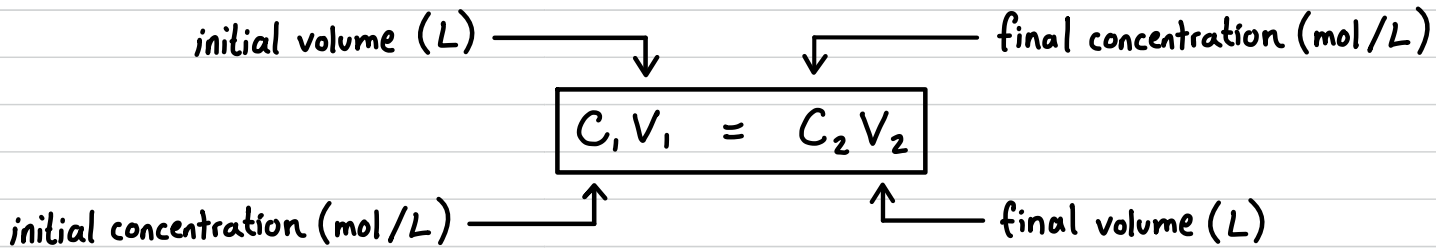
Diluting Solutions

Dilution : to make a solution less concentrated by adding more solvent

~ the number of molecules, or moles, of solute that is present remains the same before and after dilution ~



Example problems

(i) ~ calculating initial volume ~

For an experiment, you must make 2.0L of 0.10 mol/L sulfuric acid. The acid is usually sold as an 18 mol/L concentrated solution. How much of the concentrated solution should be used to make a new solution?

(ii) ~ calculating final concentration ~

A solution is prepared by adding 600mL of distilled water to 100 mL of 0.15 mol/L ammonium nitrate. Calculate the molar concentration of the diluted solution.

(iii) ~ calculating required volume for dilution ~

How much water would I need to add to 500 mL of a 2.4 M KCl solution to make a 1.0 M solution?

Creating Standard Solutions

Standard solution: solution containing precisely known concentration of a substance

uses : determine unknown concentrations of other substances via titration
as tested concentrations in scientific investigations

Preparing molar standard solutions ($mol\,L^{-1}$) using solid solute:

Part A: Calculate amount of solute needed

1 - Determine desired **concentration** and **volume** ex: **500 mL** of **0.5 M** NaCl

2 - Calculate **mass of solute** needed using $n = cv$ ex:

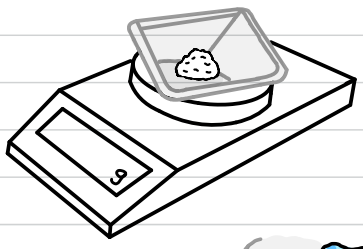


fig. 1

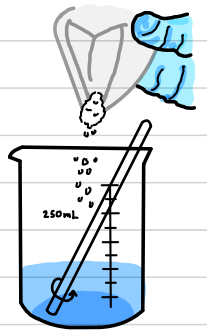


fig. 2

Part B: preparing solution

1 - weigh ___ g of NaCl on a weighing boat using electronic scale (±0.01g) - fig. 1

2 - add ~ 100mL of distilled water to a 250 mL beaker

3 - transfer ____g of NaCl to beaker and stirr with rod until dissolved. - fig. 2
Add more water if necessary

4 - transfer solution into ____mL volumetric flask (±0.5mL) using a funnel. Ensure all of solute is transferred by rinsing beaker with squirt bottle of water - fig. 3

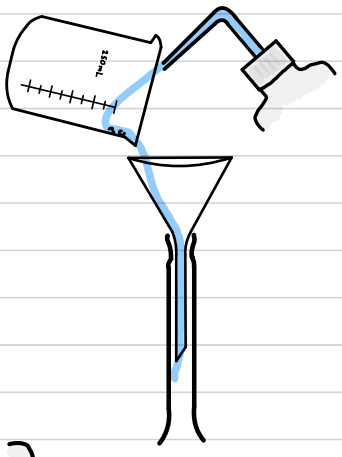


fig. 3

5 - Add distilled water to flask until ~1cm below mark on neck. - fig. 4

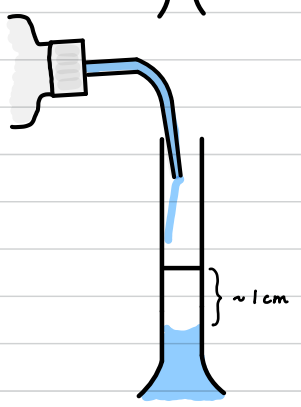


fig. 4

6 - Insert stopper and while holding it down with thumb, shake and invert flask multiple times

7 - While looking at mark at eye level, carefully add water using squirt bottle until bottom of miniscus reaches mark - fig. 5

