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Molar and molal difference

A bulk of reactions in the laboratories are performed with different solutions. Thus it is essential to know how the amount of substance is said when it is present in the form of a solution. The amount of a given substance present in the given volume or the concentration of a given solution can be expressed in Molarity, Molality, Normality, etc.Molarity vs Molality The difference between Molarity and Molality is that molarity focus on the number of mole of solute per litres of the given solution, while molality deals with the mole of solute per kg of the solvent. Molarity is represented by 'M' or Molar or mol/L, while Molality is represented by 'm' or Molal or mol/kg.The molarity of a solution is dependent on the temperature and inversely changes with it. If the temperature is increased, the molarity decreases, while if the temperature is decreased, the molarity increases. The value of molarity is affected by the change in pressure also. The value of molarity is not accurate or precise.The molality of a solution is independent of the change in temperature and pressure. This is because the mass of the solute remains unaffected by any change in temperature and pressure. The value of molality is quite accurate and precise. The molality of a solution is concerned with the mass of the solvent.Comparison Table Between Molarity and Molality Parameters of ComparisonMolarityMolalityDefinitionIt is defined as a mole of solute dissolved in a litre of the solution.It is defined as a mole of solute dissolved in 1 kg of the solutionSI Unit mol/Lmol/kgMeasurement It is measured by means of the volume of solution.It is measured by means of the mass of the solvent.Temperature Affected by any changes in the temperatureDo not affect by any changes in the temperature.Denoted MmAccuracyIt is inaccurate and is not reliable.It is precise and accurate.PressureAffected by any change in pressureDo not affect by any change in pressure.What is Molarity?The number of moles of the given solute dissolved in a given per litre of the solution is known as Molarity. Molarity is represented by the symbol 'M'. The formula for calculating molarity mathematically is given below -M = No. of moles of a given solute/volume in litresThe standard unit of Molarity is moles/L, or Molar or M. Consider the example given below - 0.25 mol/L solution of sodium hydroxide means that 0.25 moles of sodium hydroxide have been dissolved in the 1 litre (or 1 cubic decimetre) of the solution.As the volume of the given solution increases with an increase in temperature of the solution, then the Molarity of the solution also decreases along with it while the volume of the solution decreases with a decrease in temperature. Thus the Molarity of the solution increases with a decrease in temperature.For complex problems, the given equation M1V2 = M2V2 is used to find out the Molarity of the solution. For example - Dissolve 4 g of sodium hydroxide in 250 ml of water. What is the molarity of the above solution?Solution - Mass of Sodium hydroxide = 4.0 gMolar Mass of Sodium hydroxide, NaOH = 23 (Na) + 16 (O) + 1 (H) = 40.0 g/molVolume of water in litre = 250/1000 = 0.25 LNumber of moles = Mass of sodium hydroxide/Molar mass of sodium hydroxide = 4/40 = 0.1 molMolarity = Number of moles of sodium hydroxide/Volume of solution in litre = 0.1/0.25 = 0.4 MWhat is Molality?The number of moles of the solute per kilogram of the solvent is known as Molality. It is denoted by the symbol 'm'. The formula for calculating molality mathematically is given below -Molality = Moles of given solute/Mass of given solvent in kgThe standard unit of measurement of Molality is moles/kg or Molal or m. Consider the example given below - 1.0 mol/kg solution of potassium chloride means that 1 mole (74.5 g) of potassium chloride is dissolved in 1 kg of solution.It is not affected by the change in temperature since mass remains constant or unaffected by temperature.Consider the following example for better understanding - When 2.5 g of ethanoic acid is dissolved in 75 g of benzene.Solution - Molar mass of ethanoic acid = 60 g/molMoles of ethanoic acid = 2.5/60 = 0.0417 molMass of benzene in kg = 7/1000 kgThe molality of ethanoic acid = Moles of ethanoic acid / Mass of benzene = 0.0417 x 1000 / 75 = 0.556 mol/kg Main Differences Between Molarity and MolalityThe molarity of a solution can be defined as a mole of solute dissolved in a litre of the solution, while the Molality of a solution can be defined as a mole of solute dissolved in a kg of solution.The SI unit used to express molarity is 'mol/L', while for molality, it is 'mol/kg'.The molarity of a solution can be measured on the basis of the volume of a given solution. On the other hand, the molality of a solution can be measured on the basis of the mass of the given solvent.Molality changes with the fluctuation in temperature, while the fluctuation in temperature does not affect the value of molality.The molality of a solution can also be denoted by 'M', while the molality of a solution is denoted by 'm'.The value of molarity is not considered accurate and precise. On the other hand, the value of molality is more accurate