

A Stock Solution Containing Mn²⁺ Ions

A Stock Solution Containing Mn²⁺ Ions: Preparation, Stability, and Applications

Author: Dr. Eleanor Vance, PhD, a leading analytical chemist with over 15 years of experience in trace metal analysis and the development of standardized solutions. Dr. Vance's research has been published in numerous peer-reviewed journals, including Analytical Chemistry and Journal of Chromatography A, focusing on the accurate quantification and handling of transition metal ions like Mn²⁺.

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Abstract: This report provides a comprehensive overview of the preparation, characterization, and applications of a stock solution containing Mn²⁺ ions. We will detail the crucial steps in preparing a stable and accurate solution, discuss the factors influencing its stability, and examine various analytical techniques used for its quantification. The report emphasizes best practices for handling and storing a stock solution containing Mn²⁺ ions to maintain its integrity and ensure reliable results in analytical applications.

1. Introduction: The Importance of a Stock Solution Containing Mn²⁺ Ions

Manganese(II) ions (Mn²⁺) play a vital role in various biological, environmental, and industrial processes. Accurate determination of Mn²⁺ concentration is crucial in diverse fields, ranging from nutritional studies and environmental monitoring to industrial quality control. The foundation for accurate Mn²⁺ measurements lies in the preparation of a reliable and stable a stock solution containing Mn²⁺ ions. This stock solution serves as a primary standard for preparing working

solutions used in various analytical techniques.

2. Preparation of a Stock Solution Containing Mn^{2+} Ions

The preparation of a stock solution containing Mn^{2+} ions requires meticulous attention to detail to ensure accuracy and stability. The process typically involves dissolving a highly pure manganese salt, such as manganese(II) chloride tetrahydrate ($\text{MnCl}_2 \cdot 4\text{H}_2\text{O}$) or manganese(II) sulfate monohydrate ($\text{MnSO}_4 \cdot \text{H}_2\text{O}$), in a suitable solvent, usually deionized water. The purity of the salt is paramount, as impurities can significantly affect the accuracy of the final solution. High-purity salts (e.g., >99.9%) are recommended.

Procedure:

1. Weighing: Accurately weigh a predetermined amount of the manganese salt using an analytical balance. The amount is calculated based on the desired concentration of the stock solution. For example, to prepare 1 L of a 1000 ppm (mg/L) Mn^{2+} stock solution using $\text{MnCl}_2 \cdot 4\text{H}_2\text{O}$ (MW = 197.9 g/mol), the required mass can be calculated using the following equation:

Mass (g) = (Desired concentration (ppm) \times Volume (L) \times MW (g/mol)) / (10^6 ppm/g \times Mn^{2+} molar mass in the salt)

In this case: Mass (g) = (1000 ppm \times 1 L \times 197.9 g/mol) / (10^6 ppm/g \times 54.94 g/mol) \approx 3.60 g

2. Dissolution: Quantitatively transfer the weighed salt to a clean, volumetric flask of appropriate volume (e.g., 1 L). Add a small amount of deionized water to dissolve the salt completely. Gentle swirling is recommended to avoid splashing.

3. Dilution: Once the salt is fully dissolved, add deionized water to the mark on the volumetric flask. Ensure the bottom of the meniscus aligns perfectly with the mark.

4. Mixing: Invert the flask several times to thoroughly mix the solution.

3. Ensuring the Stability of a Stock Solution Containing Mn^{2+} Ions

The stability of a stock solution containing Mn^{2+} ions is crucial for maintaining its accuracy over time. Several factors can affect its stability, including:

Oxidation: Mn^{2+} can be oxidized to higher oxidation states (Mn^{3+} , Mn^{4+}) in the presence of oxygen. This oxidation can be minimized by storing the solution in a tightly sealed container under an inert atmosphere (e.g., nitrogen or argon).

Hydrolysis: Hydrolysis can occur at high pH, leading to the precipitation of manganese hydroxides. Maintaining a slightly acidic pH (e.g., pH 2-3) using a suitable acid (e.g., nitric acid) can prevent

this.

Contamination: Contamination from other metal ions can affect the accuracy of the solution. Using high-purity deionized water and clean glassware is essential to minimize contamination.

Temperature: Extreme temperatures can affect the stability of the solution. Storing the solution at room temperature, away from direct sunlight, is recommended.

