

VIVA-VOCE

APPLIED CHEMISTRY[CHEM101]

Experiment-1

AIM- To determine the ion exchange capacity of a given cation exchanger.

Q1)What is the principle of ion exchange chromatography?

Ans. Ion Exchange Chromatography

The most popular method for the purification of proteins and other charged molecules is ion exchange chromatography. In cation exchange chromatography positively charged molecules are attracted to a negatively charged solid support. Conversely, in anion exchange chromatography, negatively charged molecules are attracted to a positively charged solid support.

Mechanism

To optimize binding of all charged molecules, the mobile phase is generally a low to medium conductivity (i.e., low to medium salt concentration) solution. The adsorption of the molecules to the solid support is driven by the ionic interaction between the oppositely charged ionic groups in the sample molecule and in the functional ligand on the support. The strength of the interaction is determined by the number and location of the charges on the molecule and on the functional group. By increasing the salt concentration (generally by using a linear salt gradient) the molecules with the weakest ionic interactions start to elute from the column first. Molecules that have a stronger ionic interaction require a higher salt concentration and elute later in the gradient. The binding capacities of ion exchange resins are generally quite high. This is of major importance in process scale chromatography, but is not critical for analytical scale separations.

Q2)Give the structure of cation exchange resin?

Ans.



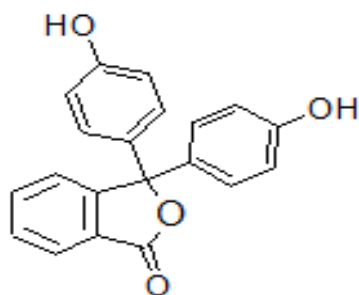
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Q3)What are ion exchange resin made of?

Ans. Most of the resins are made of Polystyrene sulfonate.

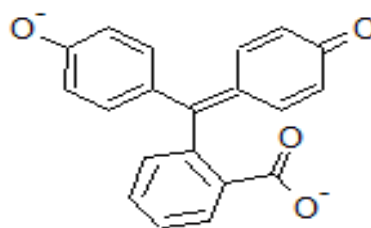
Q4)Structure of phenolphthalein in acidic and alkaline medium?

Ans. In acidic medium



Colorless Form

in alkaline medium



Colored (Pink) Form

Q5)Give advantages and disadvantages of ion exchange process for water softening?

Ans. Merits of ion-exchange process:

- Ø The process can be used to soften highly acidic or alkaline water.
- Ø It produces water of very low hardness (say 2ppm).
- Ø It is very good for treating water for use in high-pressure boiler.

Demerits of ion-exchange process:

- Ø The equipment is costly and more expensive chemicals are needed.
- Ø If water contains turbidity, then the output of the process is reduced
- Ø Turbidity must be below 10 ppm. If it is more, it has to be removed first by coagulation and filtration.

Experiment-2

AIM- To determine the temporary, permanent and total hardness of a sample of water by complexometric titration method.

Q1)What is temporary and permanent hardness of water? How is its caused?

Ans. Temporary hardness is water hardness due to the presence of calcium and magnesium carbonates and bicarbonates, which can be precipitated by heating the water. It can be removed by processes such as boiling or lime softening, and then separation of water from the resulting precipitate.

Temporary hardness is caused by dissolved calcium hydrogencarbonate (which is removed by boiling).

Permanent hardness in water is hardness due to the presence of the chlorides, nitrates and sulphates of calcium and magnesium, which will not be precipitated by boiling. The lime scale can build up on the inside of the pipe restricting the flow of water or causing a blockage. This can happen in industry where hot water is used.

Q2)Water hardness occurs naturally

Ans:Hardness comes from naturally occurring calcium and magnesium mineral salts, which are dissolved from the rocks through which rain water flows. Water is harder in chalk or limestone areas than those with insoluble rock such as granite.

Q3)What is the principle of complexometric titration?

Ans. Complexometric titration (sometimes chelatometry) is a form of volumetric analysis in which the formation of a colored complex is used to indicate the end point of a titration. Complexometric titrations are particularly useful for the determination of a mixture of different metal ions in solution. An indicator capable of producing an unambiguous color change is usually used to detect the end-point of the titration

Q4) What are advantages and disadvantages of hard water?

