Primer of Biochemical Calculations

For optimal student performance in CHEM3753: Introduction to Biochemical Methods – these are items I will expect you to already know and be comfortable working with, for example, unit conversions, calculation of molarity, etc.

3-letter and 1-letter amino acid codes
http://www.youtube.com/watch?v=gq-rWb0fmzQ
http://wwwchem.csustan.edu/chem4400/code.htm

SI units
1 L = 1000 mL = 1000000 µL
1 mL = 1 cm^3 = 1 g when density = 1 (ie., for water and aqueous based solutions)

1 mmole = 10^{-3} moles
1 µmol = 10^{-6} moles
1 nmole = 10^{-9} moles
1 pmole = 10^{-12} moles

Molarity = M = moles/L (also mmol/mL = M, µmoles/µL = M, etc.)
1 mM = 10^{-3} M = 1 mmole/L = 1 µmole/mL (ie. a 10^{-3} difference between top and bottom)
1 µM = 10^{-6} M = 1 µmole/L = 1 nmole/mL (ie. a 10^{-6} difference between top and bottom)
1 nM = 10^{-9} M = 1 nmole/L = 1 pmole/mL (ie. a 10^{-9} difference between top and bottom)

MW, conversion between Molar and % w/v, mg %, or % w/w
MW = molecular weight = g/mol for proteins also expressed as Daltons (= g/mol)
Molar = mol/L (see above)

To calculate the amount of solid to weigh out to make a given volume of solution at a particular concentration:
(g/mol) * (mol/L) * (L/1) = g *or, for example*
(mg/mmol) * (mmol/mL) * (mL) = mg

% w/v = weight/volume percent, = weight in g of solute per 100 mL of solution
mg % = milligram percent = weight in mg of solute per 100 mL of solution
% w/w = weight/weight percent = weight in g of solute per 100 mg of solution

C1V1 = C2V2 (note, when mix two components that are at the same concentration, no dilution)

The starting concentration (C1) multiplied by the starting volume (V1) will equal the ending concentration (C2) multiplied by the ending volume (V2).

Useful website:

http://abacus.bates.edu/~ganderso/biology/resources/dilutions.html

Sample questions:

Make a stock solution of Hepes (MW 238.3 g/mol) at 2 M with a final volume of 2 L

(238.3 g/mol) * (2 mol/L) * (2L / 1) = 953.2 g

Calculate this as the % w/v (= % g per 100 mL)

953.2g / 2L = 476.6g / 1L = 47.66g / 100mL = 47.66% w/v

Calculate this as the mg % (= % mg per 100 mL)

47.66g / 100mL = 47660mg / 100mL = 476.6 % mg

Make a stock solution of NaCl (MW 54.88 g/mol) at 5 M with a final volume of 500 mL

(54.88 g/mol) * (5 mol/L) * (0.5 L / 1) = 137.2 g

Using those stock solutions, what is the recipe for: (use C1V1 = C2V2)

20 mM Hepes, 50 mM NaCl (1 L volume)

(0.02 M * 1 L) / 2M = 0.01 L (10 mL) of 2M Hepes

(0.05 M * 1L) / 5M = 0.01 L (10 mL) of 5M NaCl

(1000 mL -20 mL) = 980 mL water

125 mM Hepes, 555 mM NaCl (2.2 L volume)

(0.125 M * 2.2 L) / 2M = 0.1375 L (137.5 mL) of 2M Hepes

(0.555 M * 2.2L) / 5M = 0.2442 L (244.2 mL)

(2200 mL – 137.5 mL – 244.2 mL) = 1818.3 mL