CivE 375 – Lab 1 Hints

Q1. Calculate molar concentrations.

Various calculations you might need to determine mass concentration:

Hardness:

For the purposes of this lab, hardness is a measurement of Ca^{2+} and Mg^{2+} expressed in units of mg/L as $CaCO_3$, so you will need to convert to mg/L as the ion of interest. (Note: MW_{CaCO3} = 100 g/mol)

$CaCO_3 \longrightarrow Ca^{2+} + CO_3^{2-}$

For hardness calculations, equivalents are based on charge (eg. Z=2 for Ca)

Eg. EW_{Ca} = 100g/mol $CaCO_3$ * 1 mol Ca^{2+}/2 eq = 50 g/eq as $CaCO_3$

Alkalinity:

Alkalinity is the measure of acid-consuming species (e.g. CO_3^{2-}, HCO_3^-); therefore, determine the equivalent weight of $CaCO_3$ based on the number of H^+ equivalents that can be consumed by the species in question. (Note: MW_{CaCO3} = 100 g/mol)

Eg. Alkalinity due to the presence of CO_3^{2-}

$CO_3^{2-} + 2H^+ \longrightarrow H_2CO_3$

$2H^+$ are consumed by CO_3^{2-}, therefore z = 2

so in this case, the equivalent weight for $CaCO_3$ is 100g/mol * 1mol/2eq = 50g/eq

Eg. Alkalinity due to the presence of HCO_3^-

$HCO_3^- + H^+ \longrightarrow H_2CO_3$

$1H^+$ is consumed by HCO_3^-, therefore z = 1
so in this case, the equivalent weight for $CaCO_3$ = 100g/mol * 1mol/1 eq = 100g/eq

Eg. Given $[HCO_3^-]$ = 171 mg/L; convert this to mg/L as $CaCO_3$. (Note, MW_{HCO3} = 61 g/mol).
$[HCO_3^-]$ = 171mg/L * 1mol/61g * 1eq/mol = 2.80 meq/L

$\therefore$ $[HCO_3^-]$ = 2.80 meq/L * 100g $CaCO_3$/eq = 280 mg/L as $CaCO_3$

Eg. Convert 100 mg/L as $CaCO_3$ alkalinity to mg/L as HCO_3^- (ion of interest)

100 mg/L $CaCO_3$ / EW_{CaCO3} * EW_{HCO3-} = 61 mg/L HCO_3^-

pH:

pH = -log $[H^+]$, where $[H^+]$ is in units of *molarity or mol/L*

NO_3:

The HACH spectrophotometer used in the lab measured nitrite as nitrogen (NO_3^--N). For every mole of NO_3 there is one mole of N!

Eg. Convert 3 mg/L NO_3^--N to mg/L NO_3^-

MW_{NO3-} = 62 g/mol MW_N = 14 g/mol

3 mg/L NO_3^--N /MW_N * MW_{NO3-} = 13.3 mg/L as NO_3^-

Q2. For the charge balance, use molar concentrations (multiplied by ion charge!!) or normality. Check to see if the balance is within +/-5% and comment. For possible additional analytes please refer to the notes and/or textbook.

Q3. Your bar chart should be based on the mean molar concentrations. It would be a good idea to show the standard deviations (error bars). Also, you may want to discuss the differences between the ions.

Q4. Discuss weather the results shown in Q3 are what you would expect as far as the differences between the two water samples.

Q5. See notes, text, or other literature.