Swimming is a great way to exercise and keep your body in shape. Consider what it would be like to swim in a filthy, trash-filled pool. Do you believe swimming in such a pool will be healthy? Obviously not! Many microorganisms found in filthy pools can cause a variety of ailments. Have you ever wondered how pools are routinely cleaned to maintain their hygienic conditions? You are correct! The pool cleaners use chlorine or bleaching powder! When bleaching powder, Ca(OCl)2, or any other chlorine-based chemicals come in contact with water, hypochlorous acid (HOCl), a sanitiser is generated. This sanitiser is used to disinfect swimming pools. But how can you figure out how much bleaching powder to put in a specific swimming pool? The answer to this question is a technique called Iodometry. Iodometry is routinely employed to determine how much hypochlorite is present in bleach that is actually performing the bleaching activity. With this method, an excessive amount of iodide is added to a known volume of material; only the active (electrophilic) species are able to convert the excess iodide to iodine. The availability of chlorine can be determined using iodometry by measuring the iodine content. The chlorine released when diluted acids and hypochlorite combine is referred to as "available chlorine." In general, this titration can be used to calculate the concentration of oxidising agents in any sample. TABLE OF CONTENTS What is Titration? Iodine Titration Iodometric Titrations Practice Problems Frequently Asked Questions - FAQ What is Titration? Titrimetric analysis or titration entails calculating the volume of a solution with an accurately known concentration that quantitatively react with the measured volume of the solution of a substance whose concentration is to be calculated. The standard solution is the name given to a solution whose concentration is precisely known. The volume of the standard solution used, the chemical equation, and the relative molecular masses of the interacting compounds are used to compute the mass of the substance dissolved in the solution of unknown concentration. Titrant refers to the reagent with a known concentration, while titrate refers to the material being titrated. Standard solution is typically added from the lengthy graduated tube known as the burette to perform titrimetric analysis. Titration is the process of gradually introducing the standard solution into a solution of uncertain concentration until the reaction is barely complete. The equivalency point, also known as the theoretical or stoichiometric end point, is the point at which a reaction is complete. In simple terms, titration is an analytical technique used to determine the concentration of a known volume of an unknown solution (titrate) using a solution of known concentration (titrant). Iodine Titration This method of analysis involves the use of iodine/iodide in titration. There are two types of iodine titrations. They are the direct method, also known as Iodimetry, and the indirect method, also known as Iodometry. In the direct method, a solution is used to titrate the reducing agents, which can be quantitatively oxidised at the equivalence point. As iodine is a weak oxidising agent, only a few substances can be oxidised by iodine. Thiosulphate, one of the common reducing agents, must be determined iodimetrically. Iodine (I2) is a mild oxidising agent. I2+2e-2I- (reduction) In the indirect method, also known as Iodometry, the oxidising agent that has to be estimated is treated with an excess of iodide ions and the liberated iodine is estimated by titrating with a standard thiosulphate solution. Iodide (I-) is a mild reducing agent. 2I-I2+2e- (oxidation) In this concept page article, we will discuss about iodometry in detail. Iodometric Titrations Iodometric titration is used to determine the strength or the concentration of an oxidising agent. In this method, I- is oxidised into I2 in the presence of an oxidising agent. The liberated iodine is estimated quantitatively by titrating with a standard thiosulphate solution. This method can be used to estimate almost all strong oxidising agents. Here, starch is used as an indicator which gives a dark blue colour in presence of I2. The steps involved in an iodometric titration are as follows. Step 1: An oxidising agent reacts with iodide ions (example: KI, potassium iodide). KI+OxidizingagentI2 From the equation, Equivalents of oxidising agent = Equivalents of I- oxidised = Equivalents of I2 formed Step 2: The iodine liberated is titrated with a standard hypo solution (Na2S2O3). I2+Na2S2O3NaI+Na2S4O6 From the equation, Equivalents of I2 = Equivalents of S2O32- Therefore, from the amount of iodine consumed by the thiosulphate ions, the amount of oxidising agent can be calculated. The combined schematic representation can be given as Oxidisingagent+KII2+Na2S2O3NaI+Na2S4O6 The following are some of the widely used iodometric analyses in the laboratory. 2MnO4-(aq)+10I-(aq)+16H+(aq)2Mn2+(aq)+5I2(aq)+8H2O(aq) BrO3-(aq)+6I-(aq)+6H+(aq)Br-(aq)+3I2(aq)+3H2O(aq) Cr2O72-(aq)+6I-(aq)+14H+(aq)2Cr3+(aq)+3I2(aq)+7H2O(aq) IO3-(aq)+5I-(aq)+6H+ (aq)3I2(aq)+3H2O(aq) 2HNO2(aq)+2I-(aq)+2H+(aq)2NO(aq)+I2(aq)+2H2O(aq) Practice Problems 1. Find the n-factor of S in Na2S2O3 in the reaction I2+Na2S2O3NaI+Na2S4O6 a. 1 b.2 c.3 d.4 Answer: B) Let the oxidation state of S in Na2S2O3 be x 2+2x-6=0 x=+2 Let the oxidation state of S in Na2S4O6 be y 2+4y-12=0 y=+52=+2.5 n-factor of S = number of S atoms in Na2S4O6 |O.S. of S in Na2S4O6- O.S. of S in Na2S2O3| n-factor of S = 2 |2.5 - 2| = 1 So, option A) is the correct answer. 2. Find the n-factor of Br in BrO3- in reaction BrO3+6I-+6H+Br-+3I2+3H2O a. 7 b.6 c.5 d.4 Answer: B) Let the oxidation state of Br in BrO3- be x 6-1= x=+5 Let the oxidation state of Br in Br- be y y=-1 n-factor of Br = number of Br atoms in BrO3- |O.S. of Br in Br- - O.S. of Br in BrO3-| n-factor of Br = 1 |-1-5| = 6 So, option B) is the correct answer. 3. An aqueous solution containing 0.20 g KIO3 reacted with an excess of acidified KI with HCl. The liberated I2 consumed 56.0 mL of hypo. Calculate the normality of hypo solution a. 0.025 N b.0.0025 N c.0.25 N d.2.5 N Answer: A) Step 1: KIO3+5KI+6HCl3I2+6KCl+3H2O Moles of KIO3 = 0.2214=9.310-4 mol Moles of I2 formed = 3 9.310-4 mol Step 2: I2+2Na2S2O3NaI+Na2S4O6 Moles of Na2S2O3 required = 39.310-42=13.9510-4mol Molarity of Na2S2O3 = 13.9510-4561000=0.025 n-factor of Na2S2O3 = 1 Normality of Na2S2O3 = MolarityofNa2S2O31 =0.025 N So, option A) is the correct answer. 4. Find the n-factor of I in IO3- in reaction IO3-+5I-+6H+3I2+3H2O a. 5 b.6 c.7 d. 8 Answer: B) Let the oxidation state of I in IO3- be x x 6=-1 x=+5 Let the oxidation state of I in I2 be y 2y=0 y=0 n-factor of I = 1 |5-0| = 5 Frequently Asked Questions - FAQ 1. In an iodometric titration, which indicator is used? Answer:Starch is typically used as the indication for iodine titrations. Iodine and starch combine to create a deep blue complex. Iodimetry's terminal point is marked by a sharp shift in the colour of the solution to blue. 2. In iodometry, why is acetic acid added? Answer:Glacial acetic acid's function is to maintain a pH of 3 to 4 so that starch can perform its function in the titration perfectly. 3. Why can not the starch solution be added to an iodometric titration at the beginning? Answer:Starch cannot be added to the iodometric titration at the beginning because iodine can rapidly react with it to produce a dark blue solution, which will obstruct the end point detection. Therefore, we add starch indicator as soon as the iodine colour in the solution begins to fade, which is when it turns pale yellow and indicates a very low iodine content. 4. How can the end point of an iodometric titration be determined? Answer:A starch solution is used as an indicator in an iodometric titration because it can absorb the I2 that is released. When titrated with standardised thiosulphate solution, this absorption causes the solution's colour to change from deep blue to light yellow. This represents the titration's end point. Written By Adeel Abbas Iodometric titration is a method of quantitative analysis that involves the indirect determination of the concentration of an oxidizing agent in a sample solution. This redox titration relies on the reaction between the oxidizing agent and iodide ions to produce iodine, which is then titrated using a standardized sodium thiosulfate solution. The endpoint of the titration is indicated by the disappearance of the deep blue color of the starch-iodine complex, offering high precision in determining analyte concentration. In our previous discussions, we have covered the broader concept of titration, which encompasses various types such as acid-base, redox, complexometric, and precipitation titrations. Each type of titration serves a specific purpose in quantitative analysis, allowing us to determine the concentration of analytes in a wide range of samples. Moreover, we have explored the uses of titration in diverse fields, ranging from pharmaceuticals to environmental monitoring. This powerful analytical tool enables scientists to measure the concentration of substances with accuracy and reliability, providing valuable insights into chemical processes and ensuring quality control in various industries. In the titration, the choice of indicators plays a crucial role in determining the endpoint of the titration reaction. We have delved into the fascinating world of indicators, both natural and synthetic, which serve as vital tools in visualizing the completion of titration reactions. Natural indicators, such as litmus, turmeric, and red cabbage extract, harness the inherent color-changing properties of organic compounds. On the other hand, synthetic indicators, such as phenolphthalein and methyl orange, are carefully synthesized compounds specifically designed for titrimetric applications. Now, let us delve into the intricacies of iodometric titration and discover its principles, procedure, advantages, and practical applications. Iodometric titration is a method used to measure the amount of an oxidizing agent in a solution. It works by mixing the oxidizing agent with iodide ions, which causes iodine to be released. To know when the reaction is complete, we use starch solution as an indicator. The starch forms a blue colour when it reacts with iodine. We can tell that the reaction is finished when the blue color fades away. To perform an iodometric titration, we need to follow a step-by-step process carefully. First, we dissolve an oxidizing substance in a suitable liquid. Then, we add sulfuric acid, hydrochloric acid, or acetic acid to make the solution acidic. This acid helps the next part of the reaction. Next, we introduce chlorine, which causes the release of iodide ions. The freed iodide ions are then titrated using a standardized solution of sodium thiosulfate. As the sodium thiosulfate reacts with the iodine, the solution changes color from yellow to a lighter and more diluted shade. Finally, we add a starch indicator to the solution, and the color shifts dramatically from a deep blue to a pale yellow. This change in color tells us that the titration is complete. Iodometric titration offers several noteworthy advantages, solidifying its position as a valuable analytical technique. Firstly, it allows for the precise determination of both reducing and oxidizing agents, expanding