

a substance that is dissolved in a solution

Understanding Solutes: A Comprehensive Guide to Substances Dissolved in a Solution

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Summary: This comprehensive guide explores the fundamental nature of a substance that is dissolved in a solution – the solute. It delves into the process of dissolution, factors affecting solubility, different ways to express solute concentration, best practices for preparing solutions, and common pitfalls to avoid. The guide provides valuable insights for students, researchers, and professionals working in various scientific and engineering disciplines.

1. What is a Solute?

A solute is a substance that dissolves in a solvent to form a solution. It is the component of a solution that is present in a smaller amount compared to the solvent. Understanding the properties of a solute is crucial for predicting the behavior of the solution as a whole. The nature of the solute, including its polarity, molecular weight, and interactions with the solvent, greatly influences its solubility. For example, ionic solutes like sodium chloride (NaCl) readily dissolve in polar solvents like water, while nonpolar solutes like oil dissolve better in nonpolar solvents like hexane. The term “a substance that is dissolved in a solution” directly refers to the solute.

1. The Dissolution Process: How Solutes Dissolve

The dissolution of a solute involves several steps. Initially, the solvent molecules interact with the solute particles, overcoming the attractive forces holding the solute together (e.g., ionic bonds, hydrogen bonds, van der Waals forces). This process requires energy. Simultaneously, the solute particles become surrounded by solvent molecules, a process called solvation (or hydration if the solvent is water). This solvation stabilizes the solute particles in the solution and drives the overall dissolution process. The rate of dissolution depends on factors such as temperature, surface area of the solute, and agitation.

1. Factors Affecting Solubility of a Substance that is Dissolved in a Solution

Several factors influence the solubility of a solute, i.e., the maximum amount of solute that can dissolve in a given amount of solvent at a specific temperature and pressure. These include:

Temperature: Solubility often increases with temperature, particularly for solid solutes. However, the effect of temperature on gas solubility is generally opposite; gases become less soluble as temperature increases.

Pressure: Pressure significantly affects the solubility of gases, but its effect on solid and liquid solutes is minimal. Henry's Law describes the relationship between gas solubility and pressure.

Nature of the solute and solvent: The "like dissolves like" principle dictates that polar solutes dissolve best in polar solvents, and nonpolar solutes dissolve best in nonpolar solvents.

Presence of other solutes: The presence of other ions or molecules in the solution can affect the solubility of a solute through common ion effect or complex formation.

1. Expressing Solute Concentration

The concentration of a solute in a solution indicates the amount of solute present in a given amount of solvent or solution. Several methods exist to express concentration:

Molarity (M): Moles of solute per liter of solution.

Molality (m): Moles of solute per kilogram of solvent.

Mass percentage (% w/w): Grams of solute per 100 grams of solution.

Volume percentage (% v/v): Milliliters of solute per 100 milliliters of solution.

Parts per million (ppm) and parts per billion (ppb): Commonly used for very dilute solutions.

1. Preparing Solutions: Best Practices

Accurate preparation of solutions is crucial for many scientific and industrial applications. Here are some best practices:

Use of calibrated glassware: Employing accurate volumetric flasks, pipettes, and burettes ensures

precise measurements.

Proper weighing techniques: Use an analytical balance for accurate weighing of solid solutes.

Appropriate solvents: Select the appropriate solvent based on the solute's properties and the intended application.

Careful mixing: Ensure thorough mixing to achieve a homogeneous solution.

1. Common Pitfalls in Solution Preparation

Several pitfalls can compromise the accuracy and reproducibility of solution preparation:

Incorrect weighing: Errors in weighing the solute can lead to significant deviations in the final concentration.

Improper use of glassware: Using unclean or incorrectly calibrated glassware can lead to inaccurate measurements.

Incomplete dissolution: Inadequate mixing can result in a non-homogeneous solution with varying concentrations.

Temperature effects: Changes in temperature can affect the volume of the solution and consequently the concentration.

1. Saturation, Supersaturation, and Precipitation

A solution is saturated when it contains the maximum amount of solute that can dissolve at a given temperature and pressure. A supersaturated solution contains more solute than can typically dissolve at that temperature and pressure, often achieved through careful cooling of a saturated solution. Precipitation occurs when a supersaturated solution becomes unstable and the excess solute crystallizes out of the solution.

1. Applications of Solutions and Solutes

Solutions and their solutes are ubiquitous in various fields, including:

Medicine: Many drugs are administered as solutions.

Industry: Numerous industrial processes rely on solutions for chemical reactions and material processing.

Environmental science: Understanding solute behavior is crucial for assessing water quality and managing pollution.

Food science: Many food products are solutions or contain dissolved solutes.

