LAB 12: NOTES ON LABORATORY CALCULATIONS

[This section WILL BE EXAMINED. However, it is not a scheduled laboratory]

Goals

- To provide students with the knowledge and skills required to calculate dilutions, concentrations, molarity etc prior to entry into 3rd year wet labs

All biomedical scientific laboratory work requires a functional knowledge of terminology and concepts associated with the use and manipulation of volumes, concentrations, molarity and mass.

A frequent complaint of 3rd year BSc coordinators is the inability of students to cope with simple calculations needed to work out correct volumes/molarity etc in their laboratories. The following notes are designed to address some of these inadequacies at a basic level.

TERMINOLOGY

Volume	Mass	Molar	As log
L	Kg	M	1×10^{0}
ML (milli)	mg	mM	1×10^{-3}
µL (micro)	µg	µM	1×10^{-6}
nL (nano)	ng	nM	1×10^{-9}
pL (pico)	pg	pM	1×10^{-12}
fL (femto)	fg	fM	1×10^{-15}

i.e. 1 µL x 1000 = 1 mL; 1 pg = one millionth of 1 µg.

NOTE. 1 Molar = 1 mol/L; 15 mM = 15 mmol/L (0.015 mol/L)

CONVERSIONS

When converting from various units, it is often easiest to move up or down in units of 1000. For example:

1 pmol/mL = 1 nmol/L 5 mg/L = 5 µg/mL 1200 pM = 1.2 nM

2500 ng/L = 2.5 µg/L or 2.5 ng/mL

DILUTIONS

A 1:100 dilution of a substance requires you to take one part and add 99 of diluent to give a final volume 100 times of that originally taken.

Again, for mental calculations it is useful to work in multiples of one thousand to transfer between different units. For example:

To prepare 25 mL of EDTA solution by diluting a stock EDTA solution 1:100.

One hundredth of 25 ml is equivalent to 10 x one thousandth, i.e. 10 x 25 µL = 250 µL

Therefore, adding 250 µL of stock to 24.75 mL (25 mL - 250 µL) water gives a 1:100 dilution.

Similarly, a 1:250 dilution is the same as a four times a1:1000 dilution; 1:500 is twice that of a 1:1000 dilution.

MOLARITY

The molecular weight of salt is 40. Hence, a 1 Molar (1 M) salt solution is 40 g/L (which is the same as 40 mg/mL). To convert mass data (such as g/L or mg/mL) to molarity just divide by the amount needed to give 1M (and adjust units by powers of 1000 to give a value that is convenient).

Example: Drug X has a molecular weight of 250 Daltons. A dose of 5 mg given to a patient results in a circulating level of 50 ng/ml after 2 h. What is the molarity achieved?

Convert original units to liters:	50 ng/mL = 50 μg/L.
What is molar (from molecular weight)?	250 μg/L = 1 μM (since 250 g/L = 1 M)
Do the division:	50/250 = 0.2 μM which is the same as 200 nM

Practice questions:

What concentration is a 1:250 dilution of a 10 mmol solution?

27.68 nmol/ml is ……..mM?

Which is the largest concentration, 3.33 ug/L or 333 ng/mL?

How much reagent would you need to make 200 mL at a 1:400 dilution?

If the molecular weight of drug X is 255 Da, how much would you need to make 50 mL of a 10 mM solution?

If I dilute a 50 mM stock reagent solution by 1:500, what concentration would I end up with (as nmol/L)?