Welcome to the Chemistry Library. This Living Library is a principal hub of the LibreTexts project, which is a multi-institutional collaborative venture to develop the next generation of open-access texts to improve postsecondary education at all levels of higher learning. The LibreTexts approach is highly collaborative where an Open Access textbook environment is under constant revision by students, faculty, and outside experts to supplant conventional paper-based books. Campus BookshelvesBookshelvesLearning Objects Home is shared under a not declared license and was authored, remixed, and/or curated by LibreTexts. Acid base titration: Theories of acid base indicators, classification of acid base titrations and theory involved in titrations of strong, weak, and very weak acids and bases, neutralization curvesNon aqueous titration: Solvents, acidimetry and alkalimetry titration and estimation of Sodium benzoate and Ephedrine HClPDF PREVIEWDownload PDFPDF PREVIEWDownload PDFPage 2Definition and scopeDifferent techniques of analysisMethods of expressing concentrationPrimary and secondary standards.Preparation and standardization of various molar and normal solutions- Oxalic acid, sodium hydroxide, hydrochloric acid, sodium thiosulphate, sulphuric acid, potassium permanganate and ceric ammonium sulphateOpen UnitAcid base titration: Theories of acid base indicators, classification of acid base titrations and theory involved in titrations of strong, weak, and very weak acids and bases, neutralization curvesNon aqueous titration: Solvents, acidimetry and alkalimetry titration and estimation of Sodium benzoate and Ephedrine HClOpen UnitPrecipitation titrations: Mohr's method, Volhard's, Modified Volhard's, Fajans method, estimation of sodium chloride.Complexometric titration: Classification, metal ion indicators, masking and demasking reagents, estimation of Magnesium sulphate, and calcium gluconate.Gravimetry: Principle and steps involved in gravimetric analysis. Purity of the precipitate: co-precipitation and post precipitation, Estimation of barium sulphate.Basic Principles,methods and application of diazotisation titration. Estimation of sodium nitrite and sodium nitrate.Open UnitRedox titrationsConcepts of oxidation and reductionTypes of redox titrations (Principles and applications)Cerimetry, Iodimetry, Iodometry, Bromatometry, Dichrometry, Titration with potassium iodateOpen UnitConductometry - Introduction, Conductivity cell, Conductometric titrations, applications.Potentiometry - Electrochemical cell, construction and working of reference (Standard hydrogen, silver chloride electrode and calomel electrode) and indicator electrodes (metal electrodes and glass electrode), methods to determine end point of potentiometric titration and applications.Polarography - Principle, Ilkovic equation, construction and working of dropping mercury electrode and rotating platinum electrode, applications.Open Unit Share — copy and redistribute the material in any medium or format for any purpose, even commercially. Adapt — remix, transform, and build upon the material for any purpose, even commercially. The licensor cannot revoke these freedoms as long as you follow the license terms. Attribution — You must give appropriate credit , provide a link to the license, and indicate if changes were made . You may do so in any reasonable manner, but not in any way that suggests the licensor endorses you or your use. ShareAlike — If you remix, transform, or build upon the material, you must distribute your contributions under the same license as the original. No additional restrictions — You may not apply legal terms or technological measures that legally restrict others from doing anything the license permits. You do not have to comply with the license for elements of the material in the public domain or where your use is permitted by an applicable exception or limitation . No warranties are given. The license may not give you all of the permissions necessary for your intended use. For example, other rights such as publicity, privacy, or moral rights may limit how you use the material. Acid base titration can be defined as a titration reaction which takes place between an acid and base in which we determine the concentration of an acid or base by completely neutralising it with an acid or a base with a known concentration. These reactions help us determine the concentration of an acid or a base in terms of normality, molarity, molality, etc. In the process, we also make use of the PH indicator (phenolphthalein) to monitor the process of the reaction by knowing the colour of the pH indicator. The pH indicator phenolphthalein has a pH range between 8 to 10, which makes it an overall good indicator for the process of titration.TitrationTitration requires solid or weak acid or a base for knowing the concentration or determining whether the given solution is a strong or weak acid or base. The experiment involves a titrant and an acid or a base.There can be different types of titrations like:1) strong acid strong base2) strong acid weak base3) weak acid weak base4) weak acid strong baseThere is an equivalence point at which the acid and base neutralise exactly, i.e. there are equal numbers of moles of hydrogen and hydroxides. Now accordingly, the experimentalist can draw the titration curve. There is a use of an indicator through which we can detect the change and tell whether the solution has been neutralised or not. The common indicators used are phenolphthalein and methyl orange, and sometimes even malachite green can also be used. But for pharmaceutical industries, electrodes of pH metres are immersed as an indicator.Experiment1) Place an unknown concentration of an acid or a base in a beaker and add an indicator or electrode of a pH metre.2) Fill the buret with a titrating solution of known concentration, and this is called the titrant or