Chemistry 236 -- Quiz 3 Lab Day ____

March 13, 2012 — Experiments 1 and 2

Pledge and signature:

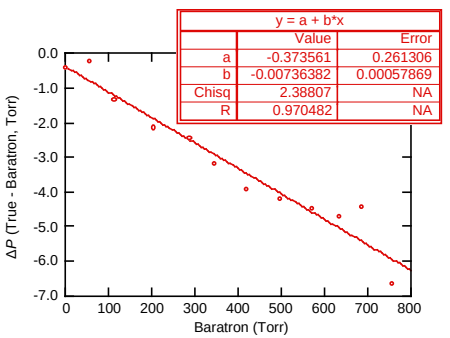
Note: If you want your paper returned folded (*i.e.*, score concealed), please print your name on the back.

A. (14) Calibration.

1. (6) Linear relations are golden in science, as they permit straight-line presentation and analysis of data. For each of the two devices you calibrated, treated in simplest approximation, we can express the relation between the measured property and the desired property as $y = a + bx$, where a and b are calibration parameters. What are "y" and "x" here if this relation is used for our two devices. Be specific in identifying each quantity, *i.e.*, name them and give units, don't just give symbols.

Baratron gauge:

Thermistor:



2. (6) This figure shows a calibration fit for the Baratron gauge.

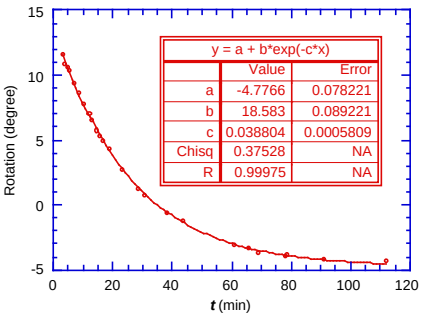
(a) When the gauge reads zero, what is the correction and its uncertainty? (State properly!)

(b) When the voltmeter on the gauge reads 6.60 volts, what is the true pressure?

(c) Suppose the student doing the calibration forgot to correct for the thermal expansion of the Hg in the manometer and barometer. If the "true" pressure is determined to be 559 Torr, what is the corrected true pressure, if the lab temperature is 21°C? (The thermal expansivity of Hg is $\alpha = 6.0\times10^{-5}\ \mathrm{K}^{-1}$, and you can neglect any other corrections.)

(3) (2) Using the results in the fit box above, estimate σ_y for the manometer measurements used to obtain the calibration data. (Hint: There are 12 data points.)

B. (12) Sucrose^{-1}.



1. (6) This figure show the analysis of some polarimetry data for the inversion of sucrose, obtained after mixing equal volumes of sucrose solution and 4.0 M HCl(*aq*). The sucrose solution was prepared by dissolving 5.16 g of sucrose in water and bringing the volume to 25.0 mL in a volumetric flask. If the specific rotations $[\alpha]_{\lambda}^{T}$ at the temperature and wavelength of these data, for sucrose, glucose, and fructose, are 66.4, 52.5, and −88.5 mL g^{-1} dm^{-1}, respectively, and the polarimeter is 20 cm long, what are the expected rotations at time = 0 and time = ∞ ? [Note: The reaction is $C_{12}H_{22}O_{11} + H_2O \rightarrow 2\ C_6H_{12}O_6$; C — 12.01, H — 1.008, O — 16.00]

2. (3) Use the fit results to obtain the experimental estimates of these two quantities. Are they in statistical agreement with the predictions?

3. (3) Suppose after collecting some similar data and analyzing them by nonlinear least squares, you discover that your polarimeter reads 2.3° with plain water in the tube. (a) Which of your results (*a*, *b*, *c*, in the LS fit) will be affected by this discovery, and (b) what value of your measured rotation α corresponds to the inversion point?