its analytical versatility. The visible color change associated with the formation of the starch-iodine complex provides a convenient visual indicator for identifying the endpoint of the titration. Additionally, iodometric titration requires only small quantities of chemicals or substances, making it a cost-effective and efficient analytical method. The presence of iodine in starch imparts a vivid blue color change, facilitating the easy detection of the completion of the reaction. Moreover, iodometric titration offers the opportunity to visually observe reactivity at equilibrium points, fostering a deeper understanding of redox chemistry and its applications. Let us explore some practical applications of iodometric titration, demonstrating its relevance in analytical chemistry. One notable example involves the standardization of sodium thiosulfate (Na2S2O3) using potassium dichromate (K2Cr2O7). By accurately determining the concentration of the sodium thiosulfate solution, we can precisely quantify the concentration of the potassium dichromate, a powerful oxidizing agent. Another application of iodometric titration involves the estimation of copper(II) (copper(II) oxide) using a sodium thiosulfate solution. This method enables the determination of copper(II) oxide concentration in a given sample, contributing to industries reliant on copper-based materials. Furthermore, iodometric titration finds application in the estimation of vitamin C, a potent reducing agent, through the iodometric method. This allows for the accurate quantification of vitamin C concentration in various biological samples, shedding light on its role in human health and nutrition. The realm of iodometric titration unfolds as a captivating avenue in analytical chemistry, empowering scientists to unravel the mysteries of oxidizing agents concentrations. With a comprehensive understanding of its principles, procedure, advantages, and practical applications, we equip ourselves with the tools to navigate the intricate world of redox analysis. H2O2 oxidizes iodide to iodine in the presence of acid and molybdate catalyst. The iodine formed is titrated with thiosulfate solution, incorporating a starch indicator.H2O2 + 2 KI + H2SO4 I2 + K2SO4 + 2 H2OI2 + 2 Na2S2O3 Na2S2O6 + 2 NaIScope of ApplicationThis method is somewhat less accurate than the permanganate titration, but is less susceptible to interferences by organics, and is more suitable for measuring mg/L levels of H2O2.InterferencesOther oxidizing agents will also produce iodine, whereas reducing agents (and unsaturated organics) will react with the liberated iodine. The contribution from other oxidizing agents can be determined by omitting the acid and molybdate catalyst.Safety PrecautionsConcentrated sulfuric acid is a corrosive, hazardous material and should be handled and disposed of in accordance with the MSDS. Neoprene gloves and monogoggles are recommended, as is working under a vacuum hood.Sample bottles containing H2O2 should not be stoppered, but rather vented or covered loosely with aluminum foil or paraffin film.ReagentsPotassium iodide solution (0.1N):Dissolve 1.0 grams KI into 100 mLs demineralized water. Store capped in cool place away from light. Yellow-orange tinted KI solution indicates some air oxidation to iodine, which can be removed by adding a 1-2 drops of dilute sodium thiosulfate solution.Ammonium molybdate solution. Dissolve 9 grams ammonium molybdate in 10 mLs Mo.Sulfuric acid solution. Carefully add one part H2SO4-98% to four parts demineralized water.Starch indicator.Sodium thiosulfate solution (0.1N).ApparatusAnalytical balance (+/- 0.1 mg/L)Small weighing bottle (< 5 mLs)250 mL Erlenmeyer flask50 mL buret (Class A)Medicine dropperProcedureWeigh to the nearest 0.1 mg an amount of H2O2 equivalent to a titer of 30 mLs (0.06 grms of H2O2) using a 5 mL beaker and medicine dropper. Transfer sample to Erlenmeyer flask.Add to Erlenmeyer flask 50 mL of demineralized water, 10 mL of sulfuric acid solution, 10-15 mLs of potassium iodide solution, and 2 drops ammonium molybdate solution.Titrate with 0.1 N sodium thiosulfate to faint yellow or straw color. Swirl or stir gently during titration to minimize iodine loss.Add about 2 mL starch indicator, and continue titration until the blue color just disappears.Repeat steps 2-4 on a blank sample of water (omitting the H2O2).CalculationWeight % H2O2 = (A B) x (Normality of Na2S2O3) x 1.7 (Sample weight in gramsWhere: A = mLs Na2S2O3 for sample; B = mLs Na2S2O3 for blankReferences:C. T. Kingzett, Chem. News, 41:76 (1880); 43:161 (1881)M. H. Kolthoff, Chem Weekblad, 17:197 (1920) Written By Adeel Abbas Iodometric titration is a method of quantitative analysis that involves the indirect determination of the concentration of an oxidizing agent in a sample solution. This redox titration relies on the reaction between the oxidizing agent and iodide ions to produce iodine, which is then titrated using a standardized sodium thiosulfate solution. 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The realm of iodometric titration unfolds as a captivating avenue in analytical chemistry, empowering scientists to unravel the mysteries of oxidizing agents concentrations. With a comprehensive understanding of its principles, procedure, advantages, and practical applications. FacebookTWitterGoogle PLuse01Shares 75 Views . Introduction to Iodometry: Iodometry is a type of volumetric analysis that involves the use of iodine (I) or iodine-containing compounds as titrants to determine the concentration of reducing agents in a solution. The key reaction in iodometry is the reduction of iodine (I) to iodide ions (I) by a reducing agent. Iodometry is commonly used for determining the concentration of substances such as ascorbic acid, sulfur dioxide, and various metal ions that act as reducing agents. Iodometry can be classified as either direct iodometry, where iodine solution is directly used as the titrant, or indirect iodometry, where iodine is generated in situ by an oxidizing agent and then titrated. 2. Principle of Iodometry: The principle behind iodometry is based on the redox reaction between iodine (I) and a reducing agent in the sample. Iodine is reduced to iodide (I), and the reducing agent is oxidized in the process. Reduction of iodine (I): The sample contains a substance that is a reducing agent (such as ascorbic acid, sulfur dioxide, or iron (II) ions), which donates electrons to reduce iodine (I) to iodide (I). The endpoint of the titration is determined by detecting when all the reducing agents in the sample have reacted with iodine. 3. Procedure of Iodometry: The following steps outline the typical procedure for performing iodometric titration: Preparation of the sample: Prepare the sample solution that contains the reducing agent to be analyzed. The sample must be free from oxidizing agents that could interfere with the titration. For substances like sulfur dioxide or ascorbic acid, the sample is usually dissolved in water or an acidic medium. Preparation of iodine solution: A standard iodine solution (I) is used as the titrant. This solution is typically prepared by dissolving iodine crystals in a potassium iodide (KI) solution, as iodine is more soluble in iodide ions. The iodine solution is often standardized using a primary standard, such as sodium thiosulfate. Titration: The iodine solution is added from a burette to the sample containing the reducing agent. During the titration, the iodine (I) is reduced to iodide ions (I) by the reducing agent present in the sample. Detection of the endpoint: The endpoint is detected by the addition of a starch indicator. Starch forms a blue complex with iodine, and the endpoint is reached when the blue color no longer appears, indicating that all the iodine has reacted with the reducing agent. If starch is not used, the appearance of a faint yellow or pale color can indicate the endpoint, as iodine becomes free in the solution when reducing agents are consumed. Calculation: The concentration of the reducing agent in the sample can be calculated using the volume of iodine solution required for the titration and its concentration. The amount of iodine used in the reaction corresponds to the amount of reducing agent present in the sample. The calculation follows the equation: 4. Applications of Iodometry: Iodometry is widely used for determining reducing agents in various fields. Some key applications include:1. Analysis of Ascorbic Acid (Vitamin C):Iodometry is commonly used to quantify ascorbic acid in food, pharmaceuticals, and biological samples because ascorbic acid acts as a reducing agent that can reduce iodine.2. Determination of Sulfur Dioxide:Iodometry is used to determine the concentration of sulfur dioxide (SO) in air, food, and beverages. Sulfur dioxide is a reducing agent that reduces iodine to iodide ions.3. Analysis of Iron (II) (Fe) ions:Iron (II) ions are frequently determined using iodometry by reducing iodine to iodide. Iron (III) (Fe) is reduced to iron (II) in the presence of a reducing agent, and iodine is titrated against the sample.4. Determination of Copper (I) and Copper (II):Copper (I) and copper (II) can be quantified using iodometric titration, as copper (I) acts as a reducing agent that can reduce iodine to iodide ions.5. Pharmaceutical Quality Control:Iodometry is used in the quality control of drugs, such as in the determination of antioxidant content or in the evaluation of the effectiveness of certain formulations.6. Analysis of Peroxides:Iodometry is employed to determine the concentration of peroxides (such as hydrogen peroxide) in solutions, as peroxides act as reducing agents capable of reducing iodine. Iodometry is one of the most important redox titration methods. Iodine reacts directly, fast and quantitatively with many organic and inorganic substances. Thanks to its relatively low, pH independent redox potential, and reversibility of the iodine/iodide reaction, iodometry can be used both to determine amount of reducing agents (by direct titration with iodine) and of oxidizing agents (by titration of iodine with thiosulfate). In all cases the same simple and reliable method of end point detection, based on blue starch complex, can be used. Reversible iodine/iodide reaction mentioned above is 2I- I2 + 2e- and obviously whether it should be treated as oxidation with iodine or reduction with iodides depends on the other redox system involved. Second important reaction used in the iodometry is reduction of iodine with thiosulfate: 2S2O32- + I2 S4O62- + 2I- In the case of both reactions it is better to avoid low pH. Thiosulfate is unstable in the presence of acids, and iodides in low pH can be oxidized by air oxygen to iodine. Both processes can be source of titration errors. It is also possible to titrate iodine in the solution of unknown concentration by for example, released iodine in a reaction of iodide with hydrogen peroxide, using sodium thiosulfate as the titrant. However, in the presence of excess iodides iodine creates I3- ions. This lowers free iodine concentration and such solutions are stable enough to be used in lab practice. Still, we should remember that their shelf life is relatively short (they should be kept tightly closed in dark brown bottles, and standardized every few weeks). Iodine solutions are prepared dissolving iodine directly in the iodide solution. Elemental