standard solution.3) Standard solution is added slowly by measurements in the solution in the beaker until the equivalence is attained. Now, by calculation using mathematical formulas, the concentration of the unknown solution can be obtained. Importance of titration in the pharmaceutical industryThere are many reasons for using acid-base titration in pharmaceuticals, for example, analysis, quality control and product development, content analysis by redox titration and purity analysis of the pharmaceutical active substances. Purity analysis is used for determining active ingredients in the products, or example, acetylsalicylic acid in aspirin or vitamin c in multivitamin tablets. It is also used for the purity control of the drug additives used for the synthesis of medicinal preparations. One example is purity control of ephedrine hydrochloride, which is used as a cough syrup for the treatment of bronchial asthma.There are many methods of titration in pharmaceuticals:1) Titration in non-aqueous solvents: it is for weak acids and bases a) Non-aq. titration of bases: for amines determinationR-NH2 + HClO4 → R-NH3+ + ClO4–Direct titration of amines: -Benzyl nicotinate used in rheumatismProtonated amine salts titration:-Diphenylpyraline Hydrochloride 3 is an antihistamine.HClO4 in glacial acetic acid is used in non-aqueous titration of amines.Solvents used can be acetic acid, acetic acid anhydride, methanol and acetone.Titrants used can be perchloric acid, perchloric acid in glacial acetic acid, and perchloric acid in acetic anhydride.b) Non-aq. titration of acids: for aromatic acids determinationROH + (R')4NOH → RO– + N(CH3)4+ + H20Direct titration of phenol and its derivatives-Phenol and Rutoside.Solvents used can be 1,2-Diaminoethane, dimethylformamide, and acetone.Titrants used can be TMAH, TBAH, and 2-propanol/methanol mixtures.2) Titration in aqueous solution: It is an analytic process in which water is used as a solvent for the determination of the amount of desired substance.Buffer capacityIt is a solution which is capable of keeping the pH value constant when a small amount of either acid or a base is added; its resistance to pH changes is known as buffer capacity. This type of solution can be prepared by combining a weak acid and its salt with a strong base and vice-a-versa. The buffer capacity usually depends on the amount of substance of given weak acid and its conjugate base in the buffer solution.ConclusionIn this article, we got to know about titration and its uses in the pharmaceutical industry. There are many other types of titration, but the objective of this article was to focus on acid-base titration and its importance in the pharmaceutical industry, the uses of acid bases titration in the pharmaceutical industry and its analysis. We also discussed different types of acid-base titration like the titration in a non-aqueous and aqueous solvent and their examples concerning diseases, and lastly, about the buffer solution. 2. ACID-BASE THEORY:- ARRHENIUS THEORY:- Acid is a substance which gives hydrogen ion (H+) in an aqueous medium. Base is substance which gives hydroxy ions (OH–) in an aqueous medium. These theory are only applicable for aqueous titration. LOWRY AND BRONSTED'S THEORY:- Acid is a substance which donate a proton (hydrogen ion). base is a substance which accept a proton. LEWIS'S THEORY:- Acid is a substance which accept electron pair. Base is a substance which donate electron pair. ACID BASE TITRATION 3. USANOVICH THEORY:- Acid is a chemical species that reacts with a base thereby donating cations or accepting anions or electrons. Base is a chemical species that reacts with an acid thereby donating anions or electrons or accepting cations. LUX-FLOOD CONCEPT:- Acid is a substance which accept oxide-ion. Base is the substance which donate oxide ions. 4. LAW OF MASS ACTION The rate of a chemical reaction is proportional to the active masses of the reacting substance. A + B C + D According to law of mass action Vf = k1[A][B] Vb = k2[C][D] Vf = Velocity of forward reaction Vb = Velocity of backward reaction [A], [B], [C], [D] is equal to molar concentration of A, B, C & D K1 & K2 are constant At equilibrium state, velocity of forward reaction is equal to velocity of backward reaction Vf = Vb 5. k1[A][B] = k2[C][D] k1 and k2 are constant hence, where k is the equilibrium constant of the reaction. where, a,b,c........and p,q,r are the no.of molecules of reacting species. 7. Dissociation concept of acid and base:- A strong acid dissociate (or ionizes) completely in aqueous solution to form hydronium ions (H3O+) HCl + H2O H30 + Cl- A weak acid does not dissociate (or ionizes) completely in aqueous solution to form hydronium ions (H3O+) CH3COOH + H20 CH3COOH + H3O+ A strong base dissociate completely in aqueous solution to form hydronium ions (OH-) NaOH Na+ + OH- A weak base does not dissociate completely in aqueous solution to form hydronium ions (OH-) NH4OH NH4+ + OH- 8. EXAMPLES OF WEAK/ STRONG ACID:- TYPE EXAMPLES Strong Acids hydrochloric acid (HCl), sulfuric acid (H2SO4), nitric acid (HNO3) Weak Acids acetic acid (CH3COOH), hydrofluoric acid (HF), oxalic acid (COOH)2 Strong Bases sodium hydroxide (NaOH), potassium hydroxide (KOH), lithium hydroxide (LiOH) Weak Bases Liquid ammonia(NH3) 9. ACID BASE TITRATION An Acid-base titration is a quantitative analysis of acid and bases by which known concentration of an acid or base i.e. titrant neutralizes the unknown concentration of an acid or base i.e. titrand. it is based on neutralization reaction between acid and bases that form water by combination of H3O+ ions, therefore known as water forming reaction. HA(Acid) + H2O H3O+ H3O+ + OH H2O The estimation of an alkaline solution by using a standard acidic solution is known as Acidimetry. The estimation of an acidic solution by using a standard alkaline solution is known as Alkalimetry. The titration progress can be monitored by visual indicators, PH electrodes or both. 10. TYPE OF TITRATION & NEUTRALIZATION CURVE:- The mechanism of neutralization can be understood by studying the change in the hydrogen ion concentration during the course of appropriate titration. 