Ans. The disadvantages of hard water

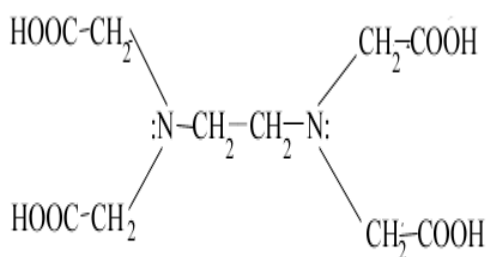
1. Since hard water does not lather easily with soap, it wastes a great deal of soap when it is used in washing. It therefore is not economical to be used in washing.
2. It is not advisable to use hard water in washing white fabrics since it tends to stain white fabrics by making them appear grey. More often than not when you use hard water to wash your white clothes, you are going to see the clothes turning grey after you have washed them. This is what hard water often does to white fabrics.
3. Hard water is not good for dyeing materials. This is why the dyeing industry doesn't use it to work.
4. Hard water forms annoying limescales in containers such as kettles, pots, pipes, etc.

The advantages of hard water :-

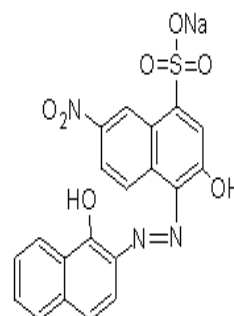
1. hard water is good for making our bones and teeth stronger when we drink it. The reason hard water is capable of doing this is because it contains high amounts of calcium and iron, which are good for the bones and teeth. This means the more hard water you drink, the stronger your bones and teeth are going to become.
2. Hard water does not dissolve lead, and as a result of this it does not lead to lead poisoning if lead pipes are used in transferring the water into households.
3. Hard water tastes better than soft water.
4. Hard water is generally safer for drinking than soft water.

Q5) Give the structure of EDTA and EBT?

Ans.



structure of EDTA



↳ Eriochrome Black T (sodium salt)

Q6)How is temporary hardness removed?

Ans. Temporarily hard water is hard because of the presence of carbonate or bicarbonate ions of calcium and/or magnesium. It can be “softened” by boiling or adding lime to it in a process called Lime softening . It can also be softened by ion exchange also called Zeolite softening.

Q7)What is standard hard water?

Ans. Hard water is water that has high mineral content (in contrast with "soft water"). Hard water is formed when water percolates through deposits of limestone and chalk which are largely made up of calcium and magnesium carbonates.

Q8)What is an alternative indicator to EBT?

Ans. We found the following alternative methods for using Eriochrome Black as an indicator.

1. Dry powder form: Grind and mix 1 g of the solid Eriochrome Black T with 100 g of sodium chloride. Add about 0.2 g of this solid mixture to the titration flask for each titration.
2. In ethanol: 1% (w/v) solution. Dissolve 1.0 g of Eriochrome Black T in 80 mL 95% ethanol. Make up to 100 mL with 95% ethanol.
3. In ethanolamine/ethanol: Dissolve 0.2 g of Eriochrome Black T in 15 mL of triethanolamine and then add 5 mL of absolute ethanol.
4. Substitution: Use Calmagite in place of Eriochrome Black T. Dissolve 0.05 g of Calmagite in sufficient distilled water and make up to 50 mL.
5. In ethanol/hydroxylamine hydrochloride: Dissolve 0.5 g of Eriochrome Black T in 50 mL 95% ethanol. Add 4.5 g hydroxylamine hydrochloride. Make up to 100 mL with 95% ethanol.

Q9)Why does hard water not lather with soap?

Ans. Soft water readily forms lather with soap, but it is more difficult to form lather with hard water. The dissolved calcium ions and magnesium ions in hard water react with the soap to form scum, so more soap is needed. Soapless detergents do not form scum with hard water.

Q10)What are the other units in which hardness can be expressed?

Ans. Water hardness is often not expressed as a molar concentration, but rather in various units, such as degrees of general hardness (dGH), German

degrees ($^{\circ}\text{dH}$), parts per million (ppm, mg/L, or American degrees), grains per gallon (gpg), English degrees ($^{\circ}\text{e}$, e, or $^{\circ}\text{Clark}$), or French degrees ($^{\circ}\text{fH}$, $^{\circ}\text{F}$ or $^{\circ}\text{F}$; lowercase *f* is used to prevent confusion with degrees Fahrenheit).

