread / ropes of nylon can be withdrawn from the reaction mixture in an interfaced polymer?

Ans:-

Rope like structures formed in the beakers because of the presence of two phases present inside \rightarrow on the virtue of two different immiscible solvents in the beaker namely water (which dissolves amine) & an organic solvent (which dissolves the diacid chloride). The interface of the both solvents gives way for the polymerisation of flexible films.

5

Is the stoichiometric balance important for the success of interfacial polymerisation?

Ans:- Because of monomers diffusing from the organic and aqueous solution phases respectively in an ambiguous and random fashion, stoichiometry automatically exists on the solvent interface in a balanced sense.

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→ EXPERIMENT 5: To determine the electrochemical equivalent of copper. (AIM)

④ QUESTIONS:-

Q.1] Define electrochemical equivalent.

Ans:- When a specific quantity of electrical charge is passed through an element, the mass of the element that gets either evolved or deposited is known as electrochemical equivalent. Its abbreviated as ECE or eq and can be measured with the help of a voltmeter. The ECE here is directly proportional to the quantity of charge passed through the element.

Q.2] Explain the significance of electrochemical equivalent determination.

Ans:- The ECE obtained is used for:

- a) determination of the kinetics of corrosion rates.
- b) estimating oxidizing powers in specific environments.

Q.3] what is the effect of temperature on determination?

Ans:- Kinetic energy is gained as the movement of the ions

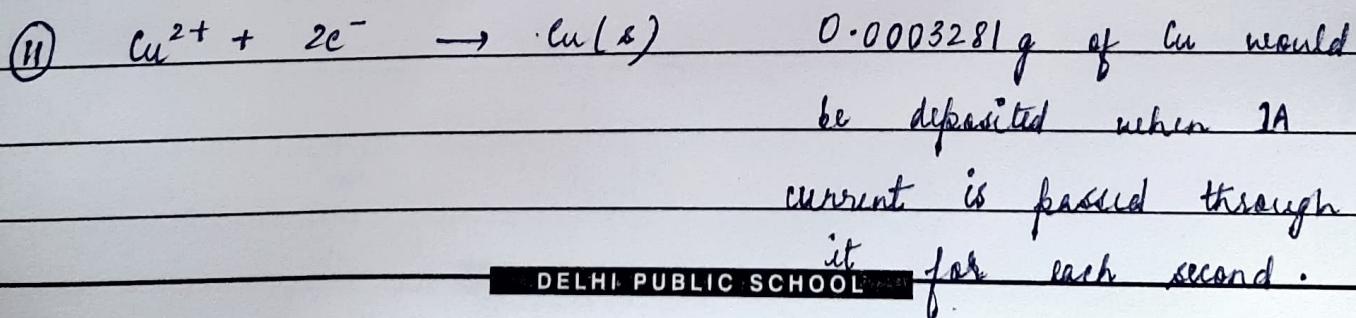
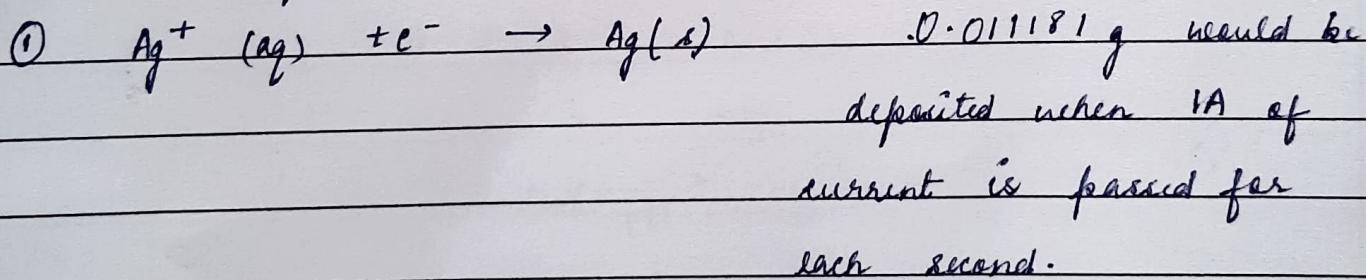
rapidly increases with increasing temperatures supplementing to higher energy states. Thus, increase in temperature increases the electrolytic conductivity.

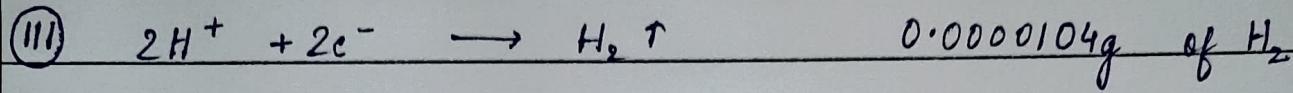
Q.4] What do you understand from the value of ECE of the following elements :

<u>Element</u>	<u>ECE</u>
Silver	0.0011181
Copper	0.0003281
Hydrogen	0.0000104

Ans:- The table values show that for each second, if we pass an ampere worth of current \rightarrow the mentioned amount of element gets deposited or evolved would be equal to its ECE.