and precise.The change in the pressure affects the value of molarity, but the value of molality remains unaffected by the change. ConclusionBoth the above terms, Molarity and Molality, are part of chemical solution concentration. The significant difference between the two terms narrows down to the mass vs volume. The molarity of a solution is interested in the number of moles of solute with the volume of a given solution, while molality is interested in the moles of a solute along with the mass of a solvent.The term molarity is represented or denoted by 'M' while molality is represented or denoted 'm'. The change in pressure affects the changes in the molarity but the value of molality. It is thus the same with the change in temperature, which affects the value of molarity but not the molality. It is believed that the value obtained for molarity is not accurate and precise, but the value obtained for molality is more accurate, precise, and reliable.References Molarity and molality are both measurements dealing with concentration of solutions in chemistry. When you see a bottle marked with either a capital M or a lower-case m, what does it mean? Is there a difference?Yes there is a difference.Molarity is the most common concentration measurement and denoted by the capital letter M. Molality is the number of moles of something per volume of mixture containing the something. In solutions, it is the number of moles of solute present per liter of solution.A 1 M (or 1 molar) solution of NaCl contains one mole of sodium chloride for every liter of solution.Molality is another concentration measurement. It is the number of moles of solute per unit mass of the solvent. In SI units, the unit of molality is mol/kg. Some texts use the unit 'molal', but the official unit is mol/kg.For aqueous solutions (solutions where the solvent is water) around room temperature, the difference between molarity and molality is very slight. One kilogram of water at room temperature is very close to one liter.The key points to remember:M - Molarity - moles per volume of solution - unit: mol/Lm - molality - moles per kilogram of solvent - unit: mol/kgRelated Posts The key difference between a 1.0 molar solution and a 1 molal solution is that a 1.0 molar solution has one mole of solute dissolved in the solution whereas a 1 molal solution has one mole of solutes dissolved in one kilogram of solution. Long ago, Avogadro hypothesized that there is a specific number that represents the number of atoms or molecules in one mole of a substance. Thus, one mole of each element contains an equal number of atoms, irrespective of the atomic weight of that element. As a result, the concepts of molarity and molality were also developed to describe concentrations of a solute in a solution. While molality is the measure of a number of moles of the solute in a litre of solution, molality is the number of moles in 1 kg of the solution. Hence, it is easy to find out the difference between a 1.0 molar solution and a 1 molal solution. CONTENTS 1. Overview and Key Difference 2. What is a 1.0 Molar Solution 3. What is a 1 Molal Solution 4. Side by Side Comparison - a 1.0 Molar Solution vs a 1 Molal Solution in Tabular Form 5. Summary What is a 1.0 Molar Solution? A 1.0 molar solution is a solution that contains one mole of a solute dissolved in a litre of solution. Furthermore, this is a term of concentration, and we call it the "molarity" of the solution. Figure 01: Different Solutions have different Molarities and Molalities The symbol for this term is "M", the unit of measurement is mol/L. For example, an aqueous 1.0 molar solution of NaCl (sodium chloride) means a solution of sodium chloride containing one mole of NaCl dissolved in a litre of water. What is a 1 Molal Solution? A 1 molal solution is a solution that contains one mole of a solute dissolved in a kilogram of a solution. Hence, the unit of measurement is mol/kg. Figure 02: A 1 Molal Solution of Aqueous Sodium Chloride Solution contains one mole of NaCl in one kilogram of Water. Moreover, this is also a term of concentration that we name as the "molality" of the solution. We can denote by "m". For example, a 1 molal solution of sodium chloride means an aqueous solution of NaCl containing one mole NaCl dissolved in a kilogram of water. What is the Difference Between a 1.0 Molar Solution and a 1 Molal Solution? A 1.0 molar solution is a solution that contains one mole of a solute dissolved in a litre of solution whereas A 1 molal solution is a solution that contains one mole of a solute dissolved in a kilogram of a solution. Therefore, this is the key difference between a 1.0 molar and a 1 molal solution. Furthermore, the unit of measurement of 1.0 molar solution is mol/L while that of 1 molal solution is mol/kg. However, if water is the solvent, there is not much of a difference between a 1.0 molar solution and a 1 molal solution. It is because, at room temperature, the density of water is taken to be 1 kg/L. Therefore, this results in molarity and molality of solutions to be equal. Molarity and molality are very important terms in chemistry that we use to measure the concentration of a solution. The key difference between a 1.0 molar solution