Bitesize Bio Lab math cheat sheet

Common lab calculations for the modern molecular biologist.

BiteSize Bio

See all of Bitesize Bio's handy downloadables here.

Calculations for making up solutions

1. Calculating moles

$n = M \times V$

n = number of moles
M = molarity of final solutions
V = volume in liters

2. Calculating moles

$m = n \times Mw$

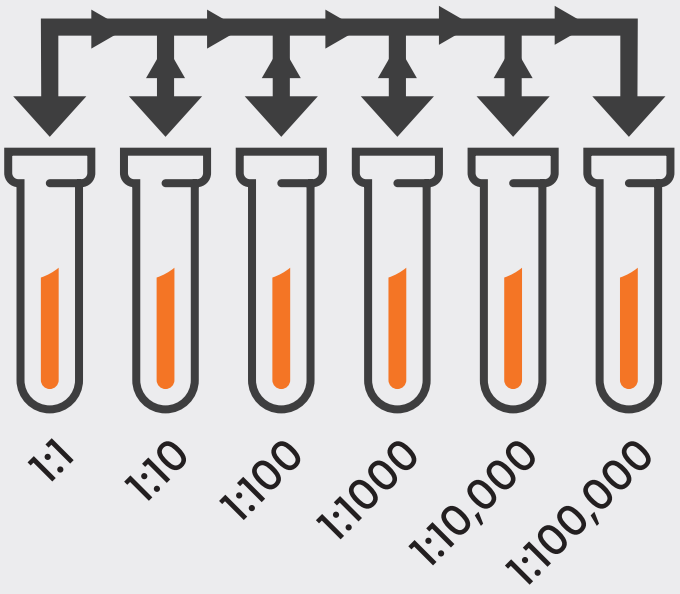
m = mass in grams
n = number of moles
Mw = g mol-1

3. Diluting stock solutions

$V_1 = \left(\frac{C_2}{C_1}\right) \times V_2$

V_1 = Volume of stock solution required
C_1 = Concentration of stocksolution
V_2 = Volume of final solution
C_2 = Concentration of final solution

4. Serial dilutions (1:10)



- Take 1/10th of the total volume out of 1st tube and mix with 9/10th of dilutant in 2nd and mix well.
- Take 1/10th of the total volume out of 2nd tube and mix with 9/10th of dilutant in 3rd tube and mix well.
- Repeat for remaining tubes.

Calculations for DNA and RNA

1. Calculating Concentration of DNA & RNA by measuring OD_{260}

For double-stranded DNA:
$C = 50 \times OD_{260} \times df$

For single-stranded DNA:
$C = 33 \times OD_{260} \times df$

For single-stranded RNA:
$C = 40 \times OD_{260} \times df$

C = Concentration of nucleic acid in µg/mL

OD_{260} = Absorbance at 260 nm

df = dilution factor*
(i.e., how much the nucleic acid in the cuvette was diluted)

If you took 10µl of your DNA/RNA and diluted it in 90µl of dilutant this would be a 1 in 10 dilution, and your dilution factor would be 10.

2. Determining contamination of DNA & RNA by measuring absorbance

Any notable absorption above background for DNA and RNA at the below wavelengths indicates contamination:

Containment	Wavelength
Organic compounds, thiocyanates and phenolate ions	230
Phenol	270
Protein	280
Particulates	>330mm

3. Calculating purity of DNA & RNA using OD_{260} : OD_{280}

Pure nucleic acid	OD_{260} : OD_{280}
DNA	~1.8
RNA	~2

Calculations for Ligations

Calculating amount of insert for ligations

1:1 ratio of vector to insert:

$$Iw = \left(\frac{I}{V}\right) \times Vw$$

I = length of insert in kb

V = length of vector in kb

Vw = vector weight in ng

Iw = insert weight in ng

1:X ratio of vector to insert:

$$Iw = \left(\left(\frac{I}{V}\right) \times Vw\right) \times X$$

I = length of insert in kb

V = length of vector in kb

Vw = vector weight in ng

Iw = insert weight in ng

X = ratio of insert to vector (e.g., if a 1:3 ratio of vector to insert desired, X = 3)

Cell culture calculations

1. Counting cells per mL using a hemocytometer

$$N \times D \times 10^4 = C$$

N = Number of cells in a 1mm x 1mm square

D = Dilution factor*

C= Number of cells per mL

*The dilution factor is calculated by the total volume of your sample after dilution (T) divided by the sample volume prior to dilution (S).

For example, where you added 1ml sample to 1ml trypan blue:

T = 1+1 = 2

S = 1

D = 2/1 = 2

2. Calculating percentage viability using a hemocytometer

$$\frac{U}{U+S} \times 100 = P$$

U = Unstained cells

S = Stained cells

P = Percentage of cells that are viable