Lab Math
Quantitative expression of Concentrations
Molarity

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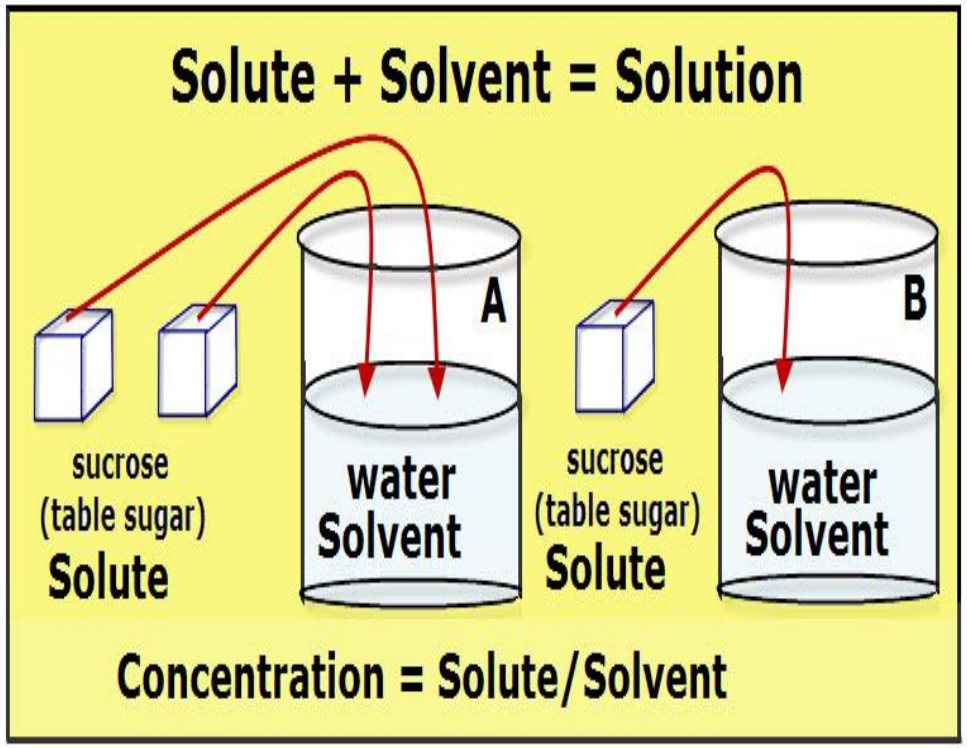
APHL-CDC

Solution: ***One phase*** homogeneous mixture

- **Solute**: Substance dissolved in another substance

- **Solvent**: Substance where the solute is being dissolved. Water is the most common used solvent (polar/hydrogen bonds)



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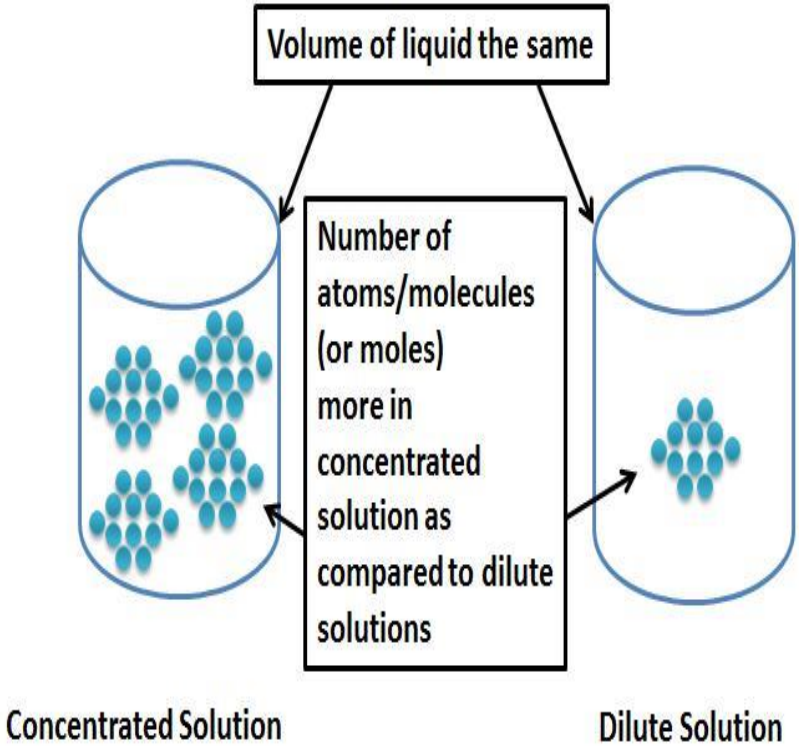