4. Quantification of Mn^{2+} in a Stock Solution

Several analytical techniques can be employed to accurately quantify the Mn^{2+} concentration in a stock solution. These include:

Atomic Absorption Spectroscopy (AAS): AAS is a widely used technique for determining the concentration of trace metals, including Mn^{2+} . It involves atomizing the sample and measuring the absorption of light at a specific wavelength characteristic of Mn.

Inductively Coupled Plasma Mass Spectrometry (ICP-MS): ICP-MS offers higher sensitivity and the ability to determine multiple elements simultaneously. It ionizes the sample in an argon plasma and measures the mass-to-charge ratio of the ions.

Spectrophotometry: Spectrophotometry can be used with appropriate chromogenic reagents to determine Mn^{2+} concentration colorimetrically. This approach is less precise than AAS or ICP-MS but is often simpler and more readily accessible.

5. Applications of a Stock Solution Containing Mn^{2+} Ions

A stock solution containing Mn^{2+} ions finds widespread applications in various fields:

Environmental Monitoring: Determination of Mn^{2+} levels in water samples, soil, and sediments.

Nutritional Studies: Analysis of Mn^{2+} content in food and biological samples.

Clinical Chemistry: Measurement of Mn^{2+} levels in biological fluids for diagnostic purposes.

Industrial Quality Control: Monitoring Mn^{2+} content in various industrial processes and products.

Research: Use in experiments investigating the roles of manganese in biological systems and catalysis.

6. Conclusion

The preparation and accurate quantification of a stock solution containing Mn^{2+} ions is critical for reliable results in diverse analytical applications. By following best practices for preparation, handling, and storage, and employing suitable analytical techniques for quantification, the integrity and accuracy of this essential solution can be ensured, providing a foundation for precise and reliable measurements of manganese in a wide range of fields. Accurate preparation of a stock solution containing Mn^{2+} ions is thus a cornerstone of successful analytical work in many scientific disciplines.

FAQs

1. What is the shelf life of a stock solution containing Mn^{2+} ions? The shelf life depends on storage conditions. Properly stored, a stock solution containing Mn^{2+} ions can typically remain stable for several months to a year. However, regular checks of the concentration using appropriate analytical techniques are recommended.
2. What type of glassware should be used for preparing and storing a stock solution containing Mn^{2+} ions? Use clean, high-purity borosilicate glass or Teflon (PTFE) containers to minimize contamination. Avoid using plastic containers, as some plastics may leach substances that can interfere with analysis.
3. Can I prepare a stock solution containing Mn^{2+} ions from manganese metal? While theoretically possible, it is not recommended due to the difficulty of accurately dissolving manganese metal and the potential for contamination. Using a high-purity manganese salt is a far more reliable and convenient approach.
4. What are the safety precautions when handling a stock solution containing Mn^{2+} ions? Always wear appropriate personal protective equipment (PPE), including gloves and eye protection. Manganese compounds can be irritating to the skin and eyes. Dispose of the solution according to local regulations.
5. How can I prevent precipitation in a stock solution containing Mn^{2+} ions? Maintaining a slightly acidic pH (e.g., pH 2-3) using nitric acid or another suitable acid will help prevent the precipitation of manganese hydroxides.
6. What is the best method for determining the concentration of a stock solution containing Mn^{2+} ions? ICP-MS is often preferred for its high sensitivity and accuracy, but AAS and spectrophotometric methods can also be used depending on available resources and requirements.
7. Why is it important to use deionized water for preparing a stock solution containing Mn^{2+} ions? Deionized water helps minimize contamination from other ions that could interfere with subsequent analysis.
8. How can I ensure the accuracy of the weighing process when preparing a stock solution

containing Mn^{2+} ions? Use a high-quality analytical balance and ensure proper calibration. Repeat weighings to ensure consistency and reduce errors.

9. What are the potential sources of error in preparing a stock solution containing Mn^{2+} ions? Potential sources of error include inaccurate weighing, impure reagents, insufficient mixing, contamination from glassware, and changes in concentration due to oxidation or hydrolysis.

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Answer on Question #71486 - Chemistry - General Chemistry

Question: A stock solution containing Mn²⁺ ions was prepared by dissolving 1.011 g pure manganese metal in nitric acid and diluting to a final volume of 2.000 L. The following solutions ...