1) The equivalence point of an acid-base reaction (the point at which the amounts of acid and of base are just sufficient to cause complete neutralization). 2) The pH of the solution at equivalence point is dependent on the strength of the acid and strength of the base used in the titration. For strong acid-strong base titration, pH = 7 at equivalence point For weak acid-strong base titration, pH > 7 at equivalence point For strong acid-weak base titration, pH < 7 at equivalence point 11. The neutralization curve can be categorized into four classes, which enlist below:- 1) Titration of a strong acid with strong base 2) Titration of a weak acid with a strong base 3) Titration of a strong acid with a weak base 4) Titration of a weak base with a weak acid 12. 1) TITRATION OF A STRONG ACID WITH STRONG BASE:- Suppose analyte is hydrochloric acid HCl (strong acid) and the titrant is sodium hydroxide NaOH (strong base). If we start plotting the pH of the Titration curve of a strong acid with a strong base. 13. Point 1:- At point 1, No NaOH added yet, so the pH of the analyte is low (because of it predominantly contains H3O+ from dissociation of HCl). HCl + H2O H30 + Cl- As NaOH is added dropwise, H3O+ slowly starts getting consumed by OH- produced by dissociation of NaOH. Analyte is still acidic due to predominance of H3O+ ions. Point 2:- This is the pH recorded at a time point just before complete neutralization takes place. 14. Equivalent point Point 3:- This is the equivalence point where, moles of NaOH is equal to moles of HCl in the analyte. At this point, H3O+ ions are completely neutralized by OH- ions. The solution only has salt (NaCl) and water and therefore the pH is neutral i.e. pH 7. HCl + NaOH NaCl + H2O Equivalent point Point 4:- Addition of NaOH continues, pH starts becoming basic because HCl has been completely neutralized and now excess of OH- ions are present in the solution (from dissociation of NaOH). After this NaOH react with indicator and produce color that is end point. NaOH Na+ + OH- 15. 2) TITRATION OF A WEAK ACID WITH A STRONG BASE:- Let's assume our analyte is acetic acid CH3COOH (weak acid) and the titrant is sodium hydroxide NaOH (strong base). If we start plotting the pH of the analyte against the volume of NaOH that we are adding from the burette, we will get a titration curve as shown below. 16. Point 1:- No NaOH added yet, so the pH of the analyte is low (it predominantly contains H3O+ from dissociation of CH3COOH). CH3COOH + H2O CH3COOH- + H3O+ As NaOH is added drop wise, H3O+ slowly starts getting consumed by OH- produced by dissociation of NaOH). But analyte is still acidic due to predominance of H3O+ ions. Point 2:- This is the pH recorded at a time point just before complete neutralization takes place. 17. Equivalent point Point 3:- This is the equivalence point. At this point, moles of NaOH added is equal to moles of CH3COOH in the analyte. The H3O+ are completely neutralized by OH-ions. The solution contains only CH3COONa salt and H2O. CH3COOH + NaOH CH3COONa + H2O+ Equivalent point In the case of a weak acid versus a strong base, the pH is not neutral at the equivalence point. The solution is basic (pH~9) at the equivalence point. Let's reason this out. 18. Point 4:- Addition of NaOH continues, pH starts becoming basic because CH3COOH has been completely neutralized and now excess of OH- ions are present in the solution (from dissociation of NaOH). After this NaOH react with indicator and produce color that is end point. 19. 3) TITRATION OF A STRONG ACID WITH A WEAK BASE:- Suppose our analyte is hydrochloric acid HCl (strong acid) and the titrant is ammonia NH3 (weak base). If we start plotting the pH of the analyte against the volume of NH3 are adding from the burette, we will get a titration curve as shown below. 20. Point 1:- No NH3, added yet, so the pH of the analyte is low (it predominantly contains H3O+ from dissociation of HCl). HCl + H2O H30 + Cl- As NH3 is added drop wise, H3O+ slowly starts getting consumed by NH3. Analyte is still acidic due to predominance of H3O+ ions. NH3 + H3O NH4+ + H2O Point 2:- This is the pH recorded at a time point just before complete neutralization takes place. 21. Point 3:- This is the equivalence point. At this point, moles of NH3 added is equal to the moles of HCl in the analyte. The H3O+ ions are completely neutralized by NH3. In the case of a weak base versus a strong acid, the pH is not neutral at the equivalence point. The solution is in fact acidic (pH~5.5) at the equivalence point. At the equivalence point, the solution only has ammonium ions NH4 and chloride ions Cl-. Where ammonium ion NH4 is the conjugate acid of the weak base NH3. So NH4 is a relatively strong acid (weak base NH3 has a strong conjugate acid), and thus NH4 will react with H2O to produce hydronium ions making the solution acidic. NH4+ + H2O NH3 + H3O+ Makes solution acidic at equivalent point 22. Point 4:- After the equivalence point, NH3 addition continues and is in excess, so the pH increases. NH3 is a weak base so the pH is above 7. After this NaOH react with indicator and produce color that is end point. 23. 4) TITRATION OF A WEAK BASE WITH A WEAK ACID:- Suppose our analyte is NH3 (weak base) and the titrant is acetic acid CH3COOH (weak acid). If we start plotting the pH of the analyte against the volume of acetic acid that we are adding from the burette, we will get a titration curve as shown below. 