Q11) Why is hardness calculated in terms of CaCO_3 equivalent?

Ans. The hardness of water is expressed in terms of ppm because the molecular weight of calcium carbonate is 100gm/mol. It is easy to calculate. This is one of the main reason for expressing the hardness of water in ppm. Also calcium carbonate is insoluble in water therefore it is easy to calculate its amount in water.

EXPERIMENT- 3

AIM- To determine the type and extent of alkalinity of given water sample.

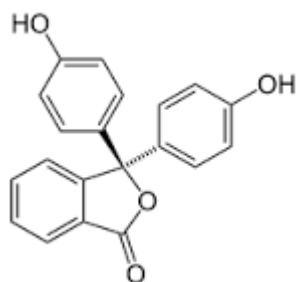
Q1)What is the source of alkalinity in water?

Ans. Alkalinity is due to the presence of HCO_3^- , CO_3^{2-} and OH^- ions.

Q2)In what form does phenolphthalein exists in acidic and basic medium?

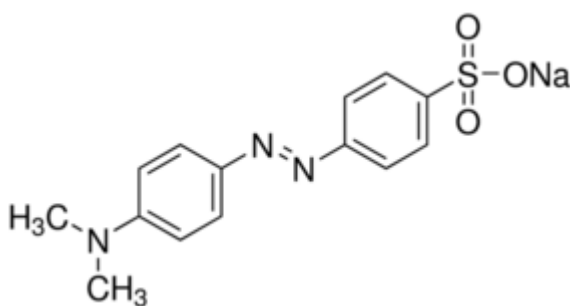
Ans. It exists in Benzenoid form (clear) in acidic medium and Quinoid form (pink) in basic medium.

Q3)What is the structural formula of phenolphthalein?



Ans. $\text{C}_{20}\text{H}_{14}\text{O}_4$

Q4)What is the structural formula of methyl orange?



Ans. $\text{C}_{14}\text{H}_{14}\text{N}_3\text{NaO}_3\text{S}$

Q5)At what pH range does phenolphthalein give a colour change?

Ans. (8.2 – 10) pH

Q6)In what forms does methyl orange exists in different mediums?

Ans. It exists in Quinoid form (yellow form) in basic medium and Benzenoid form (red form) in acidic medium.

Q7) At what pH range does methyl orange give a colour change?

Ans. (3.2 – 4.4) pH

Q8) What are different types of alkalinity?

Ans. Alkalinity is of two types-

- Caustic alkalinity due to OH^- and CO_3^{2-} ions.
- Temporary hardness due to HCO_3^- ions.

Q9) What is the factor that determines the end point of acid base titrations?

Ans. Colour change

Q10) What is your observation when $P=0$, $P=0.5\text{ M}$, $P<0.5\text{M}$, $P>0.5\text{M}$, $P=M$?

Ans.

Alkalinity	OH^- (ppm)	CO_3^{2-} (ppm)	HCO_3^- (ppm)
$P=0$	NIL	NIL	M
$P=1/2\text{ M}$	NIL	$2P$ or M	NIL
$P<1/2\text{ M}$	NIL	$2P$	$(M-2P)$
$P>1/2\text{ M}$	$(2P-M)$	$2(M-P)$	NIL
$P=M$	$P=M$	NIL	NIL

EXPERIMENT- 4

AIM- To determine the number of water molecules of crystallization in Mohr's salt (ferrous ammonium sulphate) provided standard potassium dichromate solution (0.1N) using diphenylamine as internal indicator.

Q1) Define redox titrations.

Ans. A redox titration is a type of titration based on a redox reaction between the analyte and titrant. It may involve the use of a redox indicator and/or a potentiometer.

Q2) What is an oxidizing agent?

Ans. It is an oxidizing agent is a substance that has the ability to oxidize other substances. It tends to bring about oxidation by being reduced and gaining electrons.

Q3) Why $K_2Cr_2O_7$ cannot be used as self-indicator?

Ans. Although the dichromate solutions are intensely orange coloured and a single drop of it imparts yellow colour to a colourless solution, it can't be used as self indicator.