iodine can be prepared very pure through sublimation, but because of its high volatility it is difficult to weight. Thus use of iodine as a standard substance, although possible, is not easy nor recommended. Iodine solutions can be easily normalized against arsenic (III) oxide (As2O3) or sodium thiosulfate solution. It is also possible to prepare iodine solutions mixing potassium iodide with potassium iodate in the presence of strong acid: 5I- + IO3- + 6H+ 3I2 + 3H2O Potassium iodide is a primary substance, so solution prepared this way can have exactly known concentration. However, this approach is not cost effective and in lab practice it is much better to use iodate as a primary substance to standardize thiosulfate, and then standardize iodine solution against thiosulfate. ,the free encyclopedia that anyone can edit.107,590 active editors 7,027,478 articles in EnglishDon Bradman, the Australian captainThe Second Test of the 1948 Ashes series was one of five Tests in The Ashes cricket series between Australia and England. The match was played at Lord's in London between 24 and 29June 1948. Australia won the match by 409 runs to take a 20 lead, meaning that England would need to win the remaining three matches to regain The Ashes. The Australian captain Don Bradman (pictured) won the toss and elected to bat. Australia scored 350 in their first innings, thanks to their first morning; the Australian paceman Ray Lindwall took 570. Australia reached 460/7 in their second innings before Bradman declared, setting England a target of 596. The hosts reached 106/3 at stumps on the fourth day, but then collapsed on the final morning to be all out for 186, handing Australia a 409-run victory. The leading English batsman Len Hutton was controversially dropped for the following match. The match set a new record for the highest attendance at a Test in England. (Fullarticle...)Recently featured: Daily News BuildingHippocampusHed (Taylor Swift album)ArchiveBy emailMore featured articlesAboutOphicleide... that the ophicleide (example pictured) was used in early British brass bands in the 19th century before being replaced by the euphonium?... that, at the 1964 Summer Olympics, high jumper Henri Elend placed first in the qualifiers and placed last in the final?... that the quarters at the premiere of the film Viet Flakes unknowingly controlled the projection equipment through their physical responses to images of the Vietnam War?... that Jupe Verona Marjanovi had to run through an airport while bullets were being fired to train in Germany?... that Robert Baker Park in Baltimore was named after Robert Lewis Baker, whose personal garden was recreated at the city's Flower and Garden Show the year after his death?... that Kathleen O'Melia's conversion to the Catholic Church so embarrassed the Anglican Church in Vancouver that there are almost no references to it in primary sources?... that a 1995 demonstration of the 1969-era AL1 microprocessor using Nintendo Entertainment System cartridges successfully challenged Texas Instruments' patents on the microprocessor?... that it took a two-year "campaign" from future NFL player Fred Shirey, his friends and coaches for Shirey's father to allow him to try out for his high school team?... that the reconstructed ancestral language of the Siouan languages had two sounds that linguists call "funny w" and "funny r"?ArchiveStart a new articleNominate an articleOzzy OsbourneOzzy Osbourne (pictured), the lead singer of Black Sabbath, dies at the age of 76.A fighter jet crashes into a college in Dhaka, Bangladesh, killing more than 30 people.In golf, Scottie Scheffler wins the Open Championship.A tourist boat capsizes during a thunderstorm in H Long Bay, Vietnam, leaving at least 36 people dead.Ongoing: Gaza warRussian invasion of UkrainetimelineSudanese civil wartimelineRecent deaths: Bryan BrannPhoebe AsiyoGary KarrClaus PeymannWayne ThomasAndrea GibsonNominate an articleJuly 24: Pioneer Day in Utah, United States (1847)Depiction of the Albanian revolt of 19101411 Scottish clansmen led by Donald of Islay, Lord of the Isles, and Alexander Stewart, Earl of Mar, fought the Battle of Harlaw near Inverurie, Scotland.1910 Ottoman forces captured the city of Shkodr, ending the Albanian revolt of 1910 (depicted).1920 Franco-Syrian War: At the Battle of Maysalun forces of the Arab Kingdom of Syria were defeated by a French army moving to occupy the territory allocated to them by the San Remo conference.1923 The Treaty of Lausanne was signed to settle part of the partition of the Ottoman Empire, establishing the boundaries of Greece, Bulgaria and Turkey.2019 Boris Johnson became Prime Minister of the United Kingdom after winning the Conservative Party leadership election.Martin Van Buren (d.1862)Zelda Fitzgerald (b.1900)Nayib Bukele (b.1981)Hamzah Haz (d.2024)More anniversaries: July 23July 24July 25ArchiveBy emailList of days of the yearAboutThe emperor angelfish (Pomacanthus imperator) is a species in the marine angelfish family Pomacanthidae. It is a reef-associated fish, native to the Indian and Pacific Oceans, from the Red Sea to Hawaii and the Austral Islands. Adults are found in areas where there is a rich growth of corals on clear lagoon, channel, or seaward reefs, at depths between 1 and 100 metres (3 and 330 feet). The emperor angelfish shows a marked difference between the juveniles and the adults. The juveniles have a dark body, which is marked with concentric curving lines, alternating between pale blue and yellow horizontal stripes, a light blue face with a dark blue mask over the eyes and a yellow caudal fin. It can attain a maximum total length of around 40 centimetres (16 inches). This adult emperor angelfish was photographed in the Red Sea off the coast of Egypt.Photograph credit: Diego DelsoRecently featured: Amba RodriguesKart video game burialSouthern scrub robinArchiveMore featured picturesCommunity portalThe 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 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 thesaurusThis Wikipedia is written in English. Many other Wikipedias are available; some of the largest are listed below. 1,000,000+ articles DeutschEspañolFranaisItalianoNederlandsPolskiPortuguêsSvenskaTing Vit 250,000+ articles Bahasa IndonesiaBahasa MelayuBn-lm-gCatalنإ最ke蜮éninSuomiMagyarNorsk bokmålNorske EnglishSloveninaSrpskiSrpskohrvatskiSuomiThTrke 50,000+ articles AsturianuAzrbaycancaBosanskiFryskGaeilgeGalegoHrvatskiKurdLatvieLietuviNorsk nynorskShqipSlovennaRetrieved from " 2Calendar yearYearsMillennium2ndmillenniumCenturies18thcentury19thcentury20thcenturyDecades1820s1830s1840s 1850s1860sYears1844184518461847 184818491850vteSeptember 14: Mexico City, capital of Mexico, is captured by U.S. troops led by General Winfield Scott.May 8: Earthquake in Japan kills 8,600 people.1847 by topicHumanitiesArchaeologyArchitectureArtLiteraturePoetryMusicBy countryAustraliaBelgiumBrazilCanadaChinaDenmarkFranceGermanyMexicoNew ZealandNorwayPortugalSouth AfricaSweden United StatesOther topicsRail transportScienceSportsLists of leadersSovereign statesSovereign state leadersTerritorial governorsReligious leadersLawBirth and death categoriesBirthsDeathsEstablishments and disestablishments categoriesEstablishmentsDisestablishmentsWorks categoryWorksvte1847 in various calendarsGregorian calendar1847MDCCXLVIIAb urbe condita2600Armenian calendar1296 Assyrian calendar6597Bah calendar34Balinese saka calendar176817 69Bengali calendar12531254Berber calendar2797British Regnal year10Vict.11Vict.1Buddhist calendar2391Burmese calendar1209Byzantine calendar73557356Chinese calendar (FireHorse)4544 or 4337to (FireGoat)4545 or 4338Coptic calendar15631564Discordian calendar3013Ethiopian calendar18391840Hebrew calendar56075608Hindu calendars- Vikram Samvat19031904- Shaka Samvat17681769- Kali Yuga49474948Holocene calendar11847Igbo calendar847848Iranian calendar12251226Islamic calendar12631264Japanese calendar17741775Julian calendarGregorian minus 12 daysKorean calendar4180Minguo calendar65 before ROC65Nanakshahi calendar379Thai solar calendar23892390Tibetan calendar(male Fire-Horse)1973 or 1592 or 820to(female Fire-Sheep)1974 or 1593 or 821Wikimedia Commons has media related to 1847.1847 (MDCCXLVII) was a common year starting on Friday of the Gregorian calendarand a common year starting on Wednesday of the Julian calendar, the 1847th year of the Common Era (CE) and Anno Domini (AD) designations, the 847th year of the 2ndmillennium, the 47th year of the 19thcentury, and the 8th year of the 1840s decade. As of the start of 1847, the Gregorian calendar was 12 days ahead of the Julian calendar, which remained in localized use until 1923. Calendar year January 4 Samuel Colt sells his first revolver pistol to the U.S. government.January 13 The Treaty of Cahuenga ends fighting in the MexicanAmerican War in California.January 16 John C. Frmont is appointed Governor of the new California Territory.January 17 St. Anthony Hall fraternity is founded at Columbia University, New York City.January 30 Yerba Buena, California, is renamed San Francisco.February 5 A rescue effort, called the First Relief, leaves Johnson's Ranch to save the ill-fated Donner Party of California-bound migrants who became snowbound in the Sierra Nevada earlier this winter. Some have resorted to survival by cannibalism.February 22 MexicanAmerican War: Battle of Buena Vista 5,000 American troops defeat General Zachary Taylor use their superiority in artillery to drive off 15,000 Mexican troops under Antonio Lpez de Santa Anna, defeating the Mexicans the next day.February 25 State University of Iowa is founded in Iowa City, Iowa.March 1The state of Michigan formally abolishes the death penalty.Faustin Soulouque is elected President of Haiti.March 4 The 30th United States Congress is sworn into office.March 9 MexicanAmerican War: United States forces under General Winfield Scott invade Mexico near Veracruz.March 14 Verdi's opera Macbeth premieres at the Teatro della Pergola, in Florence, Italy.March 29 MexicanAmerican War: United States forces under General Winfield Scott capture Veracruz.April 10 Alexander the statesman and publisher of the classic joke "Why did the chicken cross the road?" occurs in The Knickerbocker, or New-York Monthly Magazine.[1]April 5 The world's first municipally-funded civic public park, Birkenhead Park in Birkenhead on Merseyside, England, is opened.[2]April 15 The Lawrence School, Sanawar is established in India.April 16 New Zealand Wars: A minor Mori chief is accidentally shot by a junior British Army officer in Whanganui on New Zealand's North Island, triggering the Wanganui Campaign (which continues until July 23).April 25 The Evenmouth, carrying Irish emigrants from Derry bound for Quebec, is wrecked off Islay, with only three survivors from more than 250 on board.[3]May 7 In Philadelphia, the American Medical Association (AMA) is founded.May 8The Nagano earthquake leaves more than 8,600 people dead in Japan.Bahrain's ruler, Shaikh Mohamed bin Khalifa Al Khalifa, signs a treaty with the British to prevent and combat the slave trade in the Arabian Gulf.May 31 Second Treaty of Erzurum: the Ottoman Empire cedes Abadan Island to the Persian Empire.May The Architectural Association School of Architecture is founded in London.June 1 The first congress of the Communist League is held in London.June 9 Radley College, an English public school, is founded near Oxford as a High Anglican institution.