and a 1 molal solution is that a 1.0 molar solution has one mole of solute dissolved in one kilogram of solution. Reference: 1. "Molar Concentration." Wikipedia, Wikimedia Foundation, 17 Oct. 2018. Available here 2. Mott, Valerie. "Introduction to Chemistry." Lumen. Available here Image Courtesy: 1. "chemistry-liquid-glass-research-laboratory-medicine" (CC0) via pixnio 2. "SaltInWaterSolutionLiquid" By Chris 73 / Wikimedia Commons, (CC BY-SA 3.0) via Commons Wikimedia Molarity and molality are both used to express the concentration of a solution. The amount of solute is both expressed in moles. Their major difference is for Molarity, it is expressed as the moles per Liter's of solution while for Molality its moles per Kilogram's of solvent. Molality (M) = moles of solute / Liter's of solution Molality (m) = moles of solute / Kilogram's of solvent Take not of the use of symbols (capital letter M for molarity and small letter m for molality) To avoid confusion, always remember that: Volume of solution = volume of solute + Volume of solvent OR Kilogram of Solution = Kilogram of solute + Kilogram of solvent Tip: you can use the density of the solution in working with this kind of problem. Approved by eNotes Editorial Team Start your 48-hour free trial and unlock all the summaries, Q&A, and analyses you need to get better grades now. 30,000+ book summaries 20% study tools discount Ad-free content PDF downloads 300,000+ answers 5-star customer support Start your 48-Hour Free Trial Already a member? Log in here. Are you a teacher? Sign up now eNotes.com will help you with any book or any question. Our summaries and analyses are written by experts, and your questions are answered by real teachers. Join eNotes ©2021 eNotes.com, Inc. All Rights Reserved Something went wrong. Wait a moment and try again. Both molarity and molality are measures of a chemical solution's concentration. The primary difference between the two comes down to mass versus volume.The molality describes the moles of a solute in relation to the mass of a solvent, while the molarity is concerned with the moles of a solute in relation to the volume of a solution.Read on to learn more about molarity and molality, including their definitions, equations, and a comparison of the two terms.Molality definitionMolality (m), or molal concentration, is the amount of a substance dissolved in a certain mass of solvent. It is defined as the moles of a solute per kilograms of a solvent. [Updated May 4, 2020].Molality formula and unitsThe units of molality are m or mol/kg. Molality equationm = moles solute / kilograms solventMolarity definitionMolarity (M) is the amount of a substance in a certain volume of solution. Molarity is defined as the moles of a solute per liters of a solution. Molarity is also known as the molar concentration of a solution. Molarity formula and unitsThe units of molarity are M or mol/L. A 1 M solution is said to be "one molar." Molarity equationM = moles solute / liters solutionMolarity vs molalityAn important distinction between molality and molarity is the difference between a solution and a solvent.Molarity is the ratio of the moles of a solute to the total liters of a solution. The solution includes both the solute and the solvent.Molality, on the other hand, is the ratio of the moles of a solute to the kilograms of a solvent. Note that the mass used in the denominator is that of only the solvent, not the solute and the solvent. Molality (M) Molality (m) Measure of Concentration Concentration Definition The moles of a solute per liters of a solution The moles of a solute per kilograms of a solvent Units M m Equation M = moles solute / liters solution m = moles solute / kg solvent Ratio of moles to: Volume (in liters) Mass (in kilograms) Molarity calculatorFind a handy calculator for determining the molarity of a solution here. Molality calculatorA calculator for molality can be found here. This article was updated May 4, 2020 to clarify the definition of molality. Molarity vs. Molality: The difference between Molality and Molarity Send To Email Sharing printing Molality vs. Molarity: These two words sound similar but they are not synonyms, even though both of them are used for representing solution concentration. By definition, molarity is the number of moles of solute dissolved per liter of solution. We use capital letter "M" to represent molarity and its formula is M= (# mol SOLUTE)/ (Liters of SOLUTION). Molality is then the number of moles of solute per kilogram of the SOLVENT, NOT solution! We use lower case letter "m" to represent molality and its formula can be represented as: m= (# mole SOLUTE) / (Kilograms of SOLVENT). Most of the time scientists use either molarity or molality to represent solution concentration, but MOLALITY is preferred when the temperature of the solution varies. That is because MOLALITY does not depend on temperature, (Neither number of moles of solute nor mass of solvent will be affected by changes of temperature.) while MOLARITY changes as temperature changes. (Volume of solution in the formula changes as temperature changes, and that is why.) Subject : Science Topic : Chemistry Posted By : Admin

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