Q4) Why is dil. H_2SO_4 added while preparing standard Mohr's salt solution?

Ans. To prevent hydrolysis of salt.

Q5) Why H_3PO_4 is added when diphenylamine is used as an indicator?

Ans. It is added because during the titration when about only 50% of Fe^{2+} ions are oxidized to Fe^{3+} ions, the high conc. of Fe^{3+} ions may also cause the oxidation of diphenylamine. Thus the blue colour may result before the end point is reached. So H_3PO_4 is added to prevent this which forms a stable complex with ferric ions and prevent oxidation of indicator.

Q6) How does diphenylamine act as internal indicator?

Ans. When near end point slight excess of dichromate is added, it will bring about the oxidation of diphenylamine and results in formation of a blue coloured complex.

Q7) Why is dil. H_2SO_4 added?

Ans. To maintain acidic medium (pH).

Q8) Explain internal and external indicators.

Ans. Internal indicators are those in which one of the reactant act as self-indicator. Eg.- KMnO_4 in permanganate titrations. External indicators are which are added from outside and detects the change in pH. Eg.- phenolphthalein and methyl orange in acid base titrations.

****Experiment 5&6 are not is course**

Experiment-7

AIM-To prepare and describe a titration curve for phosphoric acid- sodium hydroxide titration using pH meter.

Q1)What is a electrochemical cell?

Ans-An apparatus that is used to generate electricity from a spontaneous redox reaction or, conversely, that uses electricity to drive a nonspontaneous redox reaction is called an **electrochemical cell**.

Q2)What are indicator and refrence electrodes?

Ans- **Chemical indicator**, any substance that gives a visible sign, usually by a colour change, of the presence or absence of a threshold concentration of a **chemicals** species, such as an acid or an alkali in a solution. Example- methyl orange, phenolphthalein etc.

A reference electrode is an electrode which has a stable and well-known electrode potential. The high stability of the electrode potential is usually reached by employing a redox system with constant (buffered or saturated) concentrations of each participants of the redox reaction. There are many ways reference electrodes are used. The simplest is when the reference electrode is used as a half cell to build an electrochemical cell. This allows the potential of the other half cell to be determined. An accurate and practical method to measure an electrode's potential in isolation (absolute electrode potential) has yet to be developed.

Q3)Why standard hydrogen electrodes not used in ph measurements ?

Ans- Theoretically, pH value can be identified very precisely with the hydrogen electrode. In practice, however, working with the hydrogen electrode is expensive and cumbersome. High-purity hydrogen and constant hydrogen pressure are conditions which are hard to create in a practical setting. The hydrogen electrode will also fail if the solution contains heavy metal ions which contaminate the platinum surface. Reductive or oxidizing components in the measuring solution also lead to undesired side reactions and therefore to errors in measurement. The hydrogen electrode is consequently only used today under very specific defined conditions for more scientific purposes. The same applies to the so-called quinhydrone electrode. As a special form of hydrogen electrode, today it is seldom used.

Q4)What is meant by pH of a solution?

Ans- pH stands for 'power of hydrogen'. it is the amount of hydrogen ions present in a solution which determines its acidity or alkalinity, mathematically it is equal to the negative decimal logarithm of the hydrogen ion activity in a solution. The scale ranges from 0 - 14, 7 being neutral below it is acidity and above it is alkalinity of a solution.

Q5) Explain the construction of a PH meter along with the types of electrodes used.

Ans- As it was signalled before, pH meter is nothing else, but precise voltmeter, that measures EMF of the pH electrode. However, most commercially available voltmeters will be of no use. pH electrode has internal resistance in the range of 10-100 M Ω . To reliably measure potential voltmeter must have internal resistance at least 100 times larger, while most digital meters available have resistance in the range of 1-10 M Ω , thus they are unsuitable.

Making high-resistance voltmeter is not easy, as such devices are much more sensitive to temperature changes and electromagnetic noise, as well as to electrostatic charges. However, with electronic elements available today it is not very difficult to create an amplifier of very high gain and very high input resistance. Such amplifier can be used as interface between pH electrode and voltmeter (see example circuit diagram below) - and that's how many of the shelf pH meters work.

