**IQRA NATIONAL UNIVERSITY**

**DEPARTMENT OF ALLIED HEALTH SCIENCES**

**Final-Term Examination (summer 2020)**

**Course Title: Basic Lab Calculation (MLT 1st) Instructor: Mr Adnan Ahmad**

**Max Marks: 50**

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1. How to prepare solution by using parts and percent concentration?

Answer

What is concentration.

The concentration of a solution expresses the amount of solute present in a given amount of solution. The terms concentrated and dilute are just relative expressions. A concentrated solution has more solute in it than a dilute solution; however, this does not give any indication of the exact amount of solute present. Therefore, we need more exact, quantitative methods of expressing concentration.

Concentration Units The following are the six methods to calculate the concentration of a solution: 1. Percent by Mass

2. Percent by Volume

3. Molarity or Molar Concentration (M)

4. Molality or Molal Concentration (m)

5. Mole Fraction (X)

6. Normality

• Percent by Mass (weight)

Percent concentration (by mass), or % m/m, is the mass of solute divided by the mass of solution, all multiplied by 100. Therefore, percent by mass can be expressed as: 𝑝𝑒𝑟𝑐𝑒𝑛𝑡 𝑏𝑦 𝑚𝑎𝑠𝑠 = 𝑚𝑎𝑠𝑠 𝑜𝑓 𝑠𝑜𝑙𝑢𝑡𝑒÷ 𝑚𝑎𝑠𝑠 𝑜𝑓 𝑠𝑜𝑙𝑢𝑡𝑖𝑜𝑛 × 100

or 𝑝𝑒𝑟𝑐𝑒𝑛𝑡 𝑏𝑦 𝑚𝑎𝑠𝑠 = 𝑚𝑎𝑠𝑠 𝑜𝑓 𝑠𝑜𝑙𝑢𝑡𝑒÷ 𝑚𝑎𝑠𝑠 𝑜𝑓 𝑠𝑜𝑙𝑢𝑡𝑒 +𝑚𝑎𝑠𝑠 𝑜𝑓 𝑠𝑜𝑙𝑣𝑒𝑛𝑡 × 100

• Percent by Volume

For liquid solutions, % v/v is used to express their concentrations. Percent concentration by volume is defined as the volume of the solute per 100 parts by volume of solution. Therefore, percent by volume can be expressed as: 𝑝𝑒𝑟𝑐𝑒𝑛𝑡 𝑏𝑦 𝑣𝑜𝑙𝑢𝑚𝑒 = 𝑣𝑜𝑙𝑢𝑚𝑒 𝑜𝑓 𝑠𝑜𝑙𝑢𝑡𝑒 𝑣𝑜𝑙𝑢𝑚𝑒 𝑜𝑓 𝑠𝑜𝑙𝑢𝑡𝑖𝑜𝑛 × 100

• Molarity or Molar Concentration (M)

Molarity refers to the number of moles of solute per liter of solution: 𝑴 = 𝒎𝒐𝒍𝒆𝒔 𝒍𝒊𝒕𝒆𝒓 𝒔𝒐𝒍𝒖𝒕𝒊𝒐𝒏 Since chemists want to know how molecules interact, they prefer to express concentration in definite numbers of molecules.

• Molality or Molal Concentration (m)

The molality, m, of a concentration of a solution is the number of moles in exactly 1 kilogram of solvent. Molality may be calculated by dividing the moles of solute in a solution by the mass of the solvent in kilograms. 𝑴𝒐𝒍𝒂𝒍𝒊𝒕𝒚 = 𝒎𝒐𝒍𝒆𝒔 𝒐𝒇 𝒔𝒐𝒍𝒖𝒕𝒆 𝒌𝒊𝒍𝒐𝒈𝒓𝒂𝒎𝒔 𝒐𝒇 𝒔𝒐𝒍𝒗𝒆𝒏𝒕

• Mole Fraction (X)

The mole fraction, (X), of a component in a solution is equal to the number of moles of that component divided by the total number of moles of all components present. It represents the ratio of the components in solution. 𝑀𝑜𝑙𝑒 𝑓𝑟𝑎𝑐𝑡𝑖𝑜𝑛 𝑜𝑓 𝐴 = 𝑋𝐴 = 𝑚𝑜𝑙𝑒𝑠 𝐴 𝑚𝑜𝑙𝑒𝑠÷ 𝐴 + 𝑚𝑜𝑙𝑒𝑠 𝐵 + 𝑚𝑜𝑙𝑒𝑠 𝐶 +

• Normality Normality

Normality Normality \could be defined as the number of gram equivalents of a solute present per liter of the solution at any given temperature and it is expressed as N In general, 𝑁𝐴 = #eq A #L soln The Normality of the solution can also be expressed in terms of mass and equivalent mass, 𝑁𝑜𝑟𝑚𝑎𝑙𝑖𝑡𝑦 = 𝑚𝑎𝑠𝑠 𝑜𝑓 𝑠𝑜𝑙𝑢𝑡𝑒 𝑒𝑞𝑢𝑖𝑣𝑎𝑙𝑒𝑛𝑡 𝑚𝑎𝑠𝑠 𝑜𝑓 𝑡ℎ𝑒 𝑠𝑜𝑙𝑢𝑡𝑒 𝐸 ×𝑣𝑜𝑙𝑢𝑚𝑒 𝑜𝑓 𝑠𝑜𝑙𝑢𝑡𝑖𝑜𝑛 𝑖𝑛 𝑙𝑖𝑡𝑒𝑟𝑠 (𝑉) In terms of weight, normality of the substance can be expressed as, 𝑁𝑜𝑟𝑚𝑎𝑙𝑖𝑡𝑦 = 𝑊𝑔 𝐸 𝑔 𝑒𝑞𝑢𝑖𝑣 ×𝑉(𝑙𝑖𝑡𝑒𝑟) = 𝑊 𝑒𝑞𝑢𝑖𝑣/𝐿 𝑊×𝑉