1. Conclusion

Understanding the properties and behavior of a substance that is dissolved in a solution (the solute) is fundamental to chemistry, various scientific disciplines, and industrial processes. By following best practices and avoiding common pitfalls, one can ensure accurate and reliable preparation and use of solutions. This guide provides a solid foundation for anyone working with solutions, from students to experienced researchers.

FAQs:

1. What is the difference between a solution, a solute, and a solvent? A solution is a homogeneous mixture. The solute is the substance being dissolved, and the solvent is the substance doing the dissolving (present in the larger amount).
1. How does temperature affect the solubility of a solid solute? Generally, solubility increases with temperature.
1. How does pressure affect the solubility of a gas? Solubility increases with increasing pressure (Henry's Law).
1. What is the common ion effect? The decrease in the solubility of a sparingly soluble salt when a soluble salt containing a common ion is added.
1. What is a saturated solution? A solution that holds the maximum amount of solute at a given temperature and pressure.
1. How can I determine the concentration of a solute in a solution? Use various methods like titration, spectroscopy, or gravimetric analysis.
1. What are some examples of common solvents? Water, ethanol, acetone, hexane.

1. Why is it important to use calibrated glassware when preparing solutions? To ensure accuracy and reproducibility of results.

1. What happens when a supersaturated solution is disturbed? Precipitation of the excess solute can occur.

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Need to Know Gaines Bradford Jackson, 2012-03

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Wastewater Mamta Tomar, 1999-04-27 Water is the most basic need of mankind. Drinking water is considered the most essential use of water in life. Therefore it must be free of pathogens, toxins and carcinogens. Absolutley pure water does not exist in nature. Surface water absorbs particles, carbon dioxide and other gases and mixes with silt and inorganic matters from the environment. When treated and untreated domestic and industrial waste is discharged into natural bodies of water the situation becomes even more complex. Thus human waste, drinking water and communicable diseases are directly related. Water contamination is measured by the level of pollutants present in a sample. Regular analytical estimation of wastewater is the answer. This manual emphasizes the importance of water purity for drinking and domestic purposes, different types of water and their utilization in various activities, the water quality requirements and criteria of International and

Governmental Agencies, and simple estimation procedures and the significance of each analytical test. Quality Assessment of Water and Wastewater describes methods for ascertaining the quality and contamination levels of waters from a range of sources like ground, surface, potable water supplies, marine, beaches, swimming pools and other recreational facilities, and domestic and industrial wastewater. It includes important derivatives used in the preparation of standard solutions, data analysis, interpretation and units of expressions of the results. It also discusses all major pollutants - their origins and impact on the environment and health - with the basic chemistry of their analysis and complete methodology explained systematically.

a substance that is dissolved in a solution: General Chemistry Ralph H. Petrucci, Ralph Petrucci, F. Geoffrey Herring, Jeffery Madura, Carey Bissonnette, 2017 The most trusted general chemistry text in Canada is back in a thoroughly revised 11th edition. General Chemistry: Principles and Modern Applications, is the most trusted book on the market recognized for its superior problems, lucid writing, and precision of argument and precise and detailed treatment of the subject. The 11th edition offers enhanced hallmark features, new innovations and revised discussions that respond to key market needs for detailed and modern treatment of organic chemistry, embracing the power of visual learning and conquering the challenges of effective problem solving and assessment. Note: You are purchasing a standalone product; MasteringChemistry does not come packaged with this content. Students, if interested in purchasing this title with MasteringChemistry, ask your instructor for the correct package ISBN and Course ID. Instructors, contact your Pearson representative for more information. If you would like to purchase both the physical text and MasteringChemistry, search for: 0134097327 / 9780134097329 General Chemistry: Principles and Modern Applications Plus MasteringChemistry with Pearson eText -- Access Card Package, 11/e Package consists of: 0132931281 / 9780132931281 General Chemistry: Principles and Modern Applications 0133387917 / 9780133387919 Study Card for General Chemistry: Principles and Modern Applications 0133387801 / 9780133387803 MasteringChemistry with Pearson eText -- Valuepack Access Card -- for General Chemistry: Principles and Modern Applications

a substance that is dissolved in a solution: The Principles of Chemistry Dmitry Ivanovich Mendeleev, 1891

Additional Resources

Quarter 1 - Module 1 ...

When one substance dissolves into ...

Chapter 13 Solutions ...

Solution: A homogeneous mixture in ...

Lesson 120: Chemistr...

Dilute - Describing a solution that has a relatively low ...

Types and Propertie...

In a solution of salt water, identify the solute and the ...

Quarter 1 - Module 1 Lesson 2: Differentiating a Solute from a ...