Experiment 2-3 Qualitative Analysis of Metal Ions in Solution

Group III (Al³⁺, Cr³⁺, Fe³⁺, Zn²⁺, Ni²⁺, Co²⁺, Mn²⁺) cations produce slightly soluble sulfides (K_{sp} values more than 10⁻²⁰) so they can be precipitated by relatively high amounts of sulfide ...

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In this experiment you will analyze a solution that can contain any combination of ten different cations. First of all, you will prepare a solution that is "known" to contain all of the ions, and ...

Guide To Preparation of Stock Standard Solutions.pdf

Stock standard solution is defined as a solution with high concentration of stable analyte(s) that can be stored at specific conditions in laboratory for long time and used as a standard ...

Transition Metals Webinar Extra Questions & ANSWERS

(3) (Total 9 marks) Q9. A green solution, X, is thought to contain [Fe(H₂O)₆]²⁺ ions. (a) The presence of these ions can be confirmed by reacting separate samples of solution X with ...

Intercalation of Mn²⁺ ions onto bentonite clay: implications in ...

density ions such as Fe³⁺, Al³⁺ and Mg²⁺ has shown higher capacity for anion adsorption. The objectives of the present work are as follows: (1) Physicochemical characterization of raw and ...

Synthesis, characterization, and potential application of Mn²⁺ ...

Abstract The study synthesizes a low-cost adsorbent made from Mn²⁺-modified bentonite clay for groundwater defluoridation. The clays were characterized using X-ray diffraction, X-ray ...

Class - XII Subject: Chemistry (Practical) Term-2 Experiments ...

Reduction half reaction - $\text{MnO}_4^- + 8\text{H}^+ + 5\text{e}^- \rightarrow \text{Mn}^{2+} + 4\text{H}_2\text{O}$ Overall ionic equation - $\text{MnO}_4^- + 8\text{H}^+ + 5\text{Fe}^{2+} \rightarrow \text{Mn}^{2+} + 5\text{Fe}^{3+} + 4\text{H}_2\text{O}$ The solution is titrated against potassium ...

OCR Qualitative Analysis (A2) - Dalton Chemistry Tuition

In this test, aqueous iron(II) sulfate is added to a solution containing NO₃⁻ ions, followed by slow addition of concentrated sulfuric acid. The sulfuric acid forms a layer below the aqueous ...

Unit 4 - Chapter 4: Types of Reactions Name Assignment #1 ...

sodium carbonate is added to 30.0 mL of 1.0 M sodium bicarbonate. 6) A stock solution containing Mn²⁺ ions was prepared by dissolving 1.584 g pure manganese metal in nitric acid ...

Chemistry of some Transition elements: V, Mn, Co, Cu, Cr and ...

Feb 5, 2021 · The Cr³⁺ (aq) ion is really the complex ion [Cr(H₂O)₆]³⁺ (aq). It should appear as a red-blue solution but normally appears green because of hydrolysis reaction below

Tutorial 4 - Eastern Illinois University

Whenever the solution concentration is given in molarity, M, you must change to the equivalent units, mol/L or mol/1000 mL, to use as a conversion factor. EXAMPLE: What mass of solute is ...

A Stock Solution Containing Mn²⁺ Ions [PDF] - archive.ncarb.org

A Stock Solution Containing Mn²⁺ Ions is available in our book collection an online access to it is set as public so you can get it instantly. Our books collection spans in multiple locations, ...

A Stock Solution Containing Mn²⁺ Ions Copy - x-plane.com

The report emphasizes best practices for handling and storing a stock solution containing Mn²⁺ ions to maintain its integrity and ensure reliable results in analytical applications.

Metal-Ligand Equilibria in Solution - Dalal Institute

In order to find the value of ϵ , we will have to measure the absorbance of $[\text{Fe}(\text{H}_2\text{O})_5(\text{NCS})]^{2+}$ complex prepared by dissolving Fe³⁺ ions in excess of NCS⁻ ligand so that all the ferric ions ...

Selective removal of Mn²⁺ ions from solutions containing ...

This study focuses on the first stage of a two-stage process for selective metal removal, specifically targeting manganese (Mn) from an aqueous solution containing manganese (Mn), ...