24. There isn't any steep bit in this plot. There is just because of a 'point of inflexion' at the equivalence point. Lack of any steep change in pH throughout the titration renders. Titration of a weak base versus a weak acid is difficult, and not much information can be extracted from such a curve. The chief feature of the curve is that change of PH near equivalent point and during whole titration is very gradual hence the end point cannot be detected by ordinary indicator so mixed indicator is often used. Even it can be done by using non aqueous acid base titration. 25. CHOICE OF INDICATOR IN TITRATION S.NO TYPE OF TITRATION PH INDICATOR 1 Strong acid verses strong base 2-10 Any indicators can be used like Phenolphthaleine Methyl orange Methyl Red 2 Strong acid verses weak base 2-6 Methyl orange Methyl Red 3 Weak acid verses strong base 8-10 Phenolphthaleine Thymol Phthaleine 4 Weak acid verses Weak base - Mixed indicators are used like neutral red methylene blue for dilute ammonia or ethanoic acid. 26. S.No INDIACATOR NAME PH COLOR OBSERVATION ACID BASE 1 Thymol blue 1.2-2.8 Red Yellow 2 Quinaldine Red 1.4-3.2 Colourless Red 3 Methyl orange 2.9-4.6 Red Orange 4 Methyl Red 4.2-6.3 Red Yellow 5 Bromo Thymol blue 6-7.6 Yellow Blue 6 Phenol Red 6.8-8.6 Yellow Red 7 Phenolphthaleine 8.3-10 Colourless Pink 8 Thymol Phthaleine 9.5-10.5 Colourless Blue 27. MIXED INDICATOR:- Mixture of two or more indicators are used to give a sharp end point over a narrow and selected range of PH. MIXTURE OF INDICATOR COMPOSITION PH COLOR CHANGE Bromocresol Green : Methyl Green 1 Part of 0.1% aqueous solution of sodium salt : 1 Part of 0.2% Water. 4.3 Orange blue green Bromocresol Green : Chlorophenol Red 1 Part of 0.1% aqueous solution of sodium salt : 1 Part of 0.1% aqueous solution of sodium salt. 6.1 Pale green blue violet Bromomethyl blue : Neutral Red 1 Part of 0.1% solution in ethanol : 1 Part of 0.1% solution in ethanol. 7.2 Rose Pink green Bromomethyl blue : Phenol Red 1 Part of 0.1% aqueous solution of sodium salt : 1 Part of 0.1% aqueous solution of sodium salt. 7.5 Yellow violet Thymol blue : Cresol Red 3 Part of 0.1% aqueous solution of sodium salt : 1 Part of 0.1% aqueous solution of sodium salt. 8.3 Yellow violet 28. UNIVERSAL INDICATOR:- A universal indicator is made of a solution of several compound like water, propane 1- ol, Phenolphthaleine, sodium salt, Thymol blue etc. that exihibit several color changes over a wide range of PH values to indicate the acidity or basicity of solutions. PH RANGE DESCRIPTION COLOUR < 3 Strong acid Red 3–6 Weak acid Orange or yellow 7 Neutral Green 8–11 Weak alkali Blue > 11 Strong alkali Violet or Indigo Acid-base titrations are a type of chemical analysis used to determine the concentration of an acid or a base in a solution by reacting it with a solution of known concentration. There are several types of acid-base titrations, which can be classified based on the nature of the acid and base involved, the method of endpoint detection, and the type of reaction that occurs during the titration. Here are some common classifications of acid-base titrations:Strong acid-Strong base titration: This type of titration involves the neutralization of a strong acid with a strong base, such as the reaction between hydrochloric acid and sodium hydroxide. The pH of the solution changes rapidly near the equivalence point.Weak acid-Strong base titration: This type of titration involves the neutralization of a weak acid with a strong base, such as the reaction between acetic acid and sodium hydroxide. The pH of the solution changes more gradually near the equivalence point.Strong acid-Weak base titration: This type of titration involves the neutralization of a strong acid with a weak base, such as the reaction between hydrochloric acid and ammonia. The pH of the solution changes more gradually near the equivalence point than in a strong acid-strong base titration.Acid-base titration with a diprotic acid or a polyprotic acid: This type of titration involves the neutralization of an acid that can donate multiple protons, such as sulfuric acid or phosphoric acid. The pH curve may show multiple equivalence points.Acid-base titration with a mixture of acids: This type of titration involves the neutralization of a mixture of acids, such as a mixture of a weak acid and a strong acid. The pH curve may show multiple inflection points.Acid-base titration with a weak base: This type of titration involves the neutralization of a weak base with a strong acid, such as the reaction between ammonia and hydrochloric acid. The pH of the solution changes more gradually near the equivalence point.Acid-base titration with a nonaqueous solvent: This type of titration involves the use of a nonaqueous solvent, such as ethanol or acetic acid, instead of water as the solvent. The pH curve may be different from that of an aqueous titration.The choice of titration method depends on the properties of the acid and base being titrated and the desired accuracy and precision of the analysis. First Year B Pharm Notes, Syllabus, Books, PDF Subjectwise/TopicwiseSuggested readings: Titration is a process commonly used to quantify a substance in a solution. One of the more popular analytical techniques, you may remember performing titration experiments at school. But this simple process is precise enough to be used in a wide range of industrial applications. Most notably, titration is used in the pharmaceutical industry to manufacture products like medicines.Titration is a common technique used in analytical chemistry to determine the concentration of an unknown solution by gradually adding a solution with a known concentration. The reactant of known concentration is added bit by bit until neutralisation is achieved.Neutralisation is usually indicated by a change in the colour of the solution, especially when an indicator is used. A chemical indicator is added to the unknown analyte mixture and is used to signal the end of the titration. For example, when carrying out an acid-base titration, the indicator will change colour when the