

# Plasmid and Protein Quantitation

## Nucleic Acid and Protein Calculations.

An online calculator for these values is available at: [www.promega.com/techserv/biomath/](http://www.promega.com/techserv/biomath/)

### Metric Prefixes

Prefix	Symbol	Factor
kilo	k	10 <sup>3</sup>
centi	c	10 <sup>-2</sup>
milli	m	10 <sup>-3</sup>
micro	μ	10 <sup>-6</sup>
nano	n	10 <sup>-9</sup>
pico	p	10 <sup>-12</sup>
femto	f	10 <sup>-15</sup>
atto	a	10 <sup>-18</sup>
zepto	z	10 <sup>-21</sup>

### Spectrophotometric Conversions

- 1 A<sub>260</sub> unit of double-stranded DNA = 50μg/ml
- 1 A<sub>260</sub> unit of single-stranded DNA = 33μg/ml
- 1 A<sub>260</sub> unit of single-stranded RNA = 40μg/ml

### DNA Molar Conversions

- 1μg of 1,000bp DNA = 1.52pmol (3.03pmol of ends)
- 1μg of pBR322 DNA = 0.36pmol DNA
- 1pmol of 1,000bp DNA = 0.66μg
- 1pmol of pBR322 DNA = 2.8μg

### Formulas for DNA Molar Conversions

#### For dsDNA:

To convert pmol to μg:

$$\text{pmol} \times N \times \frac{660\text{pg}}{\text{pmol}} \times \frac{1\mu\text{g}}{10^6\text{pg}} = \mu\text{g}$$

To convert μg to pmol:

$$\mu\text{g} \times \frac{10^6\text{pg}}{1\mu\text{g}} \times \frac{\text{pmol}}{660\text{pg}} \times \frac{1}{N} = \text{pmol}$$

where N is the number of nucleotide pairs and 660pg/pmol is the average MW of a nucleotide pair.

#### For ssDNA:

To convert pmol to μg:

$$\text{pmol} \times N \times \frac{330\text{pg}}{\text{pmol}} \times \frac{1\mu\text{g}}{10^6\text{pg}} = \mu\text{g}$$

To convert μg to pmol:

$$\mu\text{g} \times \frac{10^6\text{pg}}{1\mu\text{g}} \times \frac{\text{pmol}}{330\text{pg}} \times \frac{1}{N} = \text{pmol}$$

where N is the number of nucleotides and 330pg/pmol is the average MW of a nucleotide.

### Protein Molar Conversions

- 100pmol of 100kDa protein = 10μg
- 100pmol of 50kDa protein = 5μg
- 100pmol of 10kDa protein = 1μg
- 100pmol of 1kDa protein = 100ng

### Protein/DNA Conversions

- 1kb of DNA = 333 amino acids of coding capacity
- = 37kDa protein
- 270bp DNA = 10kDa protein
- 810bp DNA = 30kDa protein
- 1.35kb DNA = 50kDa protein
- 2.7kb DNA = 100kDa protein
- average MW of an amino acid = 110 daltons

Dalton (Da) is an alternate name for the atomic mass unit, and kilodalton (kDa) is 1,000 daltons. Thus a peptide with a mass of 64kDa has a molecular weight of 64,000 grams per mole.