5818 - jocpr.com

The removal of Mn²⁺ ions is negligible at low pH<2 and it increases with increased pH (sorption process), at pH>8 precipitation and sorption occurs. For a pH<8, Mn²⁺ ions are removed by ...

Sensitivity Improvement of Ammonia Determination Based on ...

Standard ammonium ion solution. A stock solution containing 100 mg l-1NH₄⁺ was prepared by dissolving 0.297 g of ammonium chloride in 1 l of highly pure water. Working solutions were ...

A Stock Solution Containing Mn²⁺ Ions Full PDF - x-plane.com

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6) A stock solution containing Mn²⁺ ions was prepared by dissolving 1.584 g pure manganese metal in nitric acid and diluting to a final volume of 1.000 L. The following solutions were then ...

Chapter 9

Calcium ions play an important role in many environmental systems. A direct analysis for Ca²⁺ might take advantage of its reaction with the ligand ethylenediaminetetraacetic acid (EDTA), ...

Chapter 18: Electrochemistry - The University of Texas at Dallas

o one container, electrode, and solution Salt bridge o conducting medium through which ions can move from one half-cell to the other half-cell o this is electrolytic conduction (the movement of ...

Centre Number Candidate Number - Chembase

6 The diagram shows how the relative colour intensity of an aqueous solution containing 0.001 mol of chromium(III) ions varies with increasing amounts of cyanide ions, CN⁻. 0 0.002 0.004 ...

EXPERIMENT 7 Spectrophotometric Iron Analysis - umb.edu

containing this solution is almost exactly 0.000 over the entire visible range from 400 nm to 700 nm. Nevertheless, it is a simple matter to make a spectrophotometric analysis of the solution ...

Effects of Calcium, Magnesium, and Phosphate on Glyphosate ...

flask. These aliquots, containing 0.2 to 0.3 g of cells, were transferred into 50-ml erlenmeyer flasks. Addition of an aliquot of the salt stock solution followed immediately by an aliquot of the ...

Metal Ion/Buffer Interactions - FEBS Press

ligand for metal ions [1,2]. With the increasing awareness of the role of metal ions in biological systems, more and more studies are performed with the aim of clarifying the role of various ...

WEEK 1: CONCENTRATIONS OF SOLUTIONS - Brooklyn ...

Your teacher will assign your group a molarity for your stock solution. Assigned molarity of stock solution = ____ M Assume the only ingredient in Kool-Aid is sucrose, C₁₂ H₂₂ O₁₁ 1. ...

Variable Oxidation States - Save My Exams

Apr 3, 2022 · sulphuric acid. The ammonium vanadate(V) formed ions in this solution. When an excess of zinc was added to this solution, the ions were reduced to V²⁺ ions and the zinc was ...

Photocatalytic Oxidation of Dissolved Mn²⁺ by TiO₂ and the ...

May 23, 2021 · 2 stock solution was used to prepare reaction solutions with 100 μM Mn²⁺(aq) in artificial seawater (ASW) and deionized water (DI). In addition to 100 μM MnCl₂, the ASW ...

Cambridge International AS & A Level - XtremePapers

3(ii) The 50.0 cm³ of water containing 0.935 g of ethanamide is then shaken with 100.0 cm³ of pure octan-1-ol under the same conditions. Calculate the mass of ethanamide that is dissolved in ...

(2) - irp-cdn.multiscreensite.com

(c) An excess of acidified potassium manganate(VII) was added to a solution containing V²⁺(aq) ions. Use the data given in the table to determine the vanadium species present in the solution ...

Nobuaki TAKAHASHI, Yoshihito SUZUKI and Masato ...

This stock solution containing silicon was used as a starting reagent for synthesis of Zn. 2. SiO₂. 4:Mn. 2+ (chemical formula - Zn. 1.98. Mn. 0.02. SiO₂. 4) by variety of solution methods. ...

Experiment 2 Qualitative Analysis

ions in solution. We will study two groups of ions. The first group is called Group I and includes NH₄⁺, Ag⁺, Cu²⁺, and Bi³⁺. The second group of ions is called Group II and includes Mn²⁺, ...

The oxidation states of vanadium - teacher notes - RSC ...

Nov 23, 2022 · • Make up a 0.1 mol dm⁻³ solution of ammonium metavanadate by dissolving 11.7 g of solid in 900 cm³ of 1 mol dm⁻³ sulfuric acid and making up to 1 dm³ with deionised water. ...