[4]June 26 The first passenger railway wholly within modern-day Denmark opens, from Copenhagen to Roskilde.[5]June E. H. Booth & Co. Ltd, which becomes the northern England supermarket chain Booths, is founded when tea dealer Edwin Henry Booth, 19, opens a shop called "The China House" in Blackpool.July 1 The United States issues its first postage stamps.July 24: Mormons expelled from Illinois arrive at the Great Salt Lake in what is now Utah.July 24 After 17 months of travel, Brigham Young leads 148 Mormon pioneers into Salt Lake Valley, resulting in the establishment of Salt Lake City.July 26 The nation of Liberia, founded as a haven for freed African-American slaves, becomes independent.July 29 The Cumberland School of Law is founded at Cumberland University, in Lebanon, Tennessee. At the end of this year, only 15 law schools exist in the United States. August 12 MexicanAmerican War: U.S. troops of General Winfield Scott advance along the aqueduct Chalco and Xochimilco in Mexico.August 20 MexicanAmerican War: U.S. troops of General Winfield Scott occupy Mexico City, marking the end of organized Mexican resistance.September 30 The Vegetarian Society is formed in the United Kingdom (it remains the oldest in the world).October 12 German inventors and industrialists Werner von Siemens and Johann Georg Halske found Siemens & Halske to develop the electrical telegraph.October 19 Charlotte Bront publishes Jane Eyre under the pen name of Currer Bell in England.October 31 Theta Delta Chi is founded as a social fraternity at Union College, Schenectady, New York.October The last volcanic eruption of Mount Guntur in West Java occurs.November 329 Sonderbund War: In Switzerland, General Guillaume-Henri Dufour's Federal Army defeats the Sonderbund (an alliance of seven Catholic cantons) in a civil war, with a total of only 86 deaths.November 4 James Young Simpson discovers the anesthetic properties of chloroform and first uses it, including.[6]November 17 The Battle of Vaassing Spring takes place near a spring in Qatar, after a Bahraini force under Shaikh Ali bin Khalifa Deputy Ruler of Bahrain defeats the Al Binali tribe. The chief of the Al Binali, Isa bin Tureef, is slain in battle on May 25 when only about 70 fatalities from his side.December 14 Emily Bront and Anne Bront publish Wuthering Heights and Agnes Grey, respectively, in a 3-volume set under the pen names of Ellis Bell and Acton Bell in England.December 20 British Royal Navy steam frigate HMSAvenger(1845) is wrecked on the Sorelle Rocks in the Mediterranean Sea with the loss of 246 lives and only eight survivors.[7]December 21 Emir Abdelkader surrenders to the French in Algeria.[8]The Great Famine continues in Ireland.The North Carolina General Assembly incorporates the railroad town of Goldsborough, and the Wayne county seat is moved to the new town.Welfare in Sweden takes its first step with the introduction of the 1847 rs fattigvrdfrordning.Cartier, a luxury brand in France, is founded.January 5 Oku Yasukata, Japanese field marshal, leading figure in the early Imperial Japanese Army (d. 1930)January 7 Caspar F. Goodrich, American admiral (d. 1925)January 24 Radomir Putnik, Serbian field marshal (d. 1917)January 28 Dorus Rijkers, Dutch naval hero (d. 1928)February 3 Warington Baden-Powell, British admiralty lawyer (d. 1921)February 4 Remus von Woyrsch, German field marshal (d. 1920)February 5 Joo Maria Correia Ayres de Campos, 1st Count of Ameal, Portuguese politician and antiquarian (d. 1920)February 8 Hugh Price Hughes, Methodist social reformer, first Superintendent of the West London Mission (d. 1902)February 11 Thomas Alva Edison, American inventor (d. 1931)February 14 Anna Howard Shaw, American suffragist and physician (d. 1919)February 15 Robert Fuchs, Austrian composer (d. 1927)February 16 Philipp Scharwenka, Polish-German composer (d. 1917)February 17 Otto Blehr, Norwegian attorney, Liberal Party politician, 7th Prime Minister of Norway (d. 1927)March 1 Sir Thomas Brock, English sculptor (d. 1922)March 2Isaac Barr, Anglican clergyman, promoter of British colonial settlement schemes (d. 1937)Cayetano Arellano, first Chief Justice of the Supreme Court of the Philippines under the American Civil Government (d. 1920)March 3 Edmund Gurney, British psychologist (d. 1888)March 270tto Walkh, German chemist, Nobel Prize laureate (d. 1931)Alexander Graham Bell, Scottish-born Canadian inventor (d. 1904)March 11 Sidney Sonnino, Prime Minister of Italy (d. 1922)[9]March 14 Castro Alves, Brazilian poet (d. 1871)March 18 William Crowther, British physician, poet (d. 1911)April 10 Joseph Pulitzer, Hungarian-born journalist, newspaper publisher (d. 1911)April 15 Yehudah Aryeh Leib Alter, Polish Hasidic rabbi (d. 1905)April 27 Emma Irene strm, Finnish first female university graduate (d. 1934)May 7 Archibald Primrose, 5th Earl of Rosebery, Prime Minister of the United Kingdom (d. 1929)May 14 Sir Frederick William Borden, Canadian politician (d. 1917)June 8Oleksander Barvinsky, Ukrainian politician (d. 1926)Ida Saxton McKinley, First Lady of the United States (d. 1907)June 10 Gina Krog, Norwegian suffragist (d. 1916)June 11 Dame Millicent Fawcett, British suffragist (d. 1929)June 16 Luella Dowd Smith, American educator, author, and reformer (d. 1941)Paul von HindenburgBram StokerJuly 2 Marcel Alexandre Bertrand, French geologist (d. 1907)July 9 Wong Fei-hung, Chinese healer, revolutionary (d. 1925)July 13 Damian Sawczak, Ukrainian judge (d. 1912)July 19 Alexander Meyrick Broadley, British historian (d. 1916)July 20Lord William Beresford, Irish army officer, Victoria Cross recipient (d. 1900)Max Liebermann, German painter, printmaker (d. 1935)July 25 Paul Langerhans, German pathologist, biologist (d. 1888)August 3 John Hamilton-Gordon, 1st Marquess of Aberdeen and Temair, Canadian politician, Governor General of Canada (d. 1934)August 5 Andrey Selivanov, Russian general and military (d. 1917)August 21 Hale Johnson, American temperance movement leader (d. 1902)September 3 Charles Stillman Sperry, American admiral (d. 1911)September 5 Jesse James, American outlaw (d. 1882)Joseph Pulitzer bluff, American journalist, publisher (d. 1911)September 17 John I. Beggs, American businessman (d. 1925)September 22 Enrique Almaraz y Santos, Spanish Catholic cardinal (d. 1922)September 23 Anandamohan Bose, Indian politician, academic and social reformer (d. 1906)September 30 Wilhelmina Drucker, Dutch feminist (d. 1925)Maria Pia of SavoyThomas F. PorterOctober 1 Annie Besant, English activist and writer (d. 1933)October 2 Paul von Hindenburg, German field marshal, President of Germany (d. 1934)October 13Sir Arthur Dyke Acland, 13th Baronet, British politician (d. 1926)Maurice Bailloud, French general (d. 1921)October 14 Wilgelm Vitgeft, Russian admiral (d. 1904)October 22 Koos de la Rey, Boer general (d. 1914)October 30Charlie Bastedo, American sheriff (d. 1896)Thomas F. Porter, American writer (d. 1904)November 1 Dame Emma Albani, Canadian operatic soprano (d. 1930)November 2 Georges Sorel, French socialist philosopher (d. 1922)November 6 Ugo Balzani, Italian historian (d. 1933)November 8Jean Casimir-Perier, 6th President of France (d. 1907)Bram Stoker, Irish author of the Gothic novel Dracula (d. 1912)November 17 Carlo Mirabello, Italian admiral and politician (d. 1910)[11]November 28 Magdalena of Denmark, empress of Tsar Alexander III of Russia (d. 1928)November 30 Afonso Pena, Brazilian president (d. 1909)December 1 Agathe Backer-Grøndahl, Norwegian pianist, composer (d. 1907)December 9 George Grossmith, English comic writer and performer (d. 1912)December 17mile Faguet, French writer, critic (d. 1916)December 18Michel-Joseph Maunoury, French general during World War I (d. 1923)December 18 Augusta Holms, French composer (d. 1903)December 21 John Chard, British Officer (d. 1897)December 29 Alexis-Xyste Bernard, Canadian Catholic bishop (d. 1923)December 30 John Peter Altgeld, American politician, 20th Governor of Illinois (d. 1902)Fanny MendelssohnJanuary 19 Charles Bent, American territorial governorReligious leadersJanuary 3 Marie Duplessis, French courtesan, inspiration for La Dame aux Camlias (b. 1824)February 5 Carl Josef Bayer, Austrian chemist (d. 1904)February 5 Joo Maria Bilac, Brazilian journalist (b. 1758)[12]April 21 Barbara Spooner Wilberforce, wife of British abolitionist William Wilberforce (b. 1777)April 30 Fanny Mendelssohn, German composer, pianist (b. 1805)May 15 Daniel O'Connell, Irish politician who promoted the Roman Catholic Relief Act of 1829 (b. 1775)May 16 Vicente Rocafuerte, 2nd President of Ecuador (b. 1783)May 29 Emmanuel de Grouchy, Marquis de Grouchy, French marshal (b. 1766)June 11 Alonso, Prince Imperial of Brazil (b. 1845)June 11 Sir John Franklin, British explorer (b. 1786)Felix MendelssohnJuly 7 Thomas Carpenter, American glassmaker (b. 1752)July 16 Karl Friedrich Burdach, German physiologist (b. 1776)September 4 Frantiek Vladislav Hek, Czech patriot (b. 1797)September 13 Nicolas Oudinot, French marshal (b. 1767)October 2 Vasil Aprilov, Bulgarian educator, merchant and writer (b. 1789)[13]October 22Fanny Carter, Swedish cabinet minister (b. 1764)Mongu Sahle Selassie of Shewa (b. c. 1795)November 4 Felix Mendelssohn, German composer (b. 1809)November 18 Zebulon Crocker, American clergyman (b. 1802)December 14Dorothy Ann Thrupp, British hymn writer (b. 1779)Arce, Central American politician (b. 1787)Barbarita Nieves, Venezuelan patriotess mistress of Jos Antonio Pez (b. 1803)Unknown Jeanne Genevive Labrosse, French balloonist and parachutist (b. 1775)^ The Knickerbocker, or New York Monthly Magazine. 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ISBN9780717168347Retrieved from " 3One hundred years, from 1701 to 1800For other uses, see 18th century (disambiguation).Millennia2ndmillenniumCenturies17thcentury18thcentury19thcenturyTimelines17thcentury18thcentury19thcenturyDecades1700s1710s1720s1730s1740s1750s1760s1770s1780s1790sCategories:Births Deaths Establishments DisestablishmentsvtePolitical boundaries at the beginning of the year 1700Storming of the Bastille, 14 July 1789, an iconic event of the French Revolution.Development of the Watt steam engine in the late 18th century was an important element in the Industrial Revolution in Europe.The American Revolutionary War took place in the late 18th century. The 18th century lasted from 1 January 1701 (represented by the Roman numerals MDCCI) to 31 December 1800 (MDCCC). During the 18th century, elements of Enlightenment thinking culminated in the Atlantic Revolutions. Revolutions began to challenge the legitimacy of monarchical and aristocratic power structures. The Industrial Revolution began during mid-century, leading to radical changes in human society and the environment. The European colonization of the Americas and other parts of the world intensified and associated mass migrations of people grew in size as part of the Age of Sail. During the century, slave trading expanded across the shores of the Atlantic Ocean, while declining in Russia[1] and China.[2]Western historians have occasionally defined the 18th century otherwise for the purposes of their work. For example, the "short" 18th century may be defined as 1715-1789, denoting the period of time between the death of Louis XIV of France and the start of the French Revolution, with an emphasis on directly interconnected events.