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Basic lab calculations

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

There are two types of percent concentration: percent by mass and percent by volume.

PERCENT BY MASS

The mass of solution is separated in percent by mass (m / m), multiply by 100% by the total solution mass.

Percent by mass = mass of solute

Total mass of solution × 100 %

Example

What is the percent by mass of a solution that contains 26.5 g of glucose in 500 g of solution?

Solution

Percent by mass = mass of glucose

Total mass of solution × 100 % = 26.5g

500g × 100 % = 5.30 %

PERCENT BY VOLUME

Percent by volume (v/v) is the volume of solute divided by the entire volume of the solution, multiplied by 100 %.

Percent by volume = volume of solute

Total volume of solution × 100 %

Example

How would you prepare 250 mL of 70 % (v/v) of rubbing alcohol?

Solution

70 % = volume of rubbing alcohol

Total volume of solution × 100 % × 100 %

So Volume of rubbing alcohol = volume of solution × 70 %

100 % = 250 mL × 70 100 = 175 mL

You would add enough water to 175 mL of rubbing alcohol to make a total of 250 mL of solution.

Q.2 Define basic unit, derived units, suspension, ionic solution and super saturated solution.

Basic Units

The SI base units are the traditional units of measurement for what is now known as the International Quantity System, defined by an International Unit System (SI) for the seven basic quantities, which are specifically a basic group, from which all other SI units can be derived. The measurements and their physical quantities are the second for time, the meter for length measurement, the kilograms for mass measurement, the ampere for electric current measurement, the kelvin for temperature measurement, the mole for material quantity measurement, and the luminous power candelabra. The base units of the SI are an integral component of modern metrology and are also part of the cornerstone of modern science and technology.

Derived units

The units derived from the SI are calculation units derived from the seven baselines of the system international units (SI). They are either dimensional less or can be described as a result of one or more of the base units that can be exponentiated with a sufficient power.

The SI is assigned special names for 22 of these units (for example, hertz, the frequency measurement unit SI); the rest of them clearly represents their derivative, such as the square meter (m2), the area unit SI derived and the cubic meter of the kilogram (kg / m3) and the density unit derived SI (kg / m3 or kg da −3).

Suspension

A suspension is a heterogeneous combination in which solute particles not disintegrate, but instead suspended in the bulk of the solution, flowing freely in its medium. Inner (solid) phases instead distributed in the external phase (fluid), using such excipients or suspending agents, by means of mechanical turmoil.

Sand in water will be an example of a suspension. The partitions suspended are clear under a microscope and calm down unnoticed over time. The colloid varies from the solution in where the dissolved content (solute) is not considered to be a solid and liquid and fluid are homogenously combined. This defines a suspension from a colloid in which the suspend able particles are smaller and do not settle.

Ionic Solution

A solution that contains ions, as the term indicates, is an ionic solvent. Ionic solutions are produced in solvent (typically water) by dissolving ionic compounds. The common salt (sodium chlorides and NaCl) in water is an example of ionic solution. Dissolved in water, Ionic compounds dissociate into cations and anions. The presence of these ions is why we call it an ionic solution.

Super Saturated solution

Super saturation happens in a chemical solution when the solute concentration reaches the degree of solubility defined by the value equilibrium. The concept is most widely used for a solid solution in a liquid. A supersaturated solution can be metastable stabilized by causing the excess liquid to detach from the solution. The word may also be used for a gas mixture.

Q.3 Write a note on dilution ratio and concentration of dilution with example.

Dilution ratio

The liquid to solvent ratio is the dilution ratio. This is also used for basic dilutions, in which a unit volume of a liquid substance with an acceptable amount of solvent content is mixed to reach the desired quantity. To obtain real dilution, the dissolved content must be thoroughly combined. The 1:5 dilution ratio, for example, includes the combination of 1 solute volume unit (the diluted material) and 5 solvent unit volumes to create a total of 6 solvent volumes units.