For Example :-





would evolve when

1A of current is passed
for each second.

Q.5 Name and state the laws which forms the basis of ECE.

Ans:- The base of ECE is formed by 2 Faraday's first law which states that :-

"Weight of a substance deposited on an anode electrode during electrolysis is directly proportional to the quantity of electricity passed through the electrolyte."

If $w \Rightarrow$ weight of substance deposited, $q \Rightarrow$ Qty. of electricity in coulombs

$$\text{Then } w \propto q \Rightarrow q = It; w \propto It; w = ZIt$$

$$\Rightarrow (Z) = \frac{w}{It}$$

constant \leftarrow
 $ECE \leftarrow$

→ EXPERIMENT 6:

AIM :- Estimation of dissolved oxygen in a given sample using Winkler's method.

→ QUESTIONS :

Q.1 What do you understand by phase fixation of dissolved oxygen?

Ans:- The quantity of dissolved oxygen is seemingly fixed by the addition of a series of reagents that form an acidic compound, which when titrated with a neutralizing compound results in a change in colour. The addition of alkali iodide $\xrightarrow{\text{oxide}}$ solution results in the formation of a brown precipitate of basic manganese oxide indicating the presence of a fixed amount of dissolved oxygen (which otherwise would yield a white ppt of $\text{Mn(OH)}_2 \downarrow$).

Q.2 What is the effect of oxidizing impurities like NO_3^- and Fe^{3+} (if not removed) on DO results?

Ans:- These oxidizing ions (NO_3^- & Fe^{3+}) might convert

the water molecules into oxygen gas by interacting with them in the form of oxidising impurities to generate more dissolved oxygen which would interfere with the existing oxygen present in the dissolved form, altering its quantity variably and disturbing the existing fixation.

Q.3

What is the effect of reducing impurities SO_4^{2-} , S^- and Fe^{2+} on DO determination?

Ans:

Reducing impurities, much like oxidising ones mentioned before would interfere with the ~~the~~ existing quantity of dissolved oxygen by reducing the dissolved O_2 into OH^- ions, affecting the existing DO fixation.

Q.4

What is the optimum DO value for drinking water as per standard WHO means?

Ans:

Permissible drinking water range as per WHO guidelines is capped at 7.5 mg/l.

Q.5

What is the significance of DO measurements?

Ans:

Atmospheric oxygen doesn't dissolve ~~in~~ very readily in water and varies proportionally with partial pressure

and thus impacted by different factors like temperature, altitude, organic concentrations etc. making it very important to measure the DO more accurately for differently kinds of water available as it indicates:

- ① Level of pollution / contamination of water bodies (decrease in DO seen with increase in organic contaminants) Indicates
- ② Indicates the quality of water in terms of survival of aquatic life like fish.
- ③ It also indicates whether aerobic conditions like in aerobic biological units are sufficient.
- ④ It is quite important to deem ^{water} as fit / unfit consumption.

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EXPERIMENT : 7

AIM: Determining the molecular weight of a polymer using Ostwald's viscometer

→ QUESTIONS :-

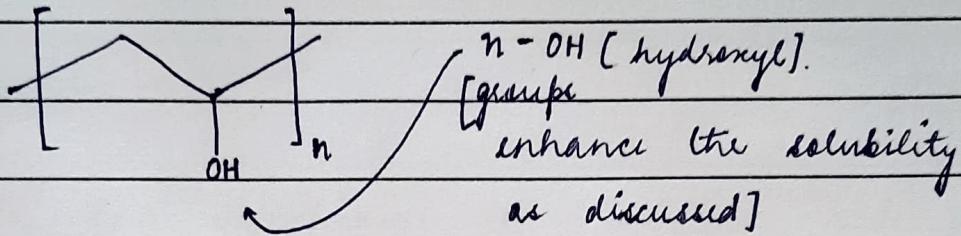
[Q.1] What do you understand by viscosity?

Ans:- Viscosity ~~descries~~ describes the internal friction of a moving fluid. It quantitatively measures a fluid's resistance to flow. Any fluid with higher viscosity resists motion (flow) due to its molecular make up. Basically viscosity emerges as the quantity that ~~descries~~ describes the resistive nature of a fluid towards relative motion of immersed objects within them as well as the motion of layers with differing velocities on the virtue of their molecular ~~at~~ ups and distribution.

[Q.2] Why is PVA soluble in water?

