Chemistry 236 -- Quiz 1

September 3, 2003 — *T* and *P* Calibration

Pledge and signature:

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

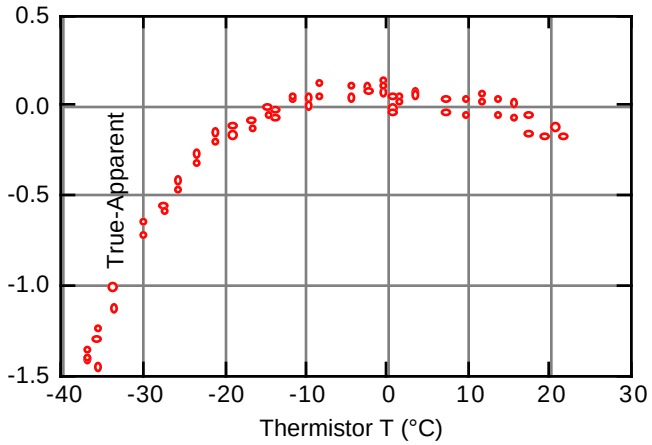
1. (3) A particular Baratron gauge (capacitance manometer) is carefully zeroed (*i.e.*, made to read 0.00 V when $P = 0$). It is then calibrated at a true pressure of 99 871 Pa, where it reads 7.77 V. Give the calibration formula for the gauge, in the form P(Pa) = $f(V)$.

   a. $P = 7.77\ V$ b. $P = 99\,871\ V$ c. $P = 7.78\times10^{-5}\ V$
   d. $P = 1285\ V$ e. none of these

   [P = 99871 Pa/7.77 V × V = 12853 (Pa/V) V]

2. (3) Student records a data point on the sublimation curve of ice, where the thermistor reads –24.1°C. If the calibration data are as shown in the accompanying graph, what is the corrected T?

   a. –24.5°C b. –23.7°C
   c. 0.4°C d. –0.5°C
   e. This cannot be determined without additional information.



3. (3) A gas is connected simultaneously to a mercury manometer, where it yields a height difference of 23.2 mm of Hg, and to another manometer containing an unknown fluid, where it displays a level difference of 244 mm. Both manometers have their reference arms evacuated ($P = 0$). If the density of Hg is 13.59 g/mL, what is the density of the unknown fluid?

   a. 0.095_1 g/mL b. 0.77_4 g/mL c. 1.29_2 g/mL d. 10.5_2 g/mL e. none of these

4. (3) A particular thermistor displays a relative sensitivity of 4.05%/K at 0°C.

   a. At 100°C, will its relative sensitivity be higher or lower? Lower

   b. Calculate it.

   As I mentioned in class, this is a variation on Study Problem 6. Use the given relative sensitivity to calculate B in the calibration formula, $R = R_\infty \exp(B/T)$. Take R to decrease by 4.05% on going from 0°C (273.15 K) to 1°C (274.15), which yields B = 3096 K. Then use this value to calculate the ratio of R at 374.15 K to that at 373.15 K. This ratio is 0.978, giving 2.2% (2.19 to 3 figures) relative sensitivity at 100°C.