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Solubility: Ability of the Solute to dissolve in the solvent

Concentrantion: Amount of solute contained in a solution

- **Percentage**: Uses measurements of weight (mass) or Volume

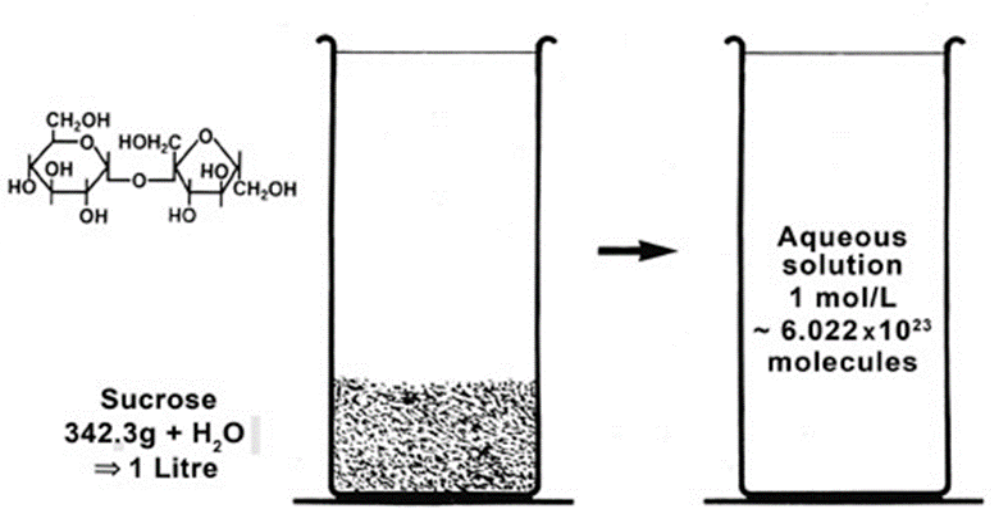
- **Mole:** Amount of a substance that contains the Avogadro constant (**6.02×10^{23}**) of an elementary entity (atoms, molecules, ions, electrons, etc). (Number of atoms in 12 grams of isotope ^{12}C).

Molecular mass (weight): Mass of 1 mole of a substance.

$H_20 = {}^{1}H_2{}^{16}0 = 18$ g/mole

$NaCl = {}^{23}Na + {}^{35}Cl = 58$ g/mole
(6.02×10^{23} molecules of NaCl = 58 g)

${}^{23}Na{}^{16}O{}^{1}H = 40$ g/mole
(6.02×10^{23} molecules of NaOH = 58 g)