Ans:- PVAs have an abundance of hydroxyl groups which make them soluble in water as these groups tend to form hydrogen bonds with the water molecules.

they interact with, generating a sense of solubility. Varying weights (molecular) and the degree of hydrolysis determines the extent of solubility for specific polyvinyl alcohols.



Q.3 Explain the significance of Molecular weight of a polymer with respect to various properties.

- Almost all properties of a polymer are dependant on its ^{molecular weight} and distribution.
- Ans:- Lower the number of repeating units (and thus molar weight), the more soft / rubbery the polymers come out to be. Because of this, they are very low in their viscosity as well and possess little ~~no~~ strength.
- On the other hand, higher molecular weight ensures high impact resistance of the material. Higher degrees of entanglement suggest improved mechanical properties like allowing stretchability before rupturing as well as improved chemical resistance to a certain extent.

EXPERIMENT - 8 :

→ AIM : ESTIMATION of moisture and ash content in a given sample of coal.

→ QUESTIONS :-

Q.1 Explain the significance of moisture and ash content determination in coal?

Ans:- Determination of moisture and ash content is an important parameter in coal analysis. It is needed to determine the calorific value and handling properties of a coal. This gives information about the practical utility of coal.

Q.2 What is the chemical composition of ash?

Ans:- The main chemical components of ash are carbon, with varying amounts of other elements including calcium, magnesium, potassium, and phosphorus - all of which were not burned when the fuel was used.

Q.3 What is the difference between free ash and fixed ash?

Ans:- Free ash is combustible inorganic matter remaining after burning a fuel, whereas fixed ash is the part of the ash content of the coal that is structurally part of the coal itself and cannot be separated.

from it by any mechanical means.

Q.4 what is inherit moisture present in coal?

Ans: Inherit moisture is the moisture remaining in coal after natural drying in air. The inherit moisture is held within the molecular structure of the coal which can be removed only at temperatures greater than 100°C .

Q.5 At what temperature, moisture and ash content present in coal can be removed?

Ans: Coal sample is heated at $105-110^{\circ}\text{C}$ temperature for removal of moisture and ash. To remove the ash and moisture, coal sample is first heated at $105-110^{\circ}\text{C}$ in silica crucible, after which pure coal remains in furnace. This is then dried, cooled and weighed.

EXPERIMENT - 9

- AIM: To determine the iron concentration in a given sample of water using calorimeter.
- POST LAB QUESTIONS :-

Q.1 What is Beer's and Lambert's law?

Ans:- Beer's law is stated as follows - when a beam of monochromatic light is allowed to pass through a transparent medium, the rate of decrease of radiant power with the concentration of medium is directly proportional to radiant power.

Lambert's law :- It states that a beam of ^{monochromatic} light is allowed to pass through a transparent medium, the rate of decrease of radiant power with thickness of medium is directly proportional to thickness of medium/ path length.

Beer's-Lambert's law :- It states that when a beam of monochromatic light is allowed to pass through a transparent medium, the absorption of medium is directly proportional to the thickness (b) and concentration of medium (c). i.e. $A = \text{constant} \times b \times c$.

Q.2 What is the significance of determination of iron concentration in water?

Ans:- Although iron is toxic only at high levels / concentration, it acts as a useful surrogate for other heavy metals, whose presence in drinking water is a real danger to public health.

Determination of iron concentration in water is important as it tells us the amount of iron in water. (drinking)

Transmittance - Transmittance is the quantity of light that passes through a solution -

absorbance and % Transmittance can be expressed by $A = 2 \log_{10} (\%T)$

[Q.3] Explain the basic terms - absorbance and % transmittance.

Ans:- Absorbance - Absorbance is a measure of the quantity of light absorbed by a sample.

Transmittance - Transmittance is the quantity of light that passes through a solution.

Absorbance and % Transmittance can be expressed by
$$A = 2 \log_{10} (\%T)$$

[Q.4]

Explain the basic principle behind Colorimeter.

Ans:-

The colorimeter is based on Beer-Lambert's law, according to which the absorption of light transmitted through the medium is directly proportional to the medium concentration with a specific wavelength.

In a colorimeter, a beam of light which may navigate the coloured light to the measuring device. This analyses the colour compared to an existing standard. A micro processor then calculates the absorbance or percent transmittance.

[Q.5]

Iron is present in water in which forms? What is their source in drinking water?

Ans:-

Iron can be present in water in two forms: either the soluble ferrous iron or the insoluble ferric iron.

Water containing ferrous iron is clear and colourless and when exposed to air in water turns cloudy causing a reddish brown ppt. of ferric iron appears.

Iron exists naturally in rivers, lakes, and underground water. It may also be released to water from natural deposits, industrial waste, refining of iron ore, and corrosion of iron containing metals.