While the basic ideas behind the pH meter working didn't change much since 1934 (see pH meter history), reliability and precision of today's pH meter are much better, although they are still limited by the electrode construction and properties of the solution itself. As every other lab device today's pH meter is digitized and able to communicate with computer, some models can automatically record data for extended period of time and print the results and so on.

There are two groups of pH meters - bench and portable. Bench pH meter is usually more precise and has more options built in - most often it can be used in any potentiometric application. Portable devices are much simpler, and often able to measure pH only. However, in field they can be invaluable.

Below is example circuit diagram of the pH meter. Note that device is built using several resistors and switches, the only active element being carefully selected operational amplifier. Switches and resistors are necessary to select the mode of operation (pH meter or millivoltmeter for potentiometric applications) and to allow calibration.

Glass electrodes are commonly used for pH measurements. There are also specialized ion sensitive glass electrodes used for determination of concentration of lithium, sodium, ammonium, and other ions. Glass electrodes have been utilized in a wide range of applications — from pure research, control of industrial processes, to analyze foods, cosmetics and comparison of indicators of the environment and environmental regulations: a microelectrode measurements of membrane electrical potential of a biological cell, analysis of soil acidity, etc.

Q6)What is glass electrode?

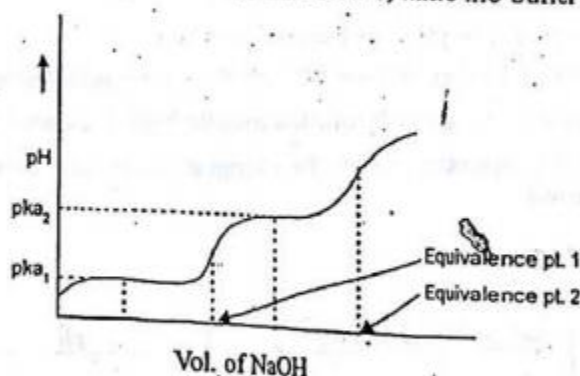
Ans- A **glass electrode** is a type of ion-selective electrode made of a doped glass membrane that is sensitive to a specific ion. The most common application of ion-selective glass electrodes is for the measurement of pH. The pH electrode is an example of a glass electrode that is sensitive to hydrogen ions. Glass electrodes play an important part in the instrumentation for chemical analysis and physico-chemical studies. The voltage of the glass electrode, relative to some reference value, is sensitive to changes in the activity of certain type of ions.

Q8)How the value of K_{a1} and K_{a2} are calculated ?

Ans-

In practice HPO_4^{2-} is too weak an acid for feasible titration in aqueous solution because its dissociation constant is so small and close to ionic product of water, that the pH change at the equivalence point can scarcely be distinguished from the titration of pure water. In general, for the titration curve of a polyprotic acid to show separate well defined equivalence point breaks, the individual K_a values must be larger than about 10^{-9} and differ from one another by at least a factor of 10^3 .

In figure given below, the rate of pH change is smallest where the volume of NaOH added equals $a/2$ and $a + [(b - a)/2]$. These points are halfway to the first and second equivalence points respectively, where the buffer capacity of the titrant solution is greatest. The rate of pH change is greatest at the equivalence points a and b, where the buffer capacity is smallest.



(21)

Thus, the slope of the pH versus volume of added base curve is smallest at the titration points halfway to equivalence, where the buffer capacity is maximum and largest at the equivalence points where the buffer capacity is minimum.

The point where $[H_2PO_4^-]/[H_3PO_4]$ is equal to 1 occurs halfway to the first equivalence point, when half of the NaOH moles needed to complete the neutralization of the first acidic proton added into the solution.

At this point, we have for K_{a1}

$$K_{a1} = \frac{[H_2PO_4^-][H_3O^+]}{[H_3PO_4]} = [H_3O^+] \text{ 1/2 eq pt. or } pK_{a1} = pH_{1/2 \text{ eq pt}}$$

Thus, a measurement of pH at half equivalence point from graph gives K_{a1} directly.

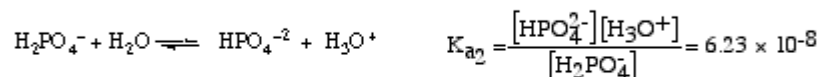
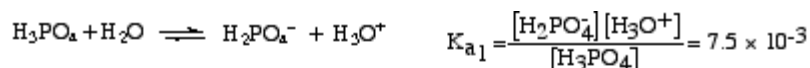
Similarly, a measurement of pH halfway between the first and second equivalence point gives K_{a2} directly.