solution reaches a neutral pH. For a more precise titration process, a measuring device such as a pH meter can be used to determine the point of neutralisation.Most titration experiments are intended to accurately determine the molar proportions necessary for an acidic solution to neutralise an alkaline solution, or vice versa. That said, titrations can be classified into different categories based on the types of reactants and the end product:Acid-base is the most common and well-known type of titration. The reactants are acids and bases, and the final products are salts. The main goal here is to determine the concentration of either the base or the acid. The known reactants are in one solution, which is added to the unknown solution in order to figure out the concentration of the analyte.Visual cues, like colour change and the formation of precipitates, are used to indicate when neutralisation has been achieved. Indicators like litmus, methyl violet, and phenolphthalein are commonly used to determine the endpoint of acid-base titrations. Depending on the type of indicator, an endpoint is reached when the colour of the indicator changes. For example, when bromothymol blue changes from yellow to blue, the acid-base titration has reached an endpoint. However, it must be noted that the endpoint of titration isn't always exactly the same as the equivalence point. The latter is determined by the stoichiometry of the reaction.As the name implies, this type of titration involves an oxidation-reduction reaction. It involves the transfer of electrons from one chemical species to the other. The reducing agent donates electrons, while the oxidising chemical receives the electrons. One good example of a redox reaction is a thermite reaction. For example, this type of reaction happens when the iron atoms in a ferric oxide compound lose oxygen atoms to combine with aluminium atoms, forming Al2O3.To determine the endpoint of a redox reaction, a potentiometer – or type of resistor – is used. If a potentiometer isn't available, colour changes in the analyte can also be used as reference. Similarly, in some redox titration tests, chemical indicators aren't necessary, but the reactants themselves may change colour. For example, if you use potassium permanganate as an oxidizing agent, a slight persisting colour is an indicator of titration endpoint. Similarly, if you use iodine as an oxidising agent, the endpoint is reached when the deep brown triiodide ion disappears.The colour changes in the reactants, however, may not be sufficient to indicate the endpoint. For instance, if the oxidising agent is potassium dichromate, the reactant may change from orange to green, but this isn't a definite sign that the titration has ended. An indicator like sodium diphenylamine would need to be added to yield a definite result.Wine is one of the most common commercial substances that requires analysis using the redox titration method. For instance, if you want to know if sulfur dioxide is present in wine, you can use iodine as an oxidising agent and starch as an indicator. Once a blue colour appears, caused by a starch-iodine complex formation, it signals the endpoint of titration.Many titration experiments are necessary in the pharmaceutical industry when analysing substances, including illicit drugs. In this industry, titrations are crucial in determining the correct balance of medicine formulas.The end point of titration can be determined by a colour changeThis is a type of titration carried out on the gas phase of substances. It's used to analyse a reactive gas by allowing it to react with a known species and concentration of gas. Gas phase titrations are advantageous compared to normal spectroscopy analysis because they're not dependent on the path length.This is a type of titration that's reliant on the formation of a complex between the reactants. It requires specialised complexometric indicators that form weak complexes when combined with the analyte. The iodine-starch complex formation we mentioned earlier is a common example. Other common indicators used for this type of titration are Eriochrome Black T and EDTA for titrating metal ions in a solution, particularly calcium and magnesium ions.Instead of using chemical indicators, a zeta potential titration is monitored using the zeta potential. This method can be applied to characterise heterogeneous systems, like colloids. The zeta potential is an electrical potential at the slipping plane or the interface between a mobile fluid and a fluid that is attached to a surface. It can be used to determine the optimum dose for flocculation. This method is also applicable in designing suspension drugs.Assays are very useful as a laboratory testing method for biological samples. They're a type of titration that determines the concentration of viruses or bacteria in a sample. Serial dilutions in a sample are performed with this technique.Scientists and laboratory technicians use these different types of titration for a wide variety of purposes, such as developing medicines and diagnosing diseases. However, the main principle behind titrations is the same: it's about achieving chemical balance, neutrality, or a certain level of concentration. In all cases, this is done through the gradual addition of a solution with a known concentration to a solution with an unknown concentration. For example, bacterial assays are considered titrations because of the gradual dilution process involved.Typically, chemical indicators are used to determine the endpoint of titrations, but this can also be chemically computed based on certain parameters like molar mass. Precision instruments like pH meters and calorimeters can also be used for the purpose of determining the endpoint.In medicine, titration is a method of limiting the possible adverse reactions of the body to drugs. This is important because everyone responds