[3][4] To historians who expand the century to include larger historical movements, the "long" 18th century[5] may run from the Glorious Revolution of 1688 to the Battle of Waterloo in 1815[6] or even later.[7] France was the sole world superpower from 1659, after it defeated Spain, until 1815, when it was defeated by Britain and its coalitions following the Napoleonic Wars.In Europe, philosophers ushered in the Age of Enlightenment. This period coincided with the French Revolution of 1789, and was later crystallized by the excesses of the Reign of Terror. At first, many monarchies of Europe embraced Enlightenment ideals, but in the wake of the French Revolution they feared loss of power and formed broad coalitions to oppose the French Republic in the French Revolutionary Wars. Various conflicts throughout the century, including the War of the Spanish Succession and the Seven Years' War, saw Great Britain triumph over its rivals to become the preeminent power in Europe. However, Britain's attempts to exert its authority over the Thirteen Colonies became a catalyst for the American Revolution. The 18th century also marked the end of the PolishLithuanian Commonwealth as an independent state. Its semi-democratic government system was not robust enough to prevent partition by the neighboring states of Austria, Prussia, and Russia.In West Asia, Nader Shah led Persia in successful military campaigns. The Ottoman Empire experienced a period of peace, taking no part in European wars from 1740 to 1768. As a result, the empire was not exposed to Europe's military improvements during the Seven Years' War. The Ottoman military consequently lagged behind and suffered several defeats against Russia in the second half of the century.In South Asia, the death of Mughal emperor Aurangzeb was followed by the expansion of the Maratha Confederacy and an increasing level of European influence and control in the region. In 1739, Persian emperor Nader Shah invaded and plundered Delhi, the capital of the Mughal Empire. Later, his general Ahmad Shah Durrani scored another victory against the Marathas, the then dominant power in India, in the Third Battle of Panipat in 1761.[8] By the middle of the century, the British East India Company began to conquer eastern India,[9][8] and by the end of the century, the Anglo-Mysore Wars against Tipu Sultan and his father Hyder Ali, led to Company rule over the south.[10][11]In East Asia, the century was marked by theHigh Qing era, a period characterized by significant cultural and territorial expansion. This period also experienced relative peace and prosperity, allowing for societal growth, increasing literacy rates, flourishing trade, and consolidating imperial power across the vast Qing dynasty's territories. Conversely, the continual seclusion policy of the Tokugawa shogunate in Japan still offered a peaceful era called Pax Tokugawa and experienced a flourishment of the arts as well as scientific knowledge and advancements, which were introduced to Japan through the Dutch port of Nagasaki. In Southeast Asia, the KonbaungAyutthaya Wars and the Ty Sn Wars broke out while the Dutch East India Company established increasing levels of control over the Mataram Sultanate.In Africa, the Ethiopian Empire underwent the Zemene

Mesafint, a period when the country was ruled by a class of regional noblemen and the emperor was merely a figurehead. The Atlantic slave trade also saw the continued involvement of states such as the Oyo Empire. In Oceania, the European colonization of Australia and New Zealand began during the late half of the century. In the Americas, the United States declared its independence from Great Britain. In 1776, Thomas Jefferson wrote the Declaration of Independence. In 1789, George Washington was inaugurated as the first president. Benjamin Franklin traveled to Europe where he was hailed as an inventor. Examples of his inventions include the lightning rod and bifocal glasses. Tpac Amaru II led an uprising that sought to end Spanish colonial rule in Peru.For a chronological guide, see Timeline of the 18th century.See also: Georgian eraMain articles: 1700s, 1710s, 1720s, 1730s, and 1740sEurope at the beginning of the War of the Spanish Succession, 1700The Battle of Poltava in 1709 turned the Russian Empire into a European power.John Churchill, 1st Duke of Marlborough17001721: Great Northern War between the Russian and Swedish Empires.1701: Kingdom of Prussia declared under King Frederick I.1701: The Battle of Feyiase marks the rise of the Ashanti Empire.17011714: The War of the Spanish Succession is fought, involving most of continental Europe.[12]17021715: Camisard rebellion in France.1703: Saint Petersburg is founded by Peter the Great; it is the Russian capital until 1918.17031711: The Rkczi uprising against the Habsburg monarchy.1704: End of Japan's Genroku period.1704: First Javanese War of Succession.[13]17061713: The War of the Spanish Succession: French troops defeated at the Battle of Ramillies and the Siege of Turin.1707: Death of Mughal Emperor Aurangzeb leads to the fragmentation of the Mughal Empire.1707: The Act of Union is passed, merging the Scottish and English Parliaments, thus establishing the Kingdom of Great Britain.[14]1708: The Company of Merchants of London Trading into the East Indies and English Company Trading to the East Indies merge to form the United Company of Merchants of England Trading to the East Indies.17081709: Famine kills one-third of East Prussia's population.1709: Foundation of the Hotak Empire.1709: The Great Frost of 1709 marks the coldest winter in 500 years, contributing to the defeat of Sweden at Poltava.1710: The world's first copyright legislation, Britain's Statute of Anne, takes effect.17101711: Ottoman Empire fights Russia in the Russo-Turkish War and regains Azov.1711: Bukhara Khanate dissolves as local begs seize power.17111715: Tuscarora War between British, Dutch, and German settlers and the Tuscarora people of North Carolina.1713: The Kangxi Emperor acknowledges the full recovery of the Chinese economy since its apex during the Ming.1714: In Amsterdam, Daniel Gabriel Fahrenheit invents the mercury-in-glass thermometer, which remains the most reliable and accurate thermometer until the electronic era.1715: The first Jacobite rising breaks out; the British halt the Jacobite advance at the Battle of Sheriffmuir; Battle of Preston.1716: Establishment of the Sikh Confederacy along the present-day India-Pakistan border.17161718: Austro-Venetian-Turkish War.1718: The city of New Orleans is founded by the French in North America.17181720: War of the Quadruple Alliance with Spain versus France, Britain, Austria, and the Netherlands.17181730: Tulip period of the Ottoman Empire.1719: Second Javanese War of Succession.[15]1720: The South Sea Bubble.17201721: The Great Plague of Marseille.1720: Qing forces oust Dzungar invaders from Tibet.1721: The Treaty of Nystad is signed, ending the Great Northern War.1721: Sack of Shamakhi, massacre of its Shia population by Sunni Lezgins.1722: Siege of Isfahan results in the handover of Iran to the Hotaki Afghans.17221723: Russo-Persian War.17221725: Controversy over William Wood's halfpence leads to the Drapier's Letters and begins the Irish economic independence from England movement.Mughal emperor Muhammad Shah with the Persian invader Nader Shah.1723: Slavery is abolished in Russia; Peter the Great converts household slaves into house serfs.[16]17231730: The "Great Disaster", an invasion of Kazakh territories by the Dzungars.17231732: The Qing and the Dzungars fight a series of wars across Qinghai, Dzungaria, and Outer Mongolia, with inconclusive results.1724: Daniel Gabriel Fahrenheit proposes the Fahrenheit temperature scale.1725: Austro-Spanish alliance revived. Russia joins in 1726.17271729: Mahmud I takes over Ottoman Empire after the Patrona Halil revolt, ending the Tulip period.17301760: The First Great Awakening takes place in Great Britain and North America.17321734: Crimean Tatar raids into Russia.[17]17331738: War of the Polish Succession.Qianlong Emperor17351739: Austro-Russo-Turkish War.17351799: The Qianlong Emperor of China oversees a huge expansion in territory.17381756: Famine across the Sahel; half the population of Timbuktu dies.[18]17371738: Hotak Empire ends after the siege of Kandahar by Nader Shah.1739: Great Britain and Spain fight the War of Jenkins' Ear in the Caribbean.1739: Nader Shah defeats a pan-Indian army of 300,000 at the Battle of Karnal. Taxation is stopped in Iran for three years.17391740: Nader Shah's Sindh expedition.1740: George Whitefield brings the First Great Awakening to New England17401741: Famine in Ireland kills 20 percent of the population.17411743: Iran invades Uzbekistan, Khwarazm, Dagestan, and Oman.17411748: War of the Austrian Succession.1742: Marvel's Mill, the first water-powered cotton mill, begins operation in England.[19]1742: Anders Celsius proposes an inverted form of the centigrade temperature, which is later renamed Celsius in his honor.1742: Premiere of George Frideric Handel's Messiah.17431746: Another Ottoman-Persian War involves 375,000 men but ultimately ends in a stalemate.The extinction of the Scottish clan system came with the defeat of the clansmen at the Battle of Culloden in 1746.[20]1744: The First Saudi State is founded by Mohammed Ibn Saud.[21]1744: Battle of Toulon is fought off the coast of France.17441748: The First Carnatic War is fought between the British, the French, the Marathas, and Mysore in India.1745: Second Jacobite rising is begun by Charles Edward Stuart in Scotland.1747: The Durrani Empire is founded by Ahmad Shah Durrani.1748: The Treaty of Aix-La-Chapelle ends the War of the Austrian Succession and First Carnatic War.17481754: The Second Carnatic War is fought between the British, the French, the Marathas, and Mysore in India.1750: Peak of the Little Ice Age.Main articles: 1750s, 1760s, 1770s, 1780s, 1790s, and 1800s1752: The British Empire adopts the Gregorian Calendar, skipping 11 days from 3 September to 13 September. On the calendar, 2 September is followed directly by 14 September.1754: The Treaty of Pondicherry ends the Second Carnatic War and recognizes Muhammed Ali Khan Wallajah as Nawab of the Carnatic.1754: King's College is founded by a royal charter of George II of Great Britain.[22]17541763: The French and Indian War, the North American chapter of the Seven Years' War, is fought in colonial North America, mostly by the French and their allies against the English and their allies.1755: The great Lisbon earthquake destroys most of Portugal's capital and kills up to 100,000.1755: The Dzungar genocide depopulates much of northern Xinjiang, allowing for Han, Uyghur, Khalkha Mongol, and Manchu colonization.17551763: The Great Upheaval forces transfer of the French Acadian population from Nova Scotia and New Brunswick.17561763: The Seven Years' War is fought among European powers in various theaters around the world.17561763: The Third Carnatic War is fought between the British, the French, and Mysore in India.1757: British conquest of Bengal.Catherine the Great, Empress of Russia.1760: George III becomes King of Britain.1761: Maratha Empire defeated at Battle of Panipat.17621796: Reign of Catherine the Great of Russia.1763: The Treaty of Paris ends the Seven Years' War and Third Carnatic War.1764: Dahomey and the Oyo Empire defeat the Ashanti army at the Battle of Atakpam.1764: The Mughals are defeated at the Battle of Buxar.1765: The Stamp Act is introduced into the American colonies by the British Parliament.17651767: The Burmese invade Thailand and utterly destroy Attuhaya.17651769: Burma under Hsinbyushin repels four invasions from Qing China, securing hegemony over the Shan states.1766: Christian VII becomes king of Denmark. He was king of Denmark to 1808.17691799: Anglo-Mysore Wars.1767: Taksin expels Burmese invaders and reunites Thailand under an authoritarian regime.17681772: War of the Bar Confederation.17681774: Russo-Turkish War.1769: Spanish missionaries establish the first of 21 missions in California.17691770: James Cook explores and maps New Zealand and Australia.17691773: The Bengal famine of 1770 kills one-third of the Bengal population.1769: The French East India Company dissolves, only to be revived in 1785.1769: French expeditions capture clove plants in Ambon, ending the Dutch East India Company's (VOC) monopoly of the plant.