Q9) Can pH meter be used for acid base titrations?

Ans-yes it can be measured.

Q10) Give equations for the neutralisation of phosphoric acid?

Ans-



****Experiment 8 is not in course**

Experiment-9

AIM-determination of dissolved oxygen in the given water sample.

Q1)What is the method used to determine dissolved oxygen content in water?

Ans- the method used to determine dissolved oxygen content in water is Winkler method or iodometric titration.

Q2)What does low dissolved oxygen content in water signify?

Ans- the deficiency of oxygen in water is an indicator of several types of pollution in water.

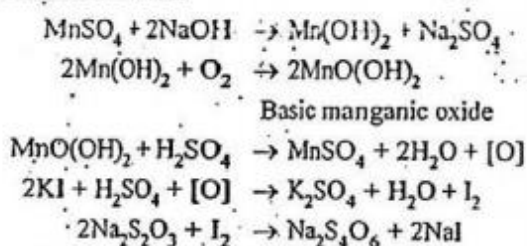
Q3)Why MnSO₄ is added?

Ans-

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

Dissolved oxygen (DO) is determined by *Winkler's method* or iodometric titration. The DO in water oxidizes KI and equivalent amount of iodine is liberated. This iodine is titrated against a standard hypo solution. However, since DO in water is in molecular state and is not capable of reacting with KI, therefore an oxygen carrier such as manganese hydroxide is used.

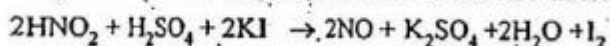
The method involves the addition of a concentrated solution of MnSO₄, NaOH, KI and azide reagent into the water sample. The white precipitate of Mn(OH)₂ which is formed, is oxidized by oxygen in water sample to give a brown precipitate basic manganic oxide [MnO(OH)₂]. This MnO(OH)₂ in acidic medium dissolves and liberates free iodine from the added KI a equivalent amount of dissolved oxygen in water sample. This liberated iodine is then titrated against Na₂S₂O₃ solution using starch as indicator. The reactions involved are:



Q4)How do nitrites interfere in the analysis?

The nitrite present in water, interfere with the titration as these can also liberate I₂ from KI.

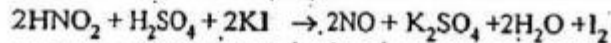
Ans-



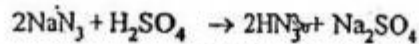
Q5)Why it is necessary to add azide during determination?

Ans- To destroy nitrite present in water, sodium azide is added during determination.

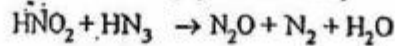
The nitrite present in water, interfere with the titration as these can also liberate I_2 from KI.



Thus to destroy nitrite, sodium azide is used.



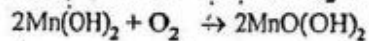
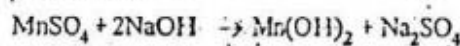
(Hydrazoic acid)



Q6) What is the brown ppt formed initially? how it is dissolved?

Ans- the brown ppt formed initially is 'basic manganic oxide'.

The method involves the addition of a concentrated solution of $MnSO_4$, NaOH, KI and azide reagent into the water sample. The white precipitate of $Mn(OH)_2$ which is formed, is oxidized by oxygen in water sample to give a brown precipitate basic manganic oxide $[MnO(OH)_2]$. This $MnO(OH)_2$ in acidic medium dissolves and liberates free iodine from the added KI a equivalent amount of dissolved oxygen in water sample. This liberated iodine is then titrated against $Na_2S_2O_3$ solution using starch as indicator. The reactions involved are:



Basic manganic oxide

Q7) Are there any substance which causes negative error (iodine to iodide) in this analysis?

Ans- the nitrite presence in water can liberate I_2 from KI

Q8) What is BOD?

Ans- biochemical oxygen demand.

Q9) Is high concentration of oxygen in water harmful?

