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Basic and Derived Units

International System of Units

Definitions:

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 base quantities via a system of quantity equations. The SI derived units for these derived quantities 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.

Question no 4

Calculation of serial dilution:

You multiply the original concentration by the dilution factors for each dilution.

Explanation:

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.

$DF=Vi/Vf$

For example, 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 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=Vi/Vf = 0.2mL/4.0mL=1/20. This is a 1:20 dilution.

Example 2

If you did the above dilution four times, what would be the final dilution factor?

Solution 2

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

Question no 5 PH:

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.

POH:

The pOH of a solution is the negative logarithm of the hydroxide-ion concentration. ... 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.

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.

Question no 3

Dilution Ratio:

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.

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.