[23]17711779: Famine in Czech lands kills hundreds of thousands.1771: The Plague Riot in Moscow.1771: The Kalmyk Khanate dissolves as the territory becomes colonized by Russians. More than a hundred thousand Kalmyks migrate back to Qing Dzungaria.1772: Gustav III of Sweden stages a coup d'tat, becoming almost an absolute monarch.Encyclopdie, ou dictionnaire raisonn des sciences, des arts et des mtiers17721779: Maratha Empire fights Britain and Raghunathrao's forces during the First Anglo-Maratha War.17721795: The Partitions of Poland end the PolishLithuanian Commonwealth and erase Poland from the map for 123 years.17731775: Pugachev's Rebellion, the largest peasant revolt in Russian history.1773: East India Company starts operations in Bengal to smuggle opium into China.1775: Russia imposes a reduction in autonomy on the Zaporizhian Cossacks of Ukraine.17751782: First Anglo-Maratha War.17751783: American Revolutionary War.1776: Several kongsi republics are founded by Chinese settlers in the island of Borneo. They are some of the first democracies in Asia.17761777: A Spanish-Portuguese War occurs over land in the South American frontiers.1776: Illuminati founded by Adam Weishaupt.1776: The United States Declaration of Independence is adopted by the Second Continental Congress in Philadelphia.1777: Adam Smith publishes The Wealth of Nations.1778: James Cook becomes the first European to land on the Hawaiian Islands.1778: Franco-American alliance signed.1778: Spain acquires its first permanent holding in Africa from the Portuguese, which is administered by the newly-established La Plata Viceroyalty.1778: Vietnam is reunified for the first time in 200 years by the Tay Son brothers. The Ty Sn dynasty has been established, terminating the L dynasty.17791809: Xhosa Wars between British and Boer settlers and the Xhosas in the South African Republic.17791783: Britain loses several islands and colonial outposts all over the world to the combined Franco-Spanish navy.1779: Iran enters yet another period of conflict and civil war after the prosperous reign of Karim Khan Zand.1780: Outbreak of the indigenous rebellion against Spanish colonization led by Tpac Amaru II in Peru.1781: The city of Los Angeles is founded by Spanish settlers.George Washington17811785: Serfdom is abolished in the Austrian monarchy (first step; second step in 1848).1782: The Thonburi Kingdom of Thailand is dissolved after a palace coup.1783: The Treaty of Paris formally ends the American Revolutionary War.1783: Russian annexation of Crimea.17851791: Imam Sheikh Mansur, a Chechen warrior and Muslim mystic, leads a coalition of Muslim Caucasian tribes from throughout the Caucasus in a holy war against Russian settlers and military bases in the Caucasus, as well as against local traditionalists, who followed the traditional customs and common law (Adat) rather than the 19th century.17871792: Russo-Turkish War.1788: First Fleet arrives in Australia.17881790: Russo-Swedish War (17881790).1788: Dutch Geert Adriaans Boomgaard (17881899) would become the first generally accepted validated case of a supercentenarian on record.[25][26]Declaration of the Rights of Man and of the Citizen17881799: Attempt to reinstall an exiled Vietnamese king in northern Vietnam ends in disaster.1789: George Washington is elected the first President of the United States; he serves until 1797.1789: Quang Trung defeats the Qing army.17891799: French Revolution.1789: The Lige Revolution.1789: The Brabant Revolution.1789: The Inconfidncia Mineira, an unsuccessful separatist movement in central Brazil led by Tiradentes1791: Suppression of the Lige Revolution by Austrian forces and re-establishment of the Prince-Bishopric of Lige.17911795: George Vancouver explores the world during the Vancouver Expedition.17911804: The Haitian Revolution.1791: Mozart premieres The Magic Flute.17921802: The French Revolutionary Wars lead into the Napoleonic Wars.1792: The New York Stock & Exchange Board is founded.1792: PolishRussian War of 1792.1792: Margaret Ann Neve (17921903) would become the first recorded female supercentenarian to reach the age of 110.[27][28]1793: Upper Canada bans slavery.1793: The largest yellow fever epidemic in American history kills as many as 5,000 people in Philadelphia, roughly 10% of the population.[29]17931796: Revolt in the Vende against the French Republic at the time of the Revolution.17941816: The Hawkesbury and Nepean Wars, which were a series of incidents between settlers and New South Wales Corps and the Aboriginal Australian clans of the Hawkesbury river in Sydney, Australia.1795: The Marseillaise is officially adopted as the French national anthem.Napoleon at the Bridge of the Arcole1795: The Battle of Nuuanu in the final days of King Kamehameha I's wars to unify the Hawaiian Islands.17951796: War of the First Coalition.1796: Edward Jenner administers the first smallpox vaccination; smallpox killed an estimated 400,000 Europeans each year during the 18th century, including five reigning monarchs.[30]1796: War of the First Coalition: The Battle of Montenotte marks Napoleon Bonaparte's first victory as an army commander.1796: The British expel the Dutch from Ceylon and South Africa.17961804: The White Lotus Rebellion against the Manchu dynasty in China.1797: John Adams is elected the second President of the United States; he serves until 1801.1798: The Irish Rebellion fails to overthrow British rule in Ireland.17981800: The Quasi-War is fought between the United States and France.1799: Dutch East India Company is dissolved.1799: Austro-Russian forces under Alexander Suvorov liberates much of Italy and Switzerland from French occupation.1799: Coup of 18 Brumaire - Napoleon's coup d'etat brings the end of the French Revolution.1799: Death of the Qianlong Emperor after 60 years of rule over China. His favorite official, Heshen, is ordered to commit suicide.1800: On 1 January, the bankrupt VOC is formally dissolved and the nationalized Dutch East Indies are established.[31]Main articles: Timeline of historic inventions 18th century, and Timeline of scientific discoveries 18th centuryThe spinning jenny1709: The first piano was built by Bartolomeo Cristofori1711: Steam engine invented by Thomas Newcomen1714: Mercury thermometer by Daniel Gabriel Fahrenheit1717: Diving bell was successfully tested by Edmond Halley, sustainable to a depth of 55ftc. 1730: Octant navigational tool was developed by John Hadley in England, and Thomas Godfrey in America1733: Flying shuttle invented by John Kay1736: Europeans encountered rubber the discovery was made by Charles Marie de La Condamine while on expedition in South America. It was named in 1770 by Joseph Priestley.1740: Modern steel was developed by Benjamin Huntsman1741: Vitus Bering discovers Alaska1745: Leyden jar invented by Ewald Georg von Kleist was the first electrical capacitor1751: Jacques de Vaucanson perfects the first precision lathe1752: Lightning rod invented by Benjamin Franklin1753: The first clock to be built in the New World (North America) was invented by Benjamin Banneker.1755: The tallest wooden Bodhisattva statue in the world is erected at Puning Temple, Chengde, China.1764: Spinning jenny created by James Hargreaves brought on the Industrial Revolution1765: James Watt enhances Newcomen's steam engine, allowing new steel technologies1761: The problem of longitude was finally resolved by the fourth chronometer of John Harrison1763: Thomas Bayes publishes first version of Bayes' theorem, paving the way for Bayesian probability17681779: James Cook mapped the boundaries of the Pacific Ocean and discovered many Pacific Islands1774: Joseph Priestley discovers "dephlogisticated air", oxygenThe Chinese Putuo Zongcheng Temple of Chengde, completed in 1771, during the reign of the Qianlong Emperor.1796: The British expel the Dutch from Ceylon and South Africa.1775: Joseph Priestley's first synthesis of "phlogisticated nitrous air", nitrous oxide, "laughing gas"1776: First improved steam engines installed by James Watt1776: Steamboat invented by Claude de Jouffroy1777: Circular saw invented by Samuel Miller1779: Photosynthesis was first discovered by Jan Ingenhousz1781: William Herschel announces discovery of Uranus1784: Bifocals invented by Benjamin Franklin1784: Argand lamp invented by Aim Argand[32]1785: Power loom invented by Edmund Cartwright1785: Automatic flour mill invented by Oliver Evans1786: Threshing machine invented by Andrew Meikle1787: Jacques Charles discovers Charles's law1789: Antoine Lavoisier discovers the law of conservation of mass, the basis for chemistry, and begins modern chemistry1798: Edward Jenner publishes a treatise about smallpox vaccination1798: The Lithographic printing process invented by Alois Senefelder[33]1799: Rosetta Stone discovered by Napoleon's troopsMain articles: 18th century in literature and 18th century in philosophy1703: The Love Suicides at Chikamatsu first performed17041717: One Thousand and One Nights translated into French by Antoine Galland. The work becomes immensely popular throughout Europe.1704: A Tale of a Tub by Jonathan Swift first published1712: The Rape of the Lock by Alexander Pope (publication of first version)1719: Robinson Crusoe by Daniel Defoe1725: The New Science by Giambattista Vico1726: Gulliver's Travels by Jonathan Swift1728: The Dunciad by Alexander Pope (publication of first version)1744: A Little Pretty Pocket-Book becomes one of the first books marketed for children1748: Chushingura (The Treasury of Loyal Retainers), popular Japanese puppet play, composed1748: Clarissa; or, The History of a Young Lady by Samuel Richardson1749: The History of Tom Jones, a Foundling by Henry Fielding1751: Elegy Written in a Country Churchyard by Thomas Gray published17511785: The French Encyclopdie A Dictionary of the English Language by Samuel Johnson1758: Arithmetika Horvatzka by Mihalj ilobod Boli1759: Candide by Voltaire1759: The Theory of Moral Sentiments by Adam Smith17591767: Tristram Shandy by Laurence Sterne1762: Emile: or, On Education by Jean-Jacques Rousseau1762: The Social Contract, Or Principles of Political Right by Jean-Jacques Rousseau1774: The Sorrows of Young Werther by Goethe first published1776: Ugetsu Monogatari (Tales of Moonlight and Rain) by Ueda Akinari1776: The Wealth of Nations, foundation of the modern theory of economy, was published by Adam Smith17661789: The History of the Decline and