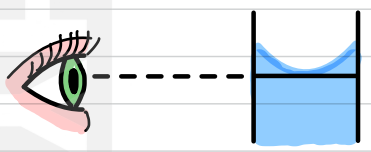


fig. 5

Preparing molar standard solutions ($mol\,L^{-1}$) by dilution:

Part A: Calculate amount of solute needed

1 - Determine desired **concentration** and **volume** ex: **100 mL** of **0.1 M** NaCl

2 - Determine **concentration of initial** standard solution ex: **0.5M** NaCl (aq)

3 - Calculate **volume of solvent** needed for dilution ex: $V_1 =$

Part B: preparing solution

1 - measure ____mL of **0.5M** NaCl solution using 50mL graduated cylinder (±0.5mL)

2 - transfer solution into ____mL volumetric flask (±0.1mL) using a funnel - fig. 6

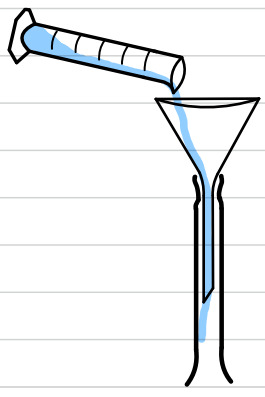


fig. 6

3 - Add distilled water to flask until ~1cm below mark on neck. - fig. 4

4 - Insert stopper and while holding it down with thumb, shake and invert flask multiple times

5 - While looking at mark at eye level, carefully add water using squirt bottle until bottom of miniscus reaches mark - fig. 5

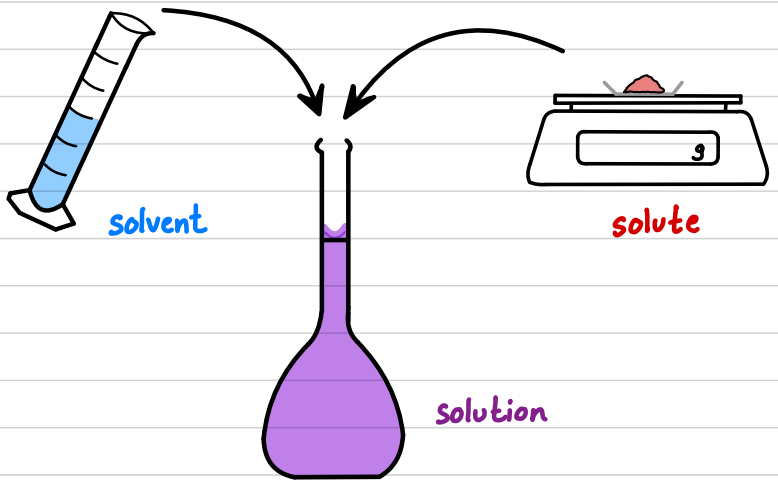
Creating Percentage Solutions

Preparing % mass/volume solutions (% m/v):

↳ these solutions are made using solid solute dissolved in liquid solvents

$$\%\ m/v = \frac{\text{mass of solute (g)}}{\text{volume of solution (mL)}} \times 100$$

ex: You want to prepare 50 mL of 20 % sucrose solution
How much solute and solvent do you need?

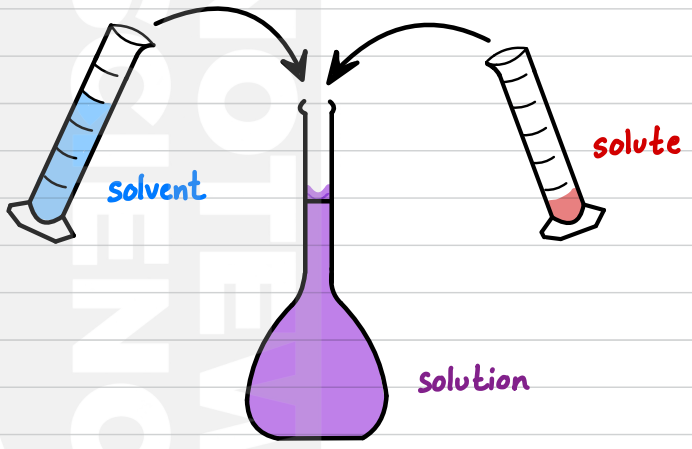


Preparing % volume/volume solutions (% v/v):

↳ these solutions are made using liquid solute dissolved in liquid solvents

$$\%\ v/v = \frac{\text{volume of solute (mL)}}{(\text{volume of solute (mL)} + \text{volume of solvent (mL)})} \times 100$$

ex: You want to prepare 100 mL of 5% HCl solution
How much solute and solvent do you need?



Preparing % mass/mass mixtures (% m/m):

↳ these mixtures are often made using different solids

$$\%\ m/m = \frac{\text{mass of solute (g)}}{(\text{mass of solute (g)} + \text{mass of 'solvent' (g)})} \times 100$$

ex: You want to prepare 150g of 1% NaCl in sand mixture
How much NaCl and sand do you need?