This is often mistaken for the word 'dilution factor' which defines the ratio between the aliquot volume and the last volume. A notation used in commercial assays is the dilution factor. For example, 1:5 dilution with a dilution factor of 1:5 (note "1 to 5" dilution) means that 1 unit volume of solution (material to be diluted) is combined with 4 solvent units' volumes (approximately) to a total of 5 units.

Concentration of dilution

Dilution is the incorporation of solvent, which lowers the solution concentration. Concentration is the solvent elimination, which increases the solution concentration. The sum of solvent remains the same in both dilution and concentration. This helps one to measure the amount of the current solution with the ideal solute concentration. From the molarity description,

Molarity = solute moles / solution liters

For the number of solute moles we can solve:

Solute moles = (molarity) (solution liters)

M to denote molarity, and V to denote volume is an easier way to write this. This is the equation.

Solute moles = MV Moles

As this number does not change before and after concentration transition, the product MV must be the same before and after a shift of concentration. We have numbers that indicate the original and final conditions

M1V1 = M2V2 M1V1

Like the equation of dilution. Volumes in the same units must be expressed. Note that only the original and final conditions and not the sum of the shift are stated in this equation. Subtraction defines the quantity of transition.

The elimination of solvents is necessary to concentrate solutions. This is generally achieved by evaporation or heating, given the heating heat does not affect the solution. In these cases, the dilution equation is still used.

Q.4 How to calculate serial dilutions?

Most procedures in the laboratory require dilution. The definition of dilutions is crucial to understand, since they are a functional method for all clinical laboratory areas. These dilutions must be taken into account since they make a quantitative difference.

Serial dilution is any dilution in which each subsequent step lowers the concentration by the same amount. Multiplicative series dilutions.

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.

DF = ViVf

For example, if you add a 1 mL sample to 9 mL of diluent to get 10 mL of solution,

DF=ViVf = 1mL 10mL=110. This is a 1:10 dilution.

Example 1

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

Vf = 0.2 mL + 3.8 mL = 4.0 mL

DF =ViVf = 0.2 mL 4.0 mL = 120. This is a 1:20 dilution.

Q.5 Explain pH and pOH with scale and examples.

PH Scale

Two extremes defining a chemical property are acidic and basic. Mixing acids and bases may remove their drastic effects or neutralize them. A non-acidic or basic material is stable.

The pH scale tests whether a substance is acidic or basic. The pH scale is between 0 and 14. A neutral pH of 7. The pH is acidic less than 7. A pH of more than 7 is fundamental.

The pH is logarithmic, such that any pH value under 7 is 10 times as acidic as the next value. For instance, pH 4 is 10 times acidic compared to pH 5, 100 times (10 times 10) is acidic compared to pH 6. The same happens to pH values above 7, each ten times more alkaline (another way of saying fundamental) than the next lower value in total. For e.g., pH 10 is 10-time more alkaline than pH 9 and 10-time (10-time).

Example: If an acid has an H+ concentration of 0.0001 M, find the pH.

Solution:

First convert the number to exponential notation, find the log, then solve the pH equation.

H+ = 0.0001M = 10-4; log of 10-4 = -4;

PH = - log [H+] = - log (10-4) = - (-4) = +4 = pH

The purpose of the negative sign in the log definition is to give a positive pH value.

POH scale

As the neutral solution is measured by a pOH of 7, the pOH scale is equivalent to the pH scale. With a pOH below 7 and an acidic one with a POH above 7, there is a clear solution. POH is conveniently used where the concentration of hydroxide ions from a solution of known pH is measured.

Find the hydroxide concentration in a 4.42 pH solution.

pH = 4.42

pH + pOH = 14

[OH-] = ? M

First, the pOH is calculated, followed by the [OH −].

{pOH} =14 {pH} =14-4.42=9.58

{pOH}}=10 {-9.58} =2.6 x 10^ {-10}

The hydroxide-ion concentrate is less than 1 = 10 -7 M and the resulting pH is an acidic solution. The answer has two important figures since there are two decimal places in the specified pH.