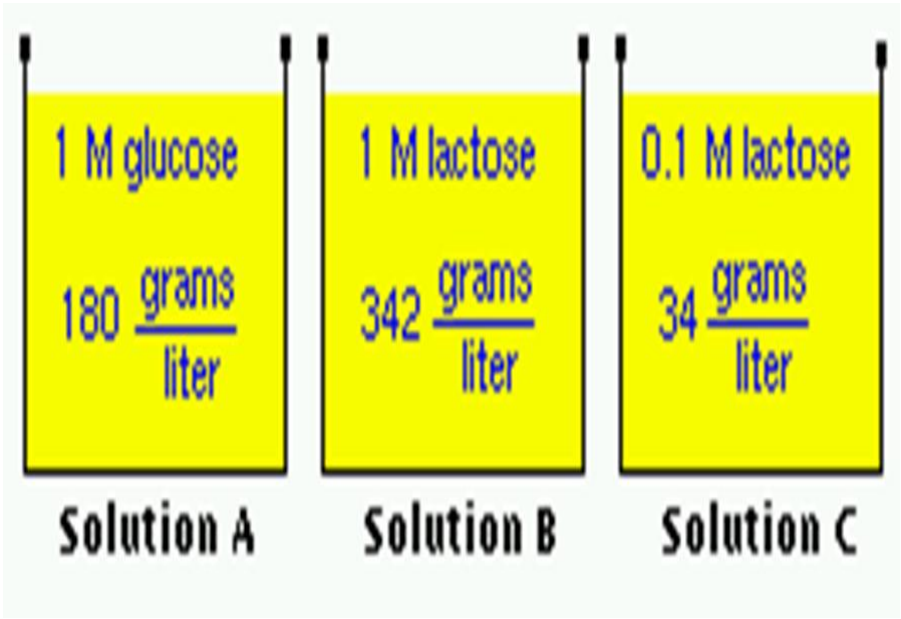


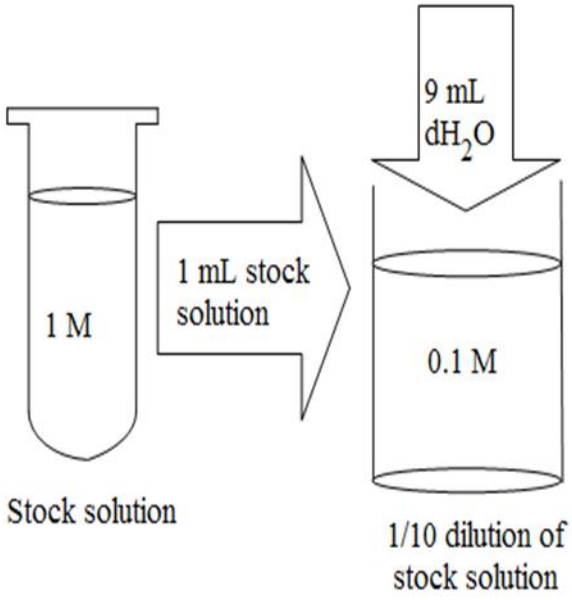
http://www.csicop.org/

Concentration of a solution:

Normality (N): Number of equivalents (number of electrons that a redox agent can accept or donate) of the dissolved substance per liter of solution. 1N = 1 Normal

Molarity (M): Number of moles of the dissolved substance per liter (litre) of solution.
1M = 1 Molar





http://www.vivo.colostate.edu/

www.austincc.edu

Molarity dilutions:

1M solution of **NaOH** ($^{23}Na^{16}O^{1}H$) = 40 g NaOH dissolved in 1 liter of H_2O = **1N**

1M solution of **$MgCl_2$** ($^{24.3}Mg^{++}\ ^{35.45}Cl^{-}_2$) = 95.2 g $MgCl_2$ dissolved in 1 liter of H_2O = **2N**

1mM (miliM) = 1:1000 dilution of 1M or **10^{-3}**

1µM (microM) = 1:1000 dilution of 1mM or 1:1,000,000 of 1M or **10^{-6}**

1nM (nanoM) = 1:1000 dilution of 1 µM or 1:1,000,000,000 of 1M or **10^{-9}**

1pM (picoM) = 1:1000 dilution of 1 nM or 1:1,000,000,000,000 of 1M or **10^{-12}**

What's the **µM** concentration of a 1:10000 dilution of a solution containing 87 g of NaCl per litter?

1M NaCl = 58 g/L => $\frac{?M}{87\ g/L} = \frac{1M}{58\ g/L} =$ 1.5M

1:10000 dilution of 1.5M = 0.00015 M x 1000 mM = 0.15 mM = 150 **µM**

Exercises:

1) How many grams of NaOH do you need to make 100 mL of a 0.5M solution?

1M = 40 g / L

0.5M = 20 g/L = 20 g/1000mL = 2 g/100 mL

If 1M = 40g / 1000mL then 0.5M = ? g / 100mL

$$\frac{40\ g}{1000\ mL} \times \frac{1}{1M} = \frac{?g}{100\ mL} \times \frac{1}{0.5M} = \frac{40\ g \times 100\ mL \times 0.5M}{1000\ mL \times 1M} = ?\ g = 2.0\ g$$

2) Calculate the Morality of a solution that contains 142.8 g of $MgCl_2$ in 750 mL of solution:

$$M = \frac{?\ mol\ MgCl_2}{L\ Sol'n} = \frac{142.8\ g\ MgCl_2}{0.75\ L} \times \frac{1\ mol\ MgCl_2}{95.2\ g} = 2M\ MgCl_2$$

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Cost-Effective and Scalable DNA Extraction Method from Dried Blood Spots.