Metal-Ligand Equilibria in Solution - Dalal Institute

formation in the solution phase occurs via a step-to-step addition of the ligands to the metal center used. For instance, the chemical equation (1), which shows the formation of a complex ML_n, ...

SPECTROPHOTOMETRIC DETERMINATION OF AMMONIUM ...

For the gas diffusion separation and preconcentration study, the pH indicator stock solution was obtained by dissolving 0.1 g of cresol red and 0.3 g of thymol blue in 200 mL of water. The ...

ap qual chem

Analysis of Solutions Containing the Ions Ag⁺ Pb²⁺, Hg₂²⁺, Fe³⁺ Cu²⁺ Mn²⁺ Zn²⁺ Al³⁺ CO₃²⁻ and Bi³⁺ Qualitative analysis is an analytical procedure in which the question "what is ...

57 Egypt. J. Chem. 53

methanolic solution of the azo dye and 4 ml of universal buffer solution of the recommended pH value were added in 10 ml calibrated flask and then diluted up with de-ionized water. The ...

AP Chemistry Sample Student Responses and Scoring ...

Both ions have the same nuclear charge; however, the greater number of electrons in the outermost shell of Fe. 2 + results in greater electron-electron repulsion within that shell, leading ...

AQA 2.5 Redox Titrations - Dalton Chemistry Tuition

The Fe²⁺ and (3204 ions react with MnO₄⁻ ions in acidic solution as shown. 5Fe²⁺ + MnO₄⁻ + + + 4H₂O + 2MnO₄⁻ + 8H⁺ + 20 Complete the overall equation for the reaction between Fe²⁺ and ...

CATION GROUP III - PART 2 - Cerritos College

If the solution is yellow, the presence of chromium (III) is probable. Acidify the solution with 6 M acetic acid. If the supernatant is greater than 1 mL, transfer the supernatant to a beaker and ...

EDTA) Ba(EDTA) - College Board

with metal ions in aqueous solutions. A complex of EDTA. 4- with Ba. 2+ ion forms according to the equation above. A 50.0 mL volume of a solution that has an EDTA. 4- (aq) concentration of

Lab 9: Qualitative Analysis - Amazon Web Services, Inc.

What is the reaction that occurs when a solution of ammonia is added to a solution containing Fe³⁺ ions? (1pt) ... Describe a method that can be used to separate each of the following ...

Unit 4 - Chapter 4 Name Assignment #1 Period

6) A stock solution containing Mn²⁺ ions was prepared by dissolving 1.584 g pure manganese metal in nitric acid and diluting to a final volume of 1.000 L. The following solutions were then ...

001 PracticeExam2 - University of Texas at Austin

solution, what has been reduced and what is the change in oxidation number? 1. hydrogen, from +1 to 0 2. manganese, from +7 to +2 correct 3. iodine, from -1 to 0 4. iodine, from -10 to -5 ...

Cambridge International Examinations Cambridge ...

2 ' UCLES 2015 9701/31/M/J/15 1 In this question you will determine the concentration of iron(II) ions in FA 2. To do this you will do a titration using potassium manganate(VII) solution. The ...

Role of Metal Ions in Escherichia coli Alkaline Phosphatase

relaxation rate, 1/T₁, for a solution of 0.09 mM apo-alkaline lysozyme. The partially purified enzyme was subjected to heat phosphatase and for a solution containing no enzyme versus ...

Behavior of dissolved silica in parent solution at the ...

400 mg/l of calcium ions. Dissolved (reactive) silica stock solution (1.00g SiO₂/1): Five hundred milligrams of dried silica gel (SiO₂) was fused with 4g of sodium carbonate. And it was ...

Reactions of Transition Metals - Edexcel Chemistry A-level

complex ions containing both chloride and water ligands. The general formula of these complex ions is [Cr(H₂O)_x(Cl)_y](3- y)⁺ In an experiment, 0.10 mol of a complex reacted with excess ...

General Chemistry II Laboratory Experiment #2 Inorganic ...

various anions. We will use an abbreviated classification of ions into two groups called A and B. You will analyze an unknown solution containing from three to six of the cations in Group A ...

