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

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

**PERCENT BY MASS.**

Percent by mass (m/m) is the mass of solute divided by the total mass of the solution, multiplied by 100 %.

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 % = 26.5 g 500g × 100 % = 5.30 %

**PERCENT BY VOLUME.**

Percent by volume (v/v) is the volume of solute divided by the total 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.

**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

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

**Ans. Basic Unit:**

A quantity in the general sense is a property ascribed to phenomena, bodies, or substances that can be quantified for, or assigned to, a particular phenomenon, body, or substance. Examples are mass and electric charge. A quantity in the particular sense is a quantifiable or assignable property ascribed to a particular phenomenon, body, or substance. Examples are the mass of the moon and the electric charge of the proton. A physical quantity is a quantity that can be used in the mathematical equations of science and technology. A unit is a particular physical quantity, defined and adopted by convention, with which other particular quantities of the same kind are compared to express their value. All physical quantities can be expressed in terms of seven base units.

Lenght, mass, time , amount of substance, luminous intensity, electric current ,

temperature .

**Derived Units:** Other quantities, called derived quantities,are defined in terms of the seven basequantities via a system of quantity equations.The SI derived units for these derivedquantities are obtained from these equations and the seven SI base units. Examples of such

SI derived units are given in Table 2, where it should be noted that the symbol 1 for quantities of dimension 1 such as mass fraction is generally omitted.

**Examples:** Area, volume, speed, velocity , acceleration etc.

**Suspension:**

A suspension is cloudy and heterogeneous. The particles are larger than 10,000

Angstroms which allows them to be filtered. If a suspension is allowed to stand the particles will separate out.

**Ionic solution:**

Any substance which, when dissolved in water, separates into pairs of particles (ions) of opposite charge. For example, sodium chloride (common salt) when dissolved in water forms positive ions of sodium and negative ions of chloride.

**Super saturated solution:**

A supersaturated solution is a more solute solution than can be dissolved by the solvent. If you haven't learned what a solute / solvent

is, the material that is dissolved in the solution, such as salts but not restricted to

salts, is a solution. The most popular example is sodium acetate which is supersaturated.

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

**Ans. Dilution Ratio:** The dilution ratio is the ratio of solute tosolvent. It is often used for simpledilutions, one in which a unit volume of aliquid material of interest is combined with anappropriate volume of a solvent liquid toachieve the desired concentration. Thediluted material must be thoroughly mixed toachieve the true dilution.

**For example,**

in a1:5 dilution, with a 1:5 dilution ratio, entailscombining 1 unit volume of solute (thematerial to be diluted) with 5 unit volumes ofthe solvent to give 6 total units of totalvolume.

**Concentration Of dilution:**

Dilutions: Explanations and Examples of Common Methods

There are many ways of expressing concentrations and dilution. The following is a

brief explanation of some ways of calculating dilutions that are common in biological science and often used at Quansys

Biosciences.

Using C1V1 = C2V2 To make a fixed amount of a dilute solution from a stock solution, you can use the formula: C1V1 = C2V2 where:

V1 = Volume of stock solution needed to make the new solution

C1 = Concentration of stock solution

V2 = Final volume of new solution

C2 = Final concentration of new solution

**Example:** Make 5 mL of a 0.25 M solution

from a 1 M solution

Formula: C1V1 = C2V2

Plug values in: (V1)(1 M) = (5 mL)(0.25 M)

Rearrange: V1 = [(5 mL)(0.25 M)] / (1 M)V1 =

1.25 mL

Answer: Place 1.25 mL of the 1 M solution

into V1-V2 = 5 mL – 1.25 mL = 3.75 mL of

diluent.

**4.How to calculate serial dilutions?**

**Ans.** 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.

**Calculation Of Serial Dilution.**

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

DF=Vi/Vf

If you add a 1 mL sample to 9 mL of diluent to get 10 mL of solution,

DF=Vi/Vf = 1mL/10mL=1/10. This is a 1:10

**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=Vi/Vf = 0.2mL/4.0mL=1/20. This is a 1:20

dilution.

**Solution.**

Remember that serial dilutions are always made by taking a set quantity of the initial dilution and adding it successively to tubes with the same volume. So you multiply each successive dilution by the dilution factor.

You would transfer 0.2 mL from Tube 1 to 3.8 mL of diluent in Tube 2 and mix. Then transfer 0.2 mL from Tube 2 to 3.8 mL of diluent in Tube 3 and mix. Repeat the process until you have four tubes.

The dilution factor after four dilutions is DF=1/20×1/20×1/20×1/20=1/160000 = 1:160 000.If the concentration of the original stock solution was 100 µg/µL, the concentration in Tube 4 would be

100 µg/µL × 1/160000 = 6.25 × 10⁻⁴ µg/µL

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

**Ans. PH:** PH, quantitative measure of the acidity orbasicity of aqueous or other liquid solutions.The term, widely used in chemistry, biology,and agronomy, translates the values of theconcentration of the hydrogen ion—whichordinarily ranges between about 1 and10−14 gram-equivalents per litre—intonumbers between 0 and 14.

**POH:** The pOH of a solution is the negativelogarithm of the hydroxide-ion concentration.The pOH scale is similar to the pH scale inthat a pOH of 7 is indicative of a neutralsolution. A basic solution has a pOH of lessthan 7, while an acidic solution has a pOH ofgreater than 7.

**pH and pOH scale:**

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.

**Examples Of pH:**

What is the pOH of a solution that has a hydroxide ion concentration of 4.82 × 10-5 M ?

pOH = -log [4.82 × 10-5] = - {- 4.32} = 4.32

**Examples Of pOH:**

pOH = 14 – pH

While the approximation works well in many settings, there are exceptions for which the pKw value should be used instead.

**THE END**