Ans- Total dissolved gas concentrations in water should not exceed 110 percent. Concentrations above this level can be harmful to aquatic life. Fish in waters containing excessive dissolved gases may suffer from "gas bubble disease"; however, this is a very rare occurrence. The bubbles or emboli block the flow of blood through blood vessels causing death. External bubbles (emphysema) can also occur and be seen on fins, on skin and on other tissue. Aquatic invertebrates are also affected by gas bubble disease but at levels higher than those lethal to fish.

Adequate dissolved oxygen is necessary for good water quality. Oxygen is a necessary element to all forms of life. Natural stream purification processes require adequate oxygen levels in order to provide for aerobic life forms. As

dissolved oxygen levels in water drop below 5.0 mg/l, aquatic life is put under stress. The lower the concentration, the greater the stress. Oxygen levels that remain below 1-2 mg/l for a few hours can result in large fish kills.

Experiment-10

AIM- To determine the total residual chlorine in water.

Q1)Why is chlorine added to water?

Ans: Chlorine is generally added in water as a disinfectant.

Q2)In what forms can chlorine be added into the water?

Ans: It is directly added as a gas or concentrated liquid or in the form of solid tablets. Chlorine in water produces hypochlorous acid, which acts as a powerful germicide. This also deactivates the enzymes of the microorganisms.

Q3)What is the action of chlorine on pathogens?

Ans: When bleaching powder dissolves, it reacts with water to underchloric acid (HOCl) and hypochlorite ions (OCl⁻). Chlorine kills pathogens such as bacteria and viruses by breaking the chemical bonds in their molecules.

Q4)Why is starch added towards the end of the titration?

Ans: Starch indicator. ... This is due to the insolubility of the starch-iodine complex which may prevent some of the iodine reacting with the titrant. Close to the end-point, the starch is added, and the titration process is resumed taking into account the amount of thiosulfate added before adding the starch.

Q5)Write the reactions between KI and I₂.

Ans:



Q6)What are the harmful effects of excess chlorine in water?

Ans: The long term effects of chlorinated drinking water have just recently being recognized. According to the U.S. Council Of Environmental Quality, "Cancer risk among people drinking chlorinated water is 93% higher than among those whose water does not contain chlorine."

Q7)What is breakpoint chlorination?

Ans: Breakpoint chlorination is the point where the demand for chlorine has been fully satisfied in terms of chlorine addition to water. When chlorine is added to water, a reaction is produced in the compounds present in the water. These compounds utilize the chlorine, resulting in zero chlorine residual.

Q8).What are other methods of disinfecting water?

Ans:

- membrane processes
- UV irradiation

Experiment-11

AIM- Determination of amount of oxalic acid and H₂SO₄ in 1 L of solution using N/10 NaOH and N/10 KMnO₄ solution.

Q1).What is meant by redox reaction?

Ans: An oxidation-reduction (redox) reaction is a type of chemical reaction that involves a transfer of electrons between two species. An oxidation-reduction reaction is any chemical reaction in which the oxidation number of a molecule, atom, or ion changes by gaining or losing an electron.

Q2).What is meant by concordant readings?

Ans: Concordant readings are similar readings, which may differ not more than 0.1ml.

Q3).Define term oxidation.

Ans: Oxidation is the loss of an electron from an atom, ion, or molecule.

Q4). What is meant by reduction?

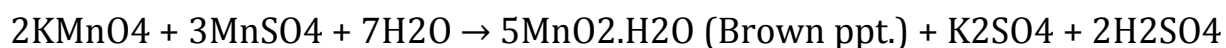
Ans: Gain of electrons or the loss of a positive valence is called reduction.

Q5).Why KMnO₄ is called a self-indicator?

Ans: KMnO₄ is a pink coloured substance, the products formed during reactions are colourless. At the end point its one drop gives pink colouration and, therefore, it behaves as a self-indicator.

Q6).What happens when KMnO₄ solution is added slowly?

Ans: If it is added slowly, a brown ppt. of hydrated manganese dioxide is produced as shown in below reaction.

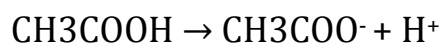


Q7). Why is heating essential in the titration of KMnO₄ with oxalic acid?

Ans: When the titration of KMnO₄ is done with oxalic acid, it takes place very slowly due to slow liberation of Mn⁺² ions. Heating is done to accelerate the reaction.