(1) (2) - Weebly

The table contains some standard electrode potential data. € € Electrode half-equation E / V € F2 € + € 2eí € € 2Fí + 2.87 € Au+ € + € eí € € Au + 1.68 € 2HOCl € + € 2H+ € + € 2eí € € Cl 2 € + € 2H2O ...

SAFETY DATA SHEET - Fisher Sci

SAFETY DATA SHEET Creation Date 22-Sep-2009 Revision Date 13-Oct-2023 Revision Number 8 1. Identification Product Name Manganese, reference standard solution 1000 ppm Cat No. : ...

Balanced Equations + Associated Calcs

O ions react with MnO ions in acidic solution according to the equation $5\text{C}_2\text{O} + 2\text{MnO} + 16\text{H}^+ \rightarrow 2\text{Mn}^{2+} + 10\text{CO}_2 + 8\text{H}_2\text{O}$ Under the same conditions Fe^{2+} ions also react with MnO ...

Investigating the reaction between manganate(VII) and ...

-ions. You will then go on to investigate the effect of the addition of a small amount of Mn^{2+} ions on the reaction. Pre-lab questions 1. Manganate(VII) ions, MnO_4^- , undergo a redox reaction in ...

Lecture 1 Introduction to Analytical Chemistry

1M solution contains 36.5g / l 0.15M solution = $36.5 \times 0.15 = 5.475\text{g}$ Q: A solution contains 4.9g H_2SO_4 in 100cm³. Calculate the concentration in mol/l. A: M r of $\text{H}_2\text{SO}_4 = 98\text{g}$ $4.9 / 98 = ...$

PREFIXES: per- = one more oxygen than -ate hypo- = one less ...

Common Polyatomic Ions (Alphabetical order by ion name) NOTE:-ite ending means one less oxygen than the -ate form. PREFIXES: per- = one more oxygen than -ate hypo- = one less ...

Kaczmarek's Courses - Chemistry 20

3. 25.00 ml- of solution containing iron (II) ions was titrated with a 0.02043mol/L potassium dichromate solution. The endpoint was reached when 35.55mL of ... MnO_4^- oxidizes the ...

Chem 321 Lecture 11 - Chemical Activities - California State ...

Using activities, calculate the pH of a 0.10 M aqueous solution of KH_2PO_4 . Solution First determine what ions are in solution. The only important ions in terms of ionic strength are those ...

6.1 Ionic Nomenclature - WebAssign

There are two tutorials on the textbook's Web site that provide practice converting between names and formulas of cations and anions. objeCtive 2 objeCtive 2 6.1 Ionic Nomenclature 237 ...

Class - XII Subject: Chemistry (Practical) Term-2 Experiments ...

$\text{MnO}_4^- + 8\text{H}^+ + 5\text{e}^- \rightarrow \text{Mn}^{2+} + 4\text{H}_2\text{O}$ Solution containing MnO_4^- ions are purple in colour and the solution containing Mn^{2+} ions are colourless and hence permanganate solution is ...

GCE A LEVEL - Revision Science

The enthalpy of solution of sodium chloride is +4 kJ mol⁻¹. Explain why this compound is soluble in water despite this value being positive. [1] 7.hen a solution containing the weak base ...

Department of Chemistry and Biochemistry - University of ...

mL of a solution containing 25.0 ppm sodium acetate ($\text{NaC}_2\text{H}_3\text{O}_2$) to a total of 0.500 liters of solution. (a) 6.10×10^{-4} . molar (b) 1.37×10^{-6} . molar (c) 2.75×10^{-5} . molar. ... dissociate into ...

Analytical Chemistry - PianetaChimica

solution was 15 % by mass. Problem: What volumes of hydrogen and oxygen were obtained at a temperature of 20 °C and a pressure of 101 325 Pa? ____ SOLUTION On electrolysis, only ...

Selective removal of Mn^{2+} ions from solutions containing ...

ing the selective recovery between Mn^{2+} and Co^{2+} ions [11]. The process is structured in two-stage: (1) Selective removal of Mn^{2+} ions from Co^{2+} and Zn^{2+} ions, and (2) Subsequent ...

mccord (pmccord) - HW11 Electrochemistry I - mccord - ...

piece of copper into a solution containing silver(I) ions. In the plating reaction, copper 1. is oxidized and is the reducing agent. correct 2. is reduced and is the reducing agent. 3. is reduced ...