Chemistry 236 -- Quiz 3
October 22, 2008 — 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. (8) Calibration with 2-point functions.
   1. A Baratron pressure gauge gives a reading of –0.27 V when $P = 0$, and 7.08 V when $P = 760$ torr. What is the apparent $P$ when this gauge reads 4.44 V?
      
      \[ P = a + bV \]
   
   2. A particular thermistor shows a resistance of 13.27 kΩ at 10.0°C and 1.557 kΩ at 50.0 °C. The resistance is measured to be 8.93 kΩ when the thermistor is immersed in an unknown bath. What is the apparent temperature of the bath?
      
      \[ T = \frac{A}{B} + C \]

B. (4) Calibration — Fitting the data. You obtain the illustrated results upon fitting your thermistor calibration data, obtained over the region 19-32°C.
   1. Properly state the correction and its statistical error at 25°C.
      
      \[ \Delta T = 0.0509(12)^\circ C \]  
      [recall 10% rule!]
   
   2. If there are 19 data points, what is the estimated standard deviation ($s_y$) of these data?
      
      \[ s_y = 0.0056^\circ C \]

C. (2) Calibration — Paying attention!
   Suppose you obtained the illustrated thermistor calibration data at the BombCal station while warming up the bath, starting just below 20°C. What do you think happened at ~27°C?
   
   Most likely explanation: The stirbar got "stuck."

D. Inversion of pickanose.
   1. (10) The figure to the right represents optical rotation data for a hypothetical sugar pickanose. From this figure, give approximate values for the following quantities: (a) $\alpha_0$, (b) $\alpha_{\infty}$, (c) the inversion time (in s), (d) the half-life, and (e) the effective rate constant $k_{\text{eff}}$.
      
      (a) 0.9°  (b) –1.5°  (c) 95 s  (d) 135 s  (e) 0.005/s
   
   2. (3) The inversion of pickanose is an acid-calalyzed reaction, with a rate constant of 0.0824 L mol⁻¹ min⁻¹. A reaction is initiated by mixing 20.00 mL of 4.0 M HCl with 10.0 mL of an aqueous solution of pickanose. Assuming that volumes are additive, calculate the effective rate constant for this mixture.
      
      \[ k_{\text{eff}} = 0.22 \text{ min}^{-1} \]