Q8).What is meant for strong acid and weak acid?

Ans: The acid, which dissociates completely giving H^+ ions is called a strong acid, like HCl , H_2SO_4 and HNO_3 . The acid, which dissociates partially is called a weak acid. For example, acetic acid.



Experiment-12

AIM- Determination of viscosity of given oil by means of Redwood viscometer I

Q1: What is Viscosity?

Ans: It may be defined as a measure of the internal resistance to motion of a fluid by reason of the forces of cohesion between molecules.

Q2:How does the viscosity of a liquid vary with temperature?

Ans: Viscosity of a liquid decreases with increase in temperature generally for every 10 rise in temperature this viscosity index decreases by 2%

Q3:What is the unit of viscosity?

Ans: Poise is the unit of viscosity.

Q4:What is the effect of temperature on viscosity of a gas?

Ans: Viscosity of gases increases with rise in temperature.

Q5.:What do you mean by the term 'viscous-static'?

Ans: Viscous-static is the state of a liquid when its viscosity does not change with rise in temperature.

Q6:What is the significance of viscosity?

Ans: Viscosity is the only property of the lubricating oils which determines their performance under the operating conditions.

Q7:How is viscosity index of a lubricating oil improved?

Ans:Viscosity index of a lubricating oil is improved by adding linear polymer like polystyrenes, polymethacrylates etc.

Q8:How can oiliness of a petroleum oil be increased?

Ans: By adding vegetable oils and higher fatty acids.

Q9.what are the two standard oils used for determining viscosity index

Ans: The two reference oils used are Pennsylvania oils (VI=100) and naphthanic base(VI=0)

Q10. What are the other apparatus that can be used instead of redwood viscometer?.

Ans: Viscometer commonly used are Engler's viscometer and saybolt viscometer.

Q11:What do you mean by all weather lubricants?

Ans: Lubricants with High viscosity index show a very small change in viscosity with change in temperature. Therefore, such lubricants can be used over wide range of temperature and are termed as all weather lubricants.

Q12: What is meant by the term oiliness of a lubricating oil?

Ans: It is a measure of capacity of the lubricating oil to stick to the surfaces of machine parts under conditions of heavy pressure or load.

Experiment-13

AIM- To determine flash point and fire point of an oil by Pensky Martin's Apparatus

Q1:What is fire point of an oil?

Ans: The fire point of an oil is the lowest temp. at which it ignites and continues to burn for atleast five seconds.

Q2:What is flash point of an oil?

Ans: Flash point is the temperature to which a combustible must be heated to giveoff sufficient vapours to.

Q3:Name the instrument commonly used to measure flash and fire point of lubricants in the laboratory?

Ans:Pensky-Mortens apparatus.

Q4:What are the factors affecting the flash and fire point?

Ans: The main factors are 1. Presence of moisture 2. Vapour pressure of oil.

Q5:How water is removed from the oil before determining the flash point?

Ans: Water is removed by (i) Filtration through suitable filter paper. (ii) Absorption by anhydrous calcium chloride. (iii) Centrifugal action.

Q6:What is meant by freaky flash?

Ans: Freaky flash is the production of irregular flashes below the true flash point of an oil due to presence of contamination of oil with small amounts of volatile organic substances.

Q7:What is flammable liquid?

Ans: If a liquid is having flash point less than 1400 F are called flammable liquid.

Q8: What is combustible liquid?

Ans: Combustible liquid have flash point above 1400F.

Q9:What is the main significance of determining the flash and fire point of the Lubricating oil?

Ans: Flash and Fire point tells us the maximum temperature upto which a lubricating oil can be used this ensures safety against fire hazard during its use

Q10:What is the effect of moisture on the flash and fire point?

Ans: Presence of moisture in the lubricant may increase or decrease the flash point. It is increased when steam prevents vapour from igniting and decreased when steam distillation of low molecular weight constituents present in oil.

Q11. What should be the flash point of a good lubricant?

Ans:Significantly higher than the expected working temperature. Engine lubricants will usually have a flash point of several 100 degrees.

"Personal" lubricants can get away with much lower flash points; since their expected working environment should never get above, say, 45 Celsius (37 is body temperature; if you get much above that, you're clearly doing something very wrong).

****Experiment 14 is not is course**