Saavedra-Matiz CA, Isabelle JT, Biski CK, Duva SJ, Sweeney ML, Parker AL, Young AJ, Diantonio LL, Krein LM, Nichols MJ, Caggana M.

Source

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Abstract

BACKGROUND: Dried blood spot (DBS) samples have been widely used in newborn screening (NBS) for the early identification of disease to facilitate the presymptomatic treatment of congenital diseases in newborns. As molecular genetics knowledge and technology progresses, there is an increased demand on NBS programs for molecular testing and a need to establish reliable, low-cost methods to perform those analyses. Here we report a flexible, cost-efficient, high-throughput DNA extraction method from DBS adaptable to small- and large-scale screening settings.METHODS: Genomic DNA (g.DNA) was extracted from single 3-mm diameter DBS by the sequential use of red cell lysis, detergent-alkaline, and acid-neutralizing buffers routinely used in whole blood and plant tissue DNA extractions. We performed PCR amplification of several genomic regions using standard PCR conditions and detection methods (agarose gel, melting-curve analysis, TaqMan-based assays). Amplicons were confirmed by BigDye® Terminator cycle sequencing and compared with reference sequences.RESULTS: High-quality g.DNA was extracted from hundreds of DBS, as proven by mutation detection of several human genes on multiple platforms. Manual and automated extraction protocols were validated. Quantification of g.DNA by Oligreen® fluorescent nucleic acid stain demonstrated a normal population distribution closely corresponding with white blood cell counts detected in newborn populations.CONCLUSIONS: High-quality, amplifiable g.DNA is extractable from DBSs. Our method is adaptable, reliable, and scalable to low- and high-throughput NBS at low cost ($0.10/sample). This method is routinely used for molecular testing in the New York State NBS program.

Clin Chem 59:7 (2013) Mar 25. [Epub ahead of print]doi:1373/clinchem.2013.205864

Editorials

Newborn Screening by Sequence and the Road Ahead.

Sondheimer N.

Source

Department of Pediatrics, University of Pennsylvania, and Section of Biochemical Genetics, Children’s Hospital Philadelphia, Philadelphia, PA.

4.3 Reagents

4.3.1 Stock Solutions

4.3.1.1

10 M NaOH: (DNA_2.3)

6 g NaOH Pellets (Cat. #: CAS 1310-73-2, Mallinckrodt, KY)
QS to 15 mL with Milli-Q H_2O

4.3.1.3

1 M Tris-HCl (Trizma® hydrochloride): (DNA_2.6)

157.6 g Trizma® (Cat #: T5941, Sigma, MO)
QS to 1 L with Milli-Q H_2O

1) Explain why you need 6 g of NaOH in 15 mL of solution to have a 10 M stock solution of NaOH

2) Prepare 250 mL of 1M Tris-HCl

4.3.2 Working Solutions

4.3.2.1

Red Blood Cell Lysis Buffer (RBC-LB) pH 8.0: (DNA_2.2)

0.01M Tris-HCl	(Trizma®, cat #: T5941, Sigma, MO)
320 mM Sucrose	(Sucrose, cat #: S0389, Sigma, MO)
5 mM $MgCl_2$	(1M $MgCl_2$, cat #: M1028, Sigma, MO)
1% Triton X 100	(Triton X 100, cat #: T8787, Sigma, MO)

Preparation (1 liter):

1 M Trizma (157.6 g/L)	10.0 mL
Sucrose	109.54 g
1M $MgCl_2$	5.0 mL
Triton X 100	10.0 mL

4.3.2.2

Buffer A: (DNA_2.7)

100 mM NaOH
2% Tween 20

3) What the mM concentration of the Tris-HCl RBC-LB?

4) How much Sucrose would you need to make a 1M solution?