



Course: MBIO 240

Laboratory Skills



Preparation and dilution of Molar solutions



Aim of the Experiment:

To understand how to prepare molar solutions and make dilutions, which is necessary knowledge needed for other experiment



Introduction:

- A simple solution is basically two substances that are mixed together → forming a homogeneous mixture of two or more substances.
- **Solute:** the substance/s that are dissolved.
- **Solvent:** the substance that dissolves the solute.
- The **concentration** of a solution → is quantity of a substance dissolved in per unit quantity of another substance.



Additional Key Concepts

➤ **Mole (mol):** The SI unit of amount of substance. One mole = 6.022×10^{23} particles (Avogadro's number).

➤ **Molecular Weight (M.W.):** The sum of the atomic weights of all atoms in a molecule, expressed in g/mol. It is required to convert grams into moles.

Periodic Table of the Elements

Group ↓	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
1	1 H Hydrogen																	2 He Helium
2	3 Li Lithium	4 Be Beryllium																10 Ne Neon
3	11 Na Sodium	12 Mg Magnesium																18 Ar Argon
4	19 K Potassium	20 Ca Calcium	21 Sc Scandium	22 Ti Titanium	23 V Vanadium	24 Cr Chromium	25 Mn Manganese	26 Fe Iron	27 Co Cobalt	28 Ni Nickel	29 Cu Copper	30 Zn Zinc	31 Ga Gallium	32 Ge Germanium	33 As Arsenic	34 Se Selenium	35 Br Bromine	36 Kr Krypton
5	37 Rb Rubidium	38 Sr Strontium	39 Y Yttrium	40 Zr Zirconium	41 Nb Niobium	42 Mo Molybdenum	43 Tc Technetium	44 Ru Ruthenium	45 Rh Rhodium	46 Pd Palladium	47 Ag Silver	48 Cd Cadmium	49 In Indium	50 Sn Tin	51 Sb Antimony	52 Te Tellurium	53 I Iodine	54 Xe Xenon
6	55 Cs Caesium	56 Ba Barium	57-71 Lanthanoids*	72 Hf Hafnium	73 Ta Tantalum	74 W Tungsten	75 Re Rhenium	76 Os Osmium	77 Ir Iridium	78 Pt Platinum	79 Au Gold	80 Hg Mercury	81 Tl Thallium	82 Pb Lead	83 Bi Bismuth	84 Po Polonium	85 At Astatine	86 Rn Radon
7	87 Fr Francium	88 Ra Radium	89-103 Actinoids**	104 Rf Rutherfordium	105 Db Dubnium	106 Sg Seaborgium	107 Bh Bohrium	108 Hs Hassium	109 Mt Meitnerium	110 Ds Darmstadtium	111 Rg Roentgenium	112 Cn Copernicium	113 Nh Nihonium	114 Fl Flerovium	115 Mc Moscovium	116 Lv Livermorium	117 Ts Tennessine	118 Og Oganesson
	57 La Lanthanum	58 Ce Cerium	59 Pr Praseodymium	60 Nd Neodymium	61 Pm Promethium	62 Sm Samarium	63 Eu Europium	64 Gd Gadolinium	65 Tb Terbium	66 Dy Dysprosium	67 Ho Holmium	68 Er Erbium	69 Tm Thulium	70 Yb Ytterbium	71 Lu Lutetium			
	89 Ac Actinium	90 Th Thorium	91 Pa Protactinium	92 U Uranium	93 Np Neptunium	94 Pu Plutonium	95 Am Americium	96 Cm Curium	97 Bk Berkelium	98 Cf Californium	99 Es Einsteinium	100 Fm Fermium	101 Md Mendelevium	102 No Nobelium	103 Lr Lawrencium			



Molarity

- **Molarity (M):** is the number of moles of solute in one liter of a solution → *no. of moles of solute ÷ volume of solution (in liters)*

$$\text{Molarity} = \frac{\text{Moles of solute (mole)}}{\text{Volume of solution in (L)}}$$



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*M → is expressed as **(mol/L)**



Example

Calculate grams of NaOH needed to prepare 250 mL of 0.5 M solution?

Step 1 →

$$\text{Molarity} = \frac{\text{Moles of solute (mole)}}{\text{Volume of solution in (L)}}$$

Step 2 →

(Rearrange to find moles)

$$\begin{aligned} \text{moles} &= M \times V \\ \Rightarrow 0.5 \text{ mol/L} \times 0.250 \text{ L} &= 0.125 \text{ mol} \end{aligned}$$



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(Convert moles to grams using MW)

$$\begin{aligned} \text{MW of NaOH} &= 40 \text{ g/mol} \\ \text{Grams} &= 0.125 \text{ mol} \times 40 \text{ g/mol} \end{aligned}$$



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Materials and Equipment

- Analytical Balance
- Volumetric pipet
- measuring cylinder
- Beaker
- class rod
- required chemical
- distilled waster



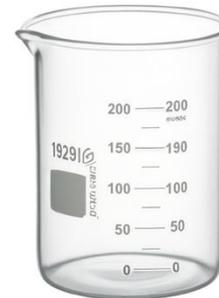
Analytical Balance



Volumetric pipet



Measuring cylinder



Beaker



Glass rod



Required chemical



Distilled water



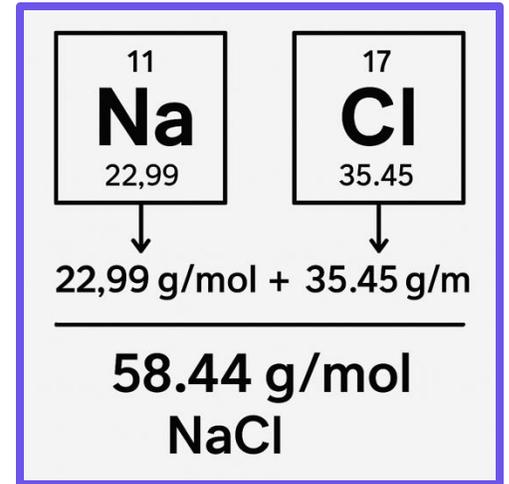
Procedure

To Prepare 100 ml of 2M NaCl solution:

Calculation:

$$\begin{aligned}\text{moles} &= M \times V = 2 \times 0.1 = 0.2 \text{ mol} \\ \text{grams} &= 0.2 \times 58.44 \text{ (MW of NaCl)} = 11.7 \text{ g}\end{aligned}$$

1. Keep a beaker in a balance and set zero the balance
2. Weight 11.7 g of NaCl, in the beaker and dissolve it in a little water (less than 100 ml)
3. The solid is dissolved the volume, then it is transferred to 100 ml volumetric flask.
4. Add required quantity of water to make up to a final volume of 100 ml. → **Final solution: 2 M NaCl (100 mL)**



References

- Cappuccino James, G. (2002). Microbiology: A Laboratory Manual, San Francisco: Benjamin Cummings.
- Lorrence, H Green, Emanuel Goldman. (2021). Practical Handbook of Microbiology. CRC Press. Pages – 975.
- John Grainger, Janet Hurst, Dariel Burdass. (2001). Basic Practical Microbiology. The Society for General Microbiology.