CHEMISTRY 133
Homework Set 1.2
Complete for quiz on Feb. 18

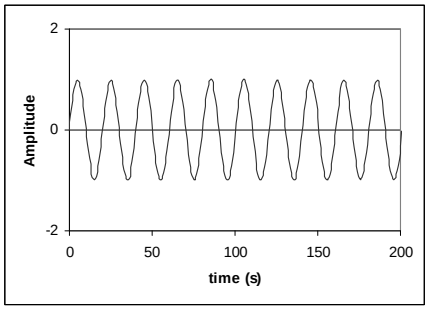
Statistics Calculations (See Chem. 133 Lab Manual pages 3-4):

1.2.1. Download the file on the Chem 133 website labeled HW11.txt. (this gives the time in minutes and the signal in fluorescence units) and transfer to an Excel File. Print a table from Excel showing two columns collected over the first 30 s period.

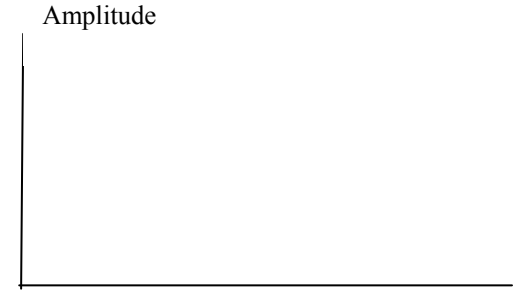
1.2.2. Make a plot of the raw data from above and also data processed with a 2 s moving average over both the first 30 s. This can be done by either using Excel's Plotting routines or by creating a 2 s moving average using a new column in Excel.

1.2.3. Sketch waveforms or Fourier transforms of waveforms

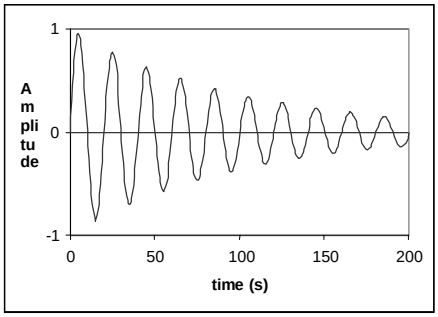
a) assume infinite waveform



F.T. →



b)



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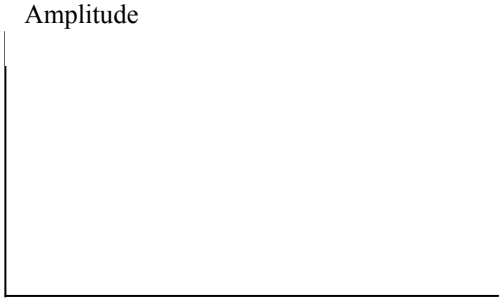
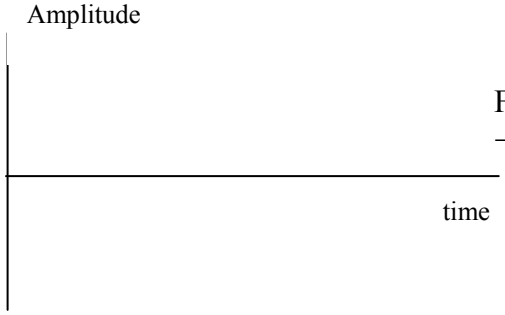
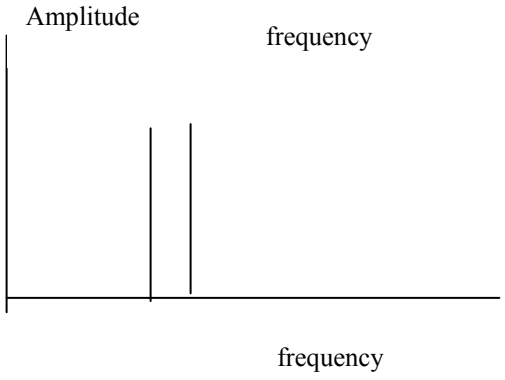


c)



F.T. →

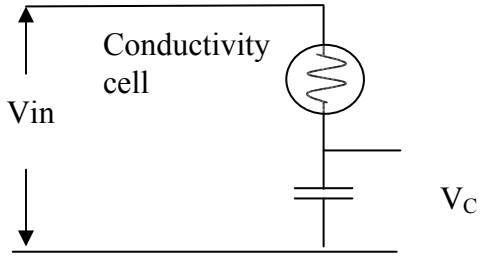


1.2.4. Given the following data, determine the concentration of chloride in an unknown and the standard deviation in its concentration.

Calibration Data..... Unknown Data

Cl Conc. μg/mL	Peak Area	Cl Conc. μg/mL	Peak Area
2	0.4516	unknown	9.2133
10	2.4344		
20	5.3388		
50	15.4836		

1.2.5. Conductivity is commonly measured in ion chromatograph detectors. Conductivity is derived from a resistance measurement in a cell, but to avoid electrodes becoming polarized, it must be conducted at high frequencies. In the circuit below, where the capacitance is 1.00×10^{-8} F and input voltage goes from 0 V to 5.00 V in a square wave at 100.0 Hz (so 0.005 s at 0 V followed by 0.005 s at 5.00 V). The time required for V_C to go from 0.00 to 4.00 V is measured (average of 100 measurements in 1 s time period) and found to be 1.92×10^{-4} s.



Determine the cell resistance.

1.2.6. Convert the following numbers between binary and decimal (a and b to decimal, c and d to binary):

a) 110101 b) 1101010 c) 15 d) 87

1.2.7. A CO monitor with an analog signal of 0.050 V/ppm put is placed in a parking garage. It is desired to be able to record "normal" garage air (concentration ranging between 1 and 10 ppm) as well as to measure high concentration periods when cars drive by (up to 100 ppm). An analog to digital converter with 10 bits with an input range of 0 to 10V is used (0 corresponding to 10 0's and 10 corresponding to 10 1's).

a) Calculate the **voltage** from the monitor and corresponding **decimal** and **binary** numbers from the digitizer given a CO concentration of 8.20 ppm.
b) What is the maximum CO concentration that can be recorded (without exceeding the A/D board's limit)?
c) It is desired to be able to record concentrations as low as 1 ppm with a relative uncertainty of 5% or less. What is the minimum number of bits needed to accomplish this?