Fall of the Roman Empire by Edward Gibbon1779: Amazing Grace published by John Newton1779: 1782: Lives of the Most Eminent English Poets by Samuel Johnson1781: Critique of Pure Reason by Immanuel Kant (publication of first edition)1781: The Robbers by Friedrich Schiller first published1782: Les Liaisons dangereuses by Pierre Choderlos de Laclos1786: Poems, Chiefly in the Scottish Dialect by Robert Burns1787: 1788: The Federalist Papers by Alexander Hamilton, James Madison, and John Jay1788: Critique of Practical Reason by Immanuel Kant1789: Songs of Innocence by William Blake1789: The Interesting Narrative of the Life of Olaudah Equiano by Olaudah Equiano1790: Journey from St. Petersburg to Moscow by Alexander Radishchev1790: Reflections on the Revolution in France by Edmund Burke1791: Rights of Man by Thomas Paine1792: A Vindication of the Rights of Woman by Mary Wollstonecraft1794: Songs of Experience by William Blake1798: Lyrical Ballads by William Wordsworth and Samuel Taylor Coleridge1798: An Essay on the Principle of Population published by Thomas Malthus(mid18th century): The Dream of the Red Chamber (authorship attributed to Cao Xueqin), one of the most famous Chinese novels1711: Rinaldo, Handel's first opera for the London stage, premiered1721: Brandenburg Concertos by J.S. Bach1723: The Four Seasons, violin concertos by Antonio Vivaldi, composed1724: St John Passion by J.S. Bach1727: St Matthew Passion composed by J.S. Bach1727: Zadok the Priest is composed by Handel for the coronation of George II of Great Britain. It has been performed at every subsequent British coronation.1733: Hippolyte et Aricie, first opera by Jean-Philippe Rameau1741: Goldberg Variations for harpsichord published by Bach1742: Messiah, oratorio by Handel premiered in Dublin1749: Mass in B minor by J.S. Bach assembled in current form1751: The Art of Fugue by J.S. Bach1762: Orfeo ed Euridice, first "reform opera" by Gluck, performed in Vienna1786: The Marriage of Figaro, opera by Mozart1787: Don Giovanni, opera by Mozart1788: Jupiter Symphony (Symphony No. 41) composed by Mozart1791: The Magic Flute, opera by Mozart17911795: London symphonies by Haydn1798: The Creation, oratorio by Haydn first performed^ Volkov, Sergey. Concise History of Imperial Russia. ^ Rowe, William T. 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Media related to 18th century at Wikimedia CommonsRetrieved from " 4The following pages link to 18th century External toolsLink countransclusion countserted list1 See help page for transcluding these entriesShowing 50 items.View (previous 50 | next 50) (20 | 50 | 100 | 250 | 500)List of decades, centuries, and millennia (links | edit)Goths (links | edit)Industrial espionage (links | edit)Romania (links | edit)20th century (links | edit)17th century (links | edit)16th century (links | edit)Time (links | edit)21st century (links | edit)Anno Domini (links | edit)42 (links | edit)1642 (links | edit)Nabob (links | edit)1661 (links | edit)1756 (links | edit)1791 (links | edit)1608 (links | edit)1818 (links | edit)1743 (links | edit)1826 (links | edit)1828 (links | edit)14th century (links | edit)1860s (links | edit)1788 (links | edit)1st century (links | edit)13th century (links | edit)1787 (links | edit)1863 (links | edit)4th century (links | edit)12th century (links | edit)11th century (links | edit)1859 (links | edit)1900 (links | edit)1848 (links | edit)1866 (links | edit)1870s (links | edit)1895 (links | edit)1861 (links | edit)1623 (links | edit)1662 (links | edit)1640s (links | edit)1780s (links | edit)1782 (links | edit)1840 (links | edit)1800s (links | edit)1883 (links | edit)1801 (links | edit)View (previous 50 | next 50) (20 | 50 | 100 | 250 | 500)Retrieved from " "WhatLinksHere/18th_century"Learn about the principle of iodometric titration, reaction, indicators, examples, advantages, and how the iodometric titration works.Titration, often known as titrimetry, is a volumetric analysis used to measure analyte concentration in a sample solution. It consists of a burette filled with titrant and a pipette used to introduce the titrant into the conical flask where the reaction occurs.A titrant of known concentration is added until the reaction is complete i.e. the chemical equivalence point. A titrant of known concentration is applied, and the reaction is complete, i.e. the chemical equivalence or equivalence point. Titration is mainly classified into four types: acid and base, redox, complexometric, and precipitation titration.What is redox titration?Redox titration is a type of titration; it is an oxidation-reduction reaction that occurs between an oxidizing and a reducing agent. There are several types of redox titration, including bromatometry, cerimetry, iodometry, iodimetry, permanganometry, and dichrometry are classified as direct titration, and back titration. It is a laboratory method used to determine the concentration of a sample analyte by causing a redox reaction between the titrant and the analyte. A potentiometer or a redox indicator may be required for this type of titration.What is iodometric titration?Iodometry, commonly known as iodometric titration, is a redox titration in which a solute (oxidizing agent) is added to excess iodide to obtain iodine, and the amount of iodine produced is determined by titration with a solution of sodium thiosulfate. It is an indirect titration in which iodide is used to determine the endpoint. At the end of the experiment, the blue color of the starch-iodine complex will fade.What is the principle of iodometric titration?Iodometric titration is based on the principle of determining the concentration of an oxidizing agent in a sample solution. Iodometry involves the indirect titration of iodine liberated by reaction with the analyte, which starch solution is used as an indicator as it can absorb the I2 that is released. When titrated with a standardized sodium thiosulfate (Na2SO3) solution, absorption causes the color to change from bright yellow to dark blue. This indicates the endpoint of the titration.Reaction involved in iodometric titration:The reaction between iodine and the thiosulfate ion is as follows. Examples of iodometric titration:To standardize the sodium thiosulfate (Na2SO3) using potassium dichromate (K2Cr2O7)Iodometric estimation of Cu (II) (Copper (II) oxide) using sodium thiosulfate solutionEstimation of vitamin C by the iodometric methodHow does iodometric titration work?To use this iodometric titration procedure will require using a material that has oxidizing properties. This oxidizing property indicates that it has the ability to remove electrons that are owned by other compounds.This oxidizing substance is later dissolved in the solvent and titrated with a standardized solution of sodium thiosulfate (Na2SO3). As the solution is acidified. We can use sulfuric acid (H2SO4), hydrochloric acid (HCl), or acetic acid (CH3COOH) to acidify the solution. Following that, add chlorine and allow the mixture to settle in a dark room for a few minutes.The iodide will then be released as a result of this reaction, in which the iodide can absorb I2 that is released. It causes the absorption color to change from dark blue to pale yellow when the solution is titrated with a standardized thiosulfate solution. Due to the formation of a starch-iodine complex, the endpoint in iodometric titration is the disappearance deep blue-black color. Advantages of iodometric titration:Iodometry can be used to determine the concentration of both reducing and oxidizing agents.It has the ability to precisely determine the concentration of the analyte.It allows us to visually detect reactivity at equilibrium point(s).The presence of iodine in starch causes a visible blue color change that occurs simultaneously, which is one of the two most important criteria for titration. It requires only a small amount of chemicals or substances. Frequently Asked Questions (FAQ):Why is KI used in iodometric titration?Because iodide will oxidize iodine in the presence of an oxidizing agent, KI (potassium iodide) is employed in iodometric titrations.Why excess KI is used in iodometric titration?Excess KI is added to help in the solubilization of free iodine, which is insoluble in water under normal conditions.What do you mean by iodometric and iodimetric titration?Iodometry and iodimetry both are common volumetric analysis methods. Iodometry is an indirect titration method used to quantify oxidizing agents, whereas iodimetry is a direct titration method used to quantify reducing agents. References: In acid solution practically all oxidizing agents will oxidize iodide ion to iodine quantitatively. The iodine formed in the reaction can then be titrated by means of a standard sodium thiosulfate solution. This type of indirect titration is given the general name of iodometry. Iodometric method of analysis have a wide applicability for the following reasons:Potassium iodide, KI, is readily available in high purity. A good indicator, starch, is available to signal the equivalence point in the reaction between iodine and thiosulfate. Starch turns blue-black in the presence of iodine. Therefore, when the blue-black color disappears, the iodine has been completely reduced to the iodide ion. Iodometric reactions are rapid and quantitative. A precise and stable reducing agent, sodium thiosulfate (Na2SO3), is available to react with the iodine. The amount of iodine liberated in the reaction between iodine and an oxidizing agent is a measure of the quantity of oxidizing agent originally present in the solution. The amount of standard sodium thiosulfate solution required to titrate the liberated iodine is then equivalent to the amount of oxidizing agent. Iodometric methods can be used for the quantitative determination of strong oxidizing agents such as potassium dichromate, permanganate, hydrogen peroxide, cupric ion and oxygen. As has been mentioned above, the endpoint in a titration of iodine with thiosulfate is signaled by the color change of the starch indicator. When starch is heated in water, various decomposition products are formed, among which is beta-amylose which forms a deep blue-black complex with iodine. The sensitivity of the indicator is increased by the presence of iodide ion in solution. However, if the starch indicator solution is added in the presence of a high concentration of iodine, the thiosulfate color is very gradual. For use in indirect methods, the indicator is therefore added at a point when virtually all of the iodine has been reduced to iodide, that is, close to the end-point. The starch indicator solution must be freshly prepared since it will decompose and its sensitivity is decreased. A properly prepared solution will keep for a period of a few weeks. A preservative such as a small amount of mercuric ions may be added to inhibit the decomposition. Solution of sodium thiosulfate are made up to an approximate concentration by dissolving the sodium salt in water that has previously been boiled. Boiling the water is necessary to destroy micro-organisms which metabolize the thiosulfate ion. A small amount of Na2CO3 is added to the solution in order to bring the pH to about 9. The solution is standardized by taking a known amount of oxidizing agent, treating it with excess iodide ion and then titrating the liberated iodine with the solution to be standardized. Oxidizing agents such as potassium dichromate, KIO3, as