Chemistry 236 -- Quiz 2

Lab Day ____

February 4, 2014 — 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. (3) Calibration functions. A Baratron pressure gauge gives a reading of −0.27 V when $P = 0$, and 8.51 V when $P = 761$ torr. What is the apparent P when this gauge reads 4.33 V?

B. (3) *P* calibration — away from mercury. An oil manometer charged with dibutyl phthalate (ρ = 1.046 g/mL) yields a level difference $h = 42.3$ mm in a system where the reference arm is held at a pressure of $P = 1.06$ Torr. What is the pressure of the gas sample? (ρ_{Hg} = 13.595 g/mL)

C. (6) Calibration — Fitting the data. You obtain the illustrated results upon fitting your thermistor calibration data (true − thermistor *vs.* thermistor), obtained over the region 19-32°C.

y = a + b*(x-25) + c*(x-25)^2		
	Value	Error
a	0.050861789	0.001247068
b	0.0036498518	0.0002037433
c	-0.00074572609	3.839555e-05
Chisq	0.00049905721	NA
R	0.96765516	NA

1. Properly state the correction and its statistical error at 25°C.

2. If there are 24 data points, what is the estimated standard deviation (s_y) of these data?

3. If the thermistor reads 30.47°C, what is the corrected temperature?

D. (15) Pickanose^{-1}.

1. (3) The acid-catalyzed inversion of pickanose has a rate constant of 0.0324 L mol^{-1} min^{-1}. A reaction is initiated by mixing 10.00 mL of 4.0 M HCl with 20.0 mL of a solution of pickanose. Assuming that volumes are additive, calculate the effective rate constant for this mixture; or indicate if you think that this cannot be done.

2. (3) This reaction is monitored by polarimetry. The optical rotation is initially 18.0° and is −8.0° when the reaction has gone to completion. Calculate the rotation (a) after one half-life, and (b) after two half-lives; or indicate if you think there is insufficient information to determine these quantities.

3. (6) The reaction is studied at 20.0°C and at 45.0°C. Suppose that the $k_{H,20}$ and $k_{H,45}$ values are each uncertain by 8%, and their ratio is 4.5.

   (a) Calculate the % uncertainty in their ratio; use this result to state this ratio and its uncertainty.

   (b) Calculate the uncertainty in $\ln(k_{H,45}/k_{H,20})$.

   (c) Use the last result to calculate the uncertainty in the activation energy E_a. (Take temperatures as error-free; R = 8.3145 J mol^{-1} K^{-1})

4. (3) A solution of a different sugar, bashanose, is prepared by dissolving 23.71 g of bashanose in water and bringing the volume to 0.100 L in a volumetric flask. The optical rotation observed at λ_D for this solution in a 0.200-m polarimetry cell at 25°C is 14.7°. Calculate the specific rotation of bashanose (units deg mL g^{-1} dm^{-1}) at this wavelength and T.