When one substance dissolves into another, a solution is formed. A solution is a homogenous mixture consisting of a solute dissolved into a solvent. A solvent is a substance that does the ...

Chapter 13 Solutions and Other Mixtures - oneonta.edu

Solution: A homogeneous mixture in which one substance is dissolved in another. Solute: The

substance that is dissolved into a solvent to form a solution. A solid can be a solid, a liquid or a ...

Lesson 120: Chemistry Solutions Terms Chemistry with Lab

Dilute - Describing a solution that has a relatively low concentration of solute. solubility - The amount of a substance that can be dissolved in a given amount of solvent.

Types and Properties of Solutions - Brooklyn Technical High ...

In a solution of salt water, identify the solute and the solvent. What are some examples of solutions (aside from salt water) that you can think of from everyday life? Try and come up with 3 ...

9.1 Mixtures and Solutions

Solute: A substance dissolved in a liquid. Solvent: The liquid in which another substance is dissolved. The Solution Process. Solubility depends primarily on the strength of the attractions ...

6 Wet Chemistry: The Science of Substances in Solution

dissolves in water to form an aqueous solution, water is the solvent and the salt is the solute. Usually a solution has the same physical state as the solvent. Homogeneous mixtures can be ...

Chem101: General Chemistry Lecture 7 - Solutions and Colloids

1. The amount of solute that is dissolved in a solution when it is saturated, determines the solute's solubility. Tables 7.2 & 7.3 - Solute Solubilities D. Solubility and temperature 1. For solids ...

KEY CONCEPT A solution is a type of mixture.

Like other mixtures, a solution has definite components. A (SAHL-yoot) is a substance that is dissolved to make a solution. When a solute dissolves, it separates into individual particles. A is a ...

AP Chemistry: Properties of Solutions Lecture Outline 13.1 The ...

Consider NaCl (solute) dissolving in water (solvent). Water molecules orient themselves on the NaCl crystals. H-bonds between the water molecules have to be broken. NaCl dissociates into Na⁺ ...

TYPES OF SOLUTIONS - Profpaz

• A solution is a homogeneous mixture of two substances: a solute and a solvent. • Solute: substance being dissolved; present in lesser amount. • Solvent: substance doing the dissolving; ...

Solutions Worksheet - Mrs Alvarenga's

On the line at the left, write the letter of the definition that best matches each term. _____ 1. solution. 1. Compare a solute and a solvent. 2. What are the three types of solutions? 3. What are ...

Chapter 8. Solutions - Louisiana Tech University

Solution - homogeneous mixture of two or more substances; often comprised of solvent. Solute - minor component mixed with solvent. e.g., gases or solids are solutes when dissolved in a liquid ...

Solution Stoichiometry & Chemical Analysis - sachem.edu

Calculate the mass of H₂O formed by this reaction to completion? Ex. A chemist synthesized a new acid, which is known to have one acidic hydrogen per molecule. A 2.321g sample of the pure acid ...

Solutes and Solvents Worksheet - Ms. Chou's Classes

Soluble substances can dissolve in certain solvents. Insoluble substances can dissolve in all solvents.

All substances are soluble in water, which is called the "universal solvent." Table salt is ...

SOLUTES AND SOLVENTS QUIZ -Answer Key

A solute is a substance that is dissolved in a solvent to form a solution, while a solvent is the substance that dissolves the solute to form the solution. OR A solute is the substance being ...

Properties of Solutions - Colby College

The Solution Process • A solution is a homogeneous mixture of solute and solvent. • Solutions may be gases, liquids, or solids. • Each substance present is a component of the solution. • The ...

Grade 5 - Lesson 2.1 Using Dissolving to Identify Substances ...

The substance being dissolved is called the . solute. and the liquid doing the dissolving is called the . solvent. In order for a substance to dissolve, the molecules of the solute need to interact with ...

PREPARING SOLUTIONS FOR BIOLOGY EVENTS Solute Mole

In a solution one pure substance is dissolved in another pure substance homogenously. For example, in a sugar and water solution, the solution has the same concentration throughout, ie. it ...

Toombs CHEMISTRY 12 - bpb-ca-c1.wpmucdn.com

A solution is created by adding 0.35 moles of zinc sulphide solid to 1.0 L of water, and heating it gently on a hot plate to promote dissolving. A) Is this a supersaturated, saturated, or unsaturated ...

Chapter 13 Properties of Solutions - alpha.chem.umb.edu

Dissolved solute is in dynamic equilibrium with solid solute particles. Less than the maximum amount of solute for that temperature is dissolved in the solvent. Solvent holds more solute than ...

A Substance That Is Dissolved In A Solution

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