your primary standard. The reaction between IO3- and I- is given as \[6H^++IO_3^-+5I^- \rightarrow 3I_2+3H_2O\] Iodometric methods depend on the following equilibrium: \[I_2+I^- \rightleftharpoons I_3^-\] Since the solubility of I2 in water is quite low, the formation of the tri-iodide ion, I3-, allows us to obtain useful concentrations of I2 in aqueous solutions. The equilibrium constant for this reaction is approximately 700. For this reason iodometric methods are carried out in the presence of excess iodide ion. The reaction between iodine and the thiosulfate ion is: \[I_2 + 2S_2O_3^{2-}\{2-\} \rightleftharpoons 2I^- + S_4O_6^{2-}\] This reaction proceeds quantitatively in neutral or slightly acidic solutions. In strongly alkaline solutions the oxidation of the thiosulfate does not proceed by a single reaction. In the former, the thiosulfate ion is oxidized to sulfate as well as to the tetrathionate. In the latter, the thiosulfuric acid formed undergoes an internal oxidation-reduction reaction to sulfurous acid and sulfur. Both of these reactions lead to errors since the stoichiometry of the reactions differs from that shown above for the thiosulfate as a reducing agent. The control of pH is clearly important. In many cases the liberated iodine is titrated in the mildly acidic solution employed for the reaction of a strong oxidizing agent and iodide ion. In these cases the titration of the liberated iodine must be completed quickly in order to eliminate undue exposure to the atmosphere since an acid medium constitutes an optimum condition for atmospheric oxidation of the excess iodide ion. The basic reaction in the determination of copper using the iodometric method is represented by the equation: \[2Cu^{2+}\{2+\} + 4I^- \rightleftharpoons 2CuI + I_2\] This is a rapid, quantitative reaction in slightly acidic solutions. If there are large excess of iodide ion present and if the copper is in the form of a single ion rather than a complex one. The iodine that is liberated can be titrated in the usual manner with standard thiosulfate solution. The reaction involving cupric ion and iodide takes place quantitatively since there is removal from the solution as a precipitate of cuprous iodide. Iron interferes since iron(III) ions will oxidize iodide. Since the iron will be found in the +3 oxidation state as a result of the dissolution of the brass sample, a means of preventing this interference is necessary. This can be accomplished by converting the iron(III) to a soluble iron(III) phosphate complex using phosphoric acid. At a pH of 3.0-4.0 the iron phosphate complex is not reduced by iodide ion. If arsenic and antimony are present, they will provide no interference at this pH if they are in their higher oxidation states. Brass formulations also may contain up to 39% Zn, 2.5% Sn and 8.5% Pb. When dissolved in concentrated nitric acid, the zinc and the lead become Pb2+ and Zn2+ . These do not interfere with the analysis of copper because they are not reduced to the Pb+ and Zn+ states by the action of iodide ion under the conditions of this experiment. The tin is oxidized to Sn4+ by the concentrated nitric acid and after dilution and adjustment of pH this form becomes SnO2 which is insoluble and may be observed as an inert white precipitate at the bottom of your flask. Under these conditions the tin does not interfere with the analysis. The following are the most important sources of error in the iodometric method: Loss of iodine by evaporation from the solution. This can be minimized by having a large excess of iodide in order to keep the iodine tied up as tri-iodide ion. It should also be apparent that the titrations involving iodine must be made in cold solutions in order to minimize loss through evaporation. Atmospheric oxidation of iodide ion in acidic solution. In acid solution, prompt titration of the liberated iodine is necessary in order to prevent oxidation. Starch solutions that are no longer fresh or improperly prepared. The indicator will then not behave properly at the endpoint and a quantitative determination is not possible. Click here to see images of what one can expect in this experiment. With a graduated cylinder measure out 1 liter of distilled water. Place it in your 1 liter beaker and boil the water for at least 5 minutes. Weigh out 25 g of Na2S2O35H2O and 0.1 g of Na2CO3. Dissolve the thiosulfate in the hot water and then cool this solution with the aid of an ice bath to room temperature. Then add the carbonate and stir until it is completely dissolved. Transfer the solution to your plastic 1 liter bottle. When not in use store this bottle in the darkness of your equipment cabinet as the decomposition of thiosulfate is catalyzed by light. Potassium iodide may contain appreciable amounts of iodate ion which in acid solution will react with iodide and yield iodine. The liberated iodine would react with thiosulfate and thereby cause the apparent molarity of the thiosulfate to be too low. The following procedure allows for the determination of a blank correction which will properly correct for any iodate that might be present. Prepare a solution of exactly 2.00 g of KI dissolved in 50 mL of distilled water and then acidify the solution with 5 mL of 3 M sulfuric acid and then immediately add 5 mL of starch indicator. If a blue-black color appears right after mixing, use the thiosulfate solution in the burette of the solution required to cause the color- to disappear. This volume must be subtracted from the standardization and analyses volumes. If the potassium iodide is completely iodate-free no color will of course develop and no blank correction is necessary. Dry approximately 2 g of potassium iodate, KIO3, at a temperature of 110 oC for one hour. Weigh to a precision of 0.0001g three samples of the potassium iodate having weights near 0.12 g directly into three 250 mL Erlenmeyer flasks. Dissolve the iodate in 75 mL of distilled water. Cover the flasks with paraffin and store them. Rinse and fill your buret with the solution. Add 2.00 g of KI to each of the potassium iodate solutions. If a blank correction is required add exactly 2.00 g of KI to each. If no blank determination is required, the exact amount of KI is not crucial but should be close to 2 g. Then add 10 mL of 1 M HCl to one of the solutions. It will turn a dark brown color. Immediately titrate it with the color of the solution becomes very pale yellow add 5 mL of starch indicator. Continue the titration until the blue color of the starch complex just disappears. Follow the same procedure with each of the other two solutions, first adding the HCl then titrating. Correct your titration data for buret error and if necessary apply the blank correction. Calculate the molarity of the Na2S2O3 solution. Results should agree to within 0.2% of the average. If you do not achieve that kind of precision, titrate additional samples. The following procedures in this section make use of the hot plates in the fume hoods. The dissolution of dissolved brass generally have a low volume and high acid and salt concentrations. "Bumping" or little explosions of steam in the superheated liquid can occur. You don't want your hand to be close to the mouth of the flask should the solution suddenly "bump" because drops of acid (not to mention part of your sample) will fly out of the flask and possibly onto your hand. For that reason you must use your tongs to place the flasks on the hot plate and to remove them. Don't use strips of paper towel or the rubber Hot Hands because your real hand will end up being too close to the mouth of the flask. The brass sample which you will receive does not have to be dried before use. Accurately weigh out three brass samples, of about 0.3 g each, directly into separate 250 mL Erlenmeyer flasks. In the fume hood add 5 mL of 6 M HNO3. Warm the solution on a hot plate in the fume hood until dissolution is complete. Add 10 mL of concentrated (not 3 M) H2SO4 and continue heating until white SO3 fumes appear. It is important that you do not mistake ordinary water vapor for SO3 fumes. It is also important at this point that the flask not be removed from the hood. SO3 fumes are dangerous and ought not to be inhaled. Only when the slightly denser white fumes of SO3 are observed can you be sure that all HNO3 has been removed. NO3- will oxidize I- and hence will seriously interfere with the procedure. Cool the flask in air for one or two minutes and then in an ice bath, then carefully add 20 mL of distilled H2O. Boil for one or two minutes then again cool in an ice bath. Continue to keep the flask in the ice bath and using your medicine dropper add concentrated NH3(aq) dropwise, and with adequate mixing, until the light-blue color of the solution is completely changed to the dark-blue color of the copper tetraammine complex. As many as 400 drops (20 mL) may be required. The solution must be kept cool in an ice bath since the reaction between the concentrated H2SO4 and concentrated NH3 is highly exothermic. Now add 3 M H2SO4 dropwise until the dark-blue color just disappears. You don't have to approach that point. The maximum addition of phosphoric acid will lower the pH appropriately to around 3.5. If you add too much 3M H2SO4 the pH may turn out to be sufficiently low to cause unwanted side reactions to occur when you reduce the Cu2+ with iodide. If you make the solution too acidic you may put 50 mL of 0.06 M Cu2+ in a clean 250 mL flask and add 12 M ammonia dropwise until you have that unmistakable dark blue color. Then add 3M H2SO4 dropwise until the blue color almost disappears. Then add 2 mL concentrated phosphoric acid and you ought to see the dark color completely disappear. You may copy that procedure to achieve an appropriate pH of around 3.5 for subsequent steps in the analysis. Now, back to your real sample: Once you are confident that you are then able until you are ready to proceed with the titration. If you have let the dissolved samples stand overnight, be sure to warm the sample on a hot plate (this can be done at your desk) in order to dissolve all larger crystals of copper sulfate that might have formed. Be sure to cool the samples to room temperature, or below, with the aid of an ice bath. The solutions will still contain a fine, white precipitate at this point; however, this will not interfere with the rest of the procedure. From this point on work with only one sample at a time. Add 4.0 g of KI to one of your samples and titrate immediately with the standard thiosulfate solution. The sample contains white CuI precipitate and the color of I3- may be observed against that precipitate. The slurry will at first appear brown or dark yellow-brown. Continue adding thiosulfate until the slurry is a light mustard color. At this point add 5 mL of starch indicator and titrate until the mixture in the flask takes on a milky pink or lavender hue. Now add 2 g of KSCN and mix well; the solution will darken somewhat. After the addition of thiocyanate, continue to add more thiosulfate dropwise. You should observe a sudden change to a white or cream color. That is the endpoint of the titration. After you have titrated all three samples calculate the percentage of Cu in each of the brass samples, the average percentage and the average deviation.The description above applies for brass samples with low concentrations of zinc (

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