1. Define basic unit, derived units, suspension, ionic solution and super saturated solution.

Basic unit:

Those units which can not be resolved into more fundamental units and cannot be derived from one another

Example:

Candela,kilogram, Kelvin,ampere,mole

Derived unit:

Those units which can be derived from from tha basic units

Examples:

Newton,joule,watt,pascal,coulomb

Suspension:

suspension is a heterogeneous mixture that contains solid particles sufficiently large for sedimentation. The particles may be visible to the naked eye, usually must be larger than one micrometer, and will eventually settle, although the mixture is only classified as a suspension when and while the particles have not settled out.

Ionic solution

The which solution containing ions. Ionic solutions are formed by dissolving ionic compounds in a solvent (typically water).

Example

Common salt (sodium chloride, NaCl)

Super saturated solution

A solution which can dissolved further solute at the higher temperature,

1. Write a note on dilution ratio and concentration of dilution with example.

Dilution:

the dilution ratio is the ratio of solute to solvent. It is often used for simple dilutions, one in which a unit volume of a liquid material of interest is combined with an appropriate volume of a solvent liquid to achieve the desired concentration. The diluted material must be thoroughly mixed to achieve the true dilution. For example, in a 1:5 dilution, with a 1:5 dilution ratio, entails combining 1 unit volume of solute (the material to be diluted) with 5 unit volumes of the solvent to give 6 total units of total volume.

This is often confused with "dilution factor" which is an expression which describes the ratio of the aliquot volume to the final volume. Dilution factor is a notation often used in commercial

assays. For example, in a 1:5 dilution, with a 1:5 dilution factor, (verbalize as "1 to 5" dilution) entails combining 1 unit volume of solute (the material to be diluted) with (approximately) 4 unit volumes of the solvent to give 5 units of total volume. Note that some solutions and mixtures take up slightly less volume than their components.

The dilution factor can be expressed using exponents: 1:5 would be 5e−1 (5−1 i.e. one-fifth:one); 1:100 would be 10e−2 (10−2 i.e. one hundredth:one), and so on.

Concentration of dilution

Concentration is the removal of solvent, which increases the concentration of the solute in the solution. (Do not confuse the two uses of the word concentration here!)

In both dilution and concentration, the amount of solute stays the same. This gives us a way to calculate what the new solution volume must be for the desired concentration of solute. From the definition of molarity,

Example:

75 mL of a 1.6 M aqueous solution of LiCl is diluted with water to a final volume of 1.0 L. What is the final concentration of the diluted solution?

M1 v1 =M2 V2

(1.6 M)(175 mL) = M2(1000 mL)

M2 = 0.28 M

1. How to calculate serial dilutions?

Answer

A serial dilution is any dilution in which the concentration decreases by the same factor in each successive step.

In serial dilutions, you multiply the dilution factors for each step.

The dilution factor or the dilution is the initial volume divided by the final volume.

Example

if you add a 1 mL sample to 9 mL of diluent to get 10 mL of solution, DF=ViVf = 1mL10mL=110

2)

What is the dilution factor if you add 0.2 mL of a stock solution to 3.8 mL of diluent?

V

f

= 0.2 mL + 3.8 mL = 4.0 mL

D

F

=

V

i

V

f

=

0.2

mL

4.0

mL

=

1

20

. This is a 1:20 dilution

5.Explain pH and pOH with scale and examples.

PH scale

PH, quantitative measure of the acidity or basicity of aqueous or other liquid solutions. The term, widely used in chemistry, biology, and agronomy, translates the values of the concentration of the hydrogen ion—which ordinarily ranges between about 1 and 10−14 gram-equivalents per litre—into numbers between 0 and 14. In pure water, which is neutral (neither acidic nor alkaline), the concentration of the hydrogen ion is 10−7 gram-equivalents per litre, which corresponds to a pH of 7. A solution with a pH less than 7 is considered acidic; a solution with a pH greater than 7 is considered basic, or alkaline.

Example

The number of hydrogen ion in a solution

**POH scale**

pOH is a measure of hydroxide ion (OH-) concentration. It is used to express the alkalinity of a solution.

Aqueous solutions at 25 degrees Celcius with pOH less than 7 are alkaline, pOH greater than 7 are acidic and pOH equal to 7 are neutral.

As with the hydrogen-ion concentration, the concentration of the hydroxide ion can be expressed logarithmically by the pOH. The pOH of a solution is the negative logarithm of the hydroxide-ion concentration.

pOH = -log[OH – ]

The pH of a solution can be related to the pOH. Consider a solution with a pH = 4.0. The [H + ] of the solution would be 1.0 × 10 -4 M. Dividing K\_w by this yields a [OH − ] of 1.0 × 10 -10 M. Finally the pOH of the solution equals -log(1.0 × 10 -10 ) = 10. This example illustrates the following relationship.

pH + pOH = 14

The pOH scale is similar to the pH scale in that a pOH of 7 is indicative of a neutral solution. A basic solution has a pOH of less than 7, while an acidic solution has a pOH of greater than 7. The pOH is convenient to use when finding the hydroxide ion concentration from a solution with a known pH