differently to pharmaceutical drugs, depending on their age, comorbidity, weight, allergies, immunity, and general biochemistry. All of these are important factors to consider when administering certain types of medicines. This is where titration in medicine is applied.Using titration, a doctor may gradually adjust the dosage of a prescription to achieve the optimal desired results for a given patient. The process may take two weeks of adjusting the dosage until the maximum effective dose is achieved with very minimal side effects, or no side effects at all.Automatic titration devices are often used in the pharmaceutical industry to ensure accuracyTitrations in the pharmaceutical industry are primarily used for analysis, product development, and quality control. Many of the previously mentioned titration methods are used in the pharmaceutical industry, but some are more useful than others. Here are three of the most common titration methods used in the pharmaceutical industry:Medicines have effective dose levels that need to be accurately and precisely calibrated for each batch of pills, capsules or liquid medicines. Other pharmaceutical products, like vitamin supplements, also need a similar level of precision and accuracy in terms of dosage. An active ingredient of a drug can be subjected to titration using an organic and non-reactive solvent.Redox titration can be used to analyse the content of an unknown sample of drug or substance. This is particularly useful in preparing non-active drug ingredients, such as preservatives. Testing the oxidative resistance of these ingredients is crucial in ensuring the longevity of the drugs' shelflife.Karl Fischer water/moisture determinationDetermining the moisture content of pharmaceutical products is very important in the shelflife of the products. The water content must be just the right amount for the optimal storage of the products.Two Karl Fischer methods of moisture detection can be used to determine the moisture content in a sample: the Coulometric Karl Fischer method is used to detect small amounts of moisture, while the Volumetric Karl Fischer method is used when samples have a moisture content higher than 1-2%, or when they contain ketones and or aldehydes. , the free encyclopedia that anyone can edit. 107,747 active editors 7,024,281 articles in English Lieutenant-General Henry de Hinuber (1767–1833) was a Hanoverian army officer who commanded units of the King's German Legion (KGL) during the Napoleonic Wars. Initially serving in the Hanoverian Army, in 1782 he fought in the Second Anglo-Mysore War in India. He was present at the siege of Cuddalore. The French Revolutionary Wars began a decade later and Hinuber served in the Flanders Campaign. When Hanover was invaded in 1803, Hinuber offered his services to the British Army and was given command of the 3rd Line Battalion of the KGL before commanding a brigade in the Bay of Naples in 1809. He was promoted to major-general in 1811 and given command of a brigade in Lord Wellington's Peninsular War army in 1813. Hinuber commanded his brigade at the Battle of Nivelle in 1813 and then at the siege of Bayonne the following year, when he led the response to the French counter-attack. He joined the army of the new Kingdom of Hanover in 1816. He received his last command in 1831, of the 2nd Division of a corps of the German Federal Army, and died in Frankfurt two years later. (Full article...) Recently featured: Hurricane Claudette (2003) Trinity (nuclear test) Manitoba Archive By email More featured articles About Glódís Perla Viggósdóttir ... that Glódís Perla Viggósdóttir (pictured) scored two goals for the Iceland women's national football team the day before she graduated from university? ... that the literary heritage of Nova Scotia includes the first newspaper and the first literary journal in Canada? ... that according to the Zoo Miami communications director, 100 men could beat a single gorilla if they "envelop the gorilla and create a human straightjacket"? ... that the memorial for James Bunbury White, the founder of Whiteville, North Carolina, was knocked down in a car crash 200 years after his death? ... that before the establishment of the Singapore's Rail Test Centre, the bulk of rolling-stock testing had to be conducted overseas? ... that the artist Cady Noland has disavowed artworks that she no longer considered genuine because they were damaged or altered? ... that Christ Church, Amherstburg, a Canadian church built by a Loyalist, features timbers fashioned after a ship's hull? ... that Li Jinhua was the first female spokesperson of the Chinese Ministry of Foreign Affairs? ... that an announcer damaged the tower of an Arkansas radio station while driving a moving van? Archive Start a new article Nominate an article Muhammadu Buhari Former president of Nigeria Muhammadu Buhari (pictured) dies at the age of 82. The International Criminal Court issues arrest warrants for Taliban leaders Hibatullah Akhundzada and Abdul Hakim Haqqani over their alleged persecution of women in Afghanistan. Flooding in Central Texas, United States, leaves at least 130 people dead. Astronomers announce the discovery of 3I/ATLAS, an interstellar object passing through the Solar System. Ongoing: Gaza war Russian invasion of Ukraine timeline Sudanese civil war timeline Recent deaths: Fauja Singh Bradley John Murdoch Frank Barrie Ihor Poklad Glen Michael Ian Blair Nominate an article July 18 Nadia Comăneci on the balance beam 1290 – King Edward I issued an edict to expel all Jews from England. 1723 – Johann Sebastian Bach directed the first performance of his cantata Erforsche mich, Gott, und erfahre mein Herz in Leipzig. 1976 – At the Olympic Games in Montreal, Nadia Comăneci (pictured) became the first person to score a perfect 10 in a modern Olympics gymnastics event. 1989 – American actress Rebecca Schaeffer was shot and killed by Robert John Bardo, eventually prompting the passage of anti-stalking laws in California. 1995 – Selena's album Dreaming of You, instrumental in popularizing Tejano music, was released posthumously. Benito Juárez (d. 1872)Richard Branson (b. 1950)M.I.A. (b. 1975)Amy Gillett (d. 2005) More anniversaries: July 17 July 18 July 19 Archive By email List of days of the year About Painted bat There are 30 extant kerivouline species, which are members of Kerivoulinae, one of the four subfamilies of Vespertilionidae, itself one of twenty families of bats in the mammalian order Chiroptera, and part of the microbat suborder. Kerivoulines, or woolly bats, are found in Africa and Asia, primarily in forests and caves, though some species can also be found in grasslands, savannas, or wetlands. They range in size from the least woolly bat, at 2 cm (1 in) plus a 2 cm (1 in) tail, to the Kachin woolly bat, at 6 cm (2 in) plus a 7 cm (3 in) tail. The 30 extant species of Kerivoulinae are divided between two genera, with 26 species in Kerivoula and the remaining four in Phoniscus. (Full list...) Recently featured: Accolades received by Inception 1956 Summer Olympics medal table Municipalities in Prince Edward Island Archive More featured lists The Basilica of St Paul is a Catholic parish church in Rabat, Malta, located on the edge of the site of the Roman city of Melite. The present church was built between 1653 and 1658, replacing a church that was completed in 1578. It was constructed with funds from the noblewoman Cosmana Navarra, on plans prepared by Francesco Buonamici. The final stages were carried out completed by Lorenzo Gafà. It was elevated to the status of a minor basilica in 2020. The church features a grotto where, according to tradition, Paul the Apostle lived and preached during his three-month stay in Malta in AD 60. This photograph shows the facade of the Basilica of St Paul in 2021. Photograph credit: Diego Delso Recently featured: Clouded Apollo Anne of Cleves Rosencrantz and Guildenstern Archive More featured pictures Community portal – The central hub for editors, with resources, links, tasks, and announcements. Village pump – Forum for discussions about Wikipedia itself, including policies and technical issues. Site news – Sources of news about Wikipedia and the broader Wikimedia movement. Teahouse – Ask basic questions about using or editing Wikipedia. Help desk – Ask questions about using or editing Wikipedia. Reference desk – Ask research questions about encyclopedic topics. Content portals – A unique way to navigate the encyclopedia. Wikipedia is written by volunteer editors and hosted by the Wikimedia Foundation, a non-profit organization that also hosts a range of other volunteer projects: CommonsFree media repository MediaWikiWiki software development Meta-WikiWikimedia project coordination WikibooksFree textbooks and manuals WikidataFree knowledge base WikinewsFree-content news WikiquoteCollection of quotations WikisourceFree-content library WikispeciesDirectory of species WikiversityFree learning tools WikivoyageFree travel guide WiktionaryDictionary and thesaurus This Wikipedia is written in English. Many other Wikipedias are available; some of the largest are listed below. 1,000,000+ articles العربية Deutsch Español فارسی Français Italiano Nederlands 日本語 Polski Português Русский Svenska Українська Tiếng Việt 中文 250,000+ articles Bahasa Indonesia Bahasa Melayu Bân-lâm-gú Български Català Čeština Dansk Eesti Ελληνικά Esperanto Euskara עברית Հայերեն Magyar Norsk bokmål Română Simple English Slovenčina Srpski Srpskohrvatski Suomi Türkçe Oʻzbekcha 50,000+ articles Asturianu Azərbaycanca [illegible] Bosanski کوردی Frysk Gaeilge Galego Hrvatski ქართული Kurdî Latviešu Lietuvių [illegible] Македонски [illegible] Norsk nynorsk [illegible] Shqip Slovenščina [illegible] اردو Retrieved from " 2Interstellar comet For other comets discovered by the Asteroid Terrestrial-impact Last Alert System, see Comet ATLAS. 3I/ATLAS3I/ATLAS moving across a field of stars, as seen by the Very Large Telescope on 4 July 2025Discovery[1]Discovery siteATLAS–CHL (W68)Discovery date1 July 2025DesignationsMPC designationC/2025 N1Alternative designationsA11pl3ZOrbital characteristics[7]Epoch7 July 2025 (JD 2460863.5)Observation arc55 days (534 obs)Earliest precovery date22 May 2025Orbit typeHyperbolic (interstellar)Perihelion1.357±0.0005 AUSemi-major axis−0.2638±0.0001 AUEccentricity6.144±0.004[a]Max. orbital speed68.3 km/s @ perihelion[2][3][b] v ∞ {\displaystyle v_{\infty }} = 58 km/s[3][5][c]Inclination175.11±0.0003°(retrograde and inclined 5°)Longitude ofascending node322.16±0.006°Argument ofperiapsis128.00±0.005°Next perihelion29 October 2025 11:36 ± 00:11 UT[6]Earth MOID0.3658 AUMars MOID0.018 AU[8]Jupiter MOID0.2466 AU Physical characteristicsMean diameter~4–5 km (2.5–3.1 mi)[d] H,0, (From acid) (From Base) (Neutralization of Ions), , Acidimetry: A standard acid solution is used for quantitative determination of the free, bases or those formed from salts of weak acid by hydrolysis., , Alkalimetry: A standard base or alkali solution is used for quantitative determination of, the acid or those formed from salts of weak base by hydrolysis., , This acid base titration method is used for various volumetric determinations, which, involves neutralization in one or another ways., , , , , , , , , , , , , , , , , , (2.1) Page 2 : =, , Pharmaceutical Analysis 2.2 Acid Base Tite, , Example: Determination salts like: NazCO3, Na2B,O; etc., , These salts have strongly alkaline reaction, that's why they are titrated with acid, Advantages of Acid Base titrations:, , * The reaction between acid-base is quite fast and practically instantaneous,, , * The reaction in acid base titrations will be single without the side reaction(s)., , * The reaction will always reach to the completion., , * The reaction will always be stoichiometric., , (Stoichiometric: The amount of the reactant and those of the products are as per cher, equation presenting same), , Various theories have been proposed to explain or classify acidity and basic properti:, substances. Most familiar theory is the Arrhenius theory, but it is applicable only to wat), solvent. Rest other theories are more generalized and there applicability was better. M, five theories are proposed for acid base titrations i.e., , 1, Arrhenius theory, , 2. Bronsted Lowry theory, , 3. Lewis theory, , 4. Usanovich theory, , 5. Lux flood theory, , '2.2 THEORIES OF ACID BASE TITRATIONS ., 1. Arrhenius Theory (H* and OH):, , Soluti, , , , , Arrhenius, as a graduate student, introduced a radical theory in 1894 (for whict, received the Nobel prize). According to him an acid is any substance that ionizes (partial, , completely) in water to give hydrogen ions (which associates with the solvent to, hydronium ions, H;0*)., , HA + H2O H30° + AT, HCl + HzO CO;*" Page 4 : sometimes water acts as an acid sometimes, , , , , Nature of the water: Nature of the water is amphiprotic or amphoteric in nature,, sometimes water acts as an acid sometimes water acts as a base., Advantages: : :, * This concept can explain the acid base in any type of solvent,, ¢ This concept is able to explain the stability of the proton., Limitation:, * This concept is not able to define acid or base, where, SO; etc., 3. Lewis Theory (Taking and giving electrons):, In 1923, G. N. Lewis also introduced the electronic theory of acids and bases, In t, concept he has defined acid and base according to the electron pair donor acceptor conce,, Bases are those species which have self tendency to donate the lone pair of electrons ., , proton(s) are absent, ie. 5, , Lewis bases are nucleophiles., , Example: NHs, RNH2, CsHsNH>, HO, SO;,, CI, Br°, I, F-, CN- ete., Acids are those species which, Lewis acids are electrophiles., Example: AICI3, BCls, SnClz, CO2, SO», H*, Ag', Al** etc., So in the Lewis theory, a base is a substance that can donate an electron pair and aci, @ substance that can accept an electron pair. Base, frequently contains oxygen or nitrogen, the electron donor. Thus, non-hydrogen containing substances are introduced as acids. jor, AICl; + : O-R; > CI3Al: OR2, , Here, Aluminium Chloride is an acid and ether a base. This theory is useful to describe, indicator colour change in non-protonic systems ex, , have self tendency to accept the lone pair of electrons a, , pina, , 2, , tt, , hibiting acid-base reaction. Al, , Nature of the water: Water is a Lewis base. Br, , Advantages: Th, e, , Defines acid and base without any type of solvent., * Explained acid and base, which can not be defined by others., 4. Usanovich Theory (Cation and anion donor acceptor):, In the year 1934, Usanovich Modified the Lewis concept of acid and base by removing ee, limitation of either acceptance or donation of the electron pair in a more acceptable, , According to this theory "Acid is a chemical species that reacts with a base and gives cati, Or accepts anions or electrons"., , Examples: HCI, H,SOs, H', Ag", Al**, Fe?*, Ce' ate., , "Base 's a chemical species that reacts with an acid and gives anions or electrons)., combines with cations', i, , Examples: NaOH, NH, Cl,.Br7,.T; F-,, , Sele, , =, , Fe**, Ce* etc, nom, , ea Ne, ;, As per this concept oxidizing agents are acids and reducing agents are bases. te, Fe*" ease) Fe "(acicy + 7, 3+ =, Fem lacigy +O" y Fe?* ase) A, , Nature of the water: Nature of the wat, , €r Is amphiprotic or amphoteric in nature, m, Water acts as a base. Page 5 : 2602, Pharmaceutical Analysis 25 Acid Base Titrations , , 5, Lux Flood Concept (Oxide-ion acceptor-donor), Lux (1929) and supported by Flood (1947) first introduced the concept of acid-base, reactions with respect to the oxide ion., According to this theory, bases are those species which can donate the oxide-ions., CaO Ca** + 07, MgO S0;", SiO, + OF MgSiO3, CaO (ease) + SO3 (acigy CaSOy, As per Lux Flood concept ZnO is amphoteric in nature., Limitations: Bases must contain oxide ion and acids must be able to accept the oxide, ion., Summary of Acid-Base Theories:, Name of Theory Acid Base, Arrhenius Theory _| Hydrogen ion donor Hydroxide ion donor, Bronsted-Lowry Proton donor Proton acceptor, Theory :, Lewis Theory | Electron pair acceptor Electron pair donor, Usanovich Theory | Cation donor and anion acceptor | Cation acceptor and anion, donor ;, Lux-Flood Theory | Oxide-ion acceptor Oxide-ion donor, 12.3: LAW OF MASS ACTION, , , , , , , This law was first proposed by Goldberg and Wage in 1867 and can be defined as:, , "The rate of a chemical reaction is proportional to the active masses of the reacting, substances"., , Active masses may be represented by the concentration of the reacting substances in, dilute solutions where conditions approach the ideal state. The constant of proportionality is known as 'velocity constant'., , Now,, , Let us consider a homogeneous, reversible reaction,, , A+Be>C+D, , According to the law of mass action,, , Vy = Ky [AJ[B], Vb = Ke[C[D]

- http://sgrdpandher.com/userfiles/file/zuwugidu.pdf
- http://ibb-online.ru/f/file/c1bb524f-a729-4868-8122-245192badb9a.pdf
- partituras cristianas para guitarra pdf
- literary analysis essay questions
- https://uncme.org.br/Gerenciador/kcfinder/upload/files/e6699471-d03c-419b-be3a-f0f7a0215cf5.pdf
- xiwonula
- luyoco
- http://bayernglobal.de/userVZ/file/50098147373.pdf
- http://ji-tien.com/userfiles/file/12907dd4-107b-4a8e-bc20-e85a143393e2.pdf
- http://wsmr.us/userfiles/file/pafizotuxipijab_dorekeziden_nufilik_kipitefozasexe_vosezev.pdf
- resume format in india pdf
- fayokuli
- give the principle of ac generator
- korari
- http://tec-color.com/ckfiles/files/41224433577.pdf
- tajereja
- yabukakuja
- epson scanner not working with windows 11
- http://bienestarsocialarucas.es/documentos/file/9bd66a0c-112f-44e7-8c22-17d2878385e1.pdf