# Chemistry 236 -- Quiz 12

Lab Day ___

November 28, 2007 — Physical Adsorption of Gases

**Pledge and signature:**

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

1. (3) In an adsorption experiment, the manifold volume is calibrated with a bulb having $V$ = **34.5 cm$^3$**. Gas having $P$ = **207 Torr** is expanded from the bulb to the rest of the system (previously evacuated), giving $P$ = **79.3 Torr**. Calculate the volume of the rest of the system.

   $V_{rest}$ = 55.5$_6$ mL

2. (3) The volume just calculated includes a small connecting region between the calibration bulb and the manifold. Gas of $P$ = **195.2 Torr** is trapped in this section and then expanded into the manifold (previously evacuated), giving $P$ = **19.2 Torr**. Calculate the volumes of (a) the connecting region and (b) the manifold.

   $V_x$ = 5.46 mL; $V_{man}$ = 50.1 mL

3. (4) In a different system, a sample cell of volume **13.3 cm$^3$** is connected to a manifold having $V$ = **63.5 cm$^3$**. The system is initially at $T$ = **299 K** with $N_2$ gas at $P$ = **178.3 Torr**. Then the fat part of the sample cell is immersed in liquid $N_2$ (**77.0 K**) and the pressure drops to **139.2 Torr**. Calculate the "cold volume."

   $V_{cold}$ = 7.48 mL

4. (6) Adsorption data for the adsorbed amount $v$ (STP cm$^3$) can be analyzed by fitting to two different relationships, one of which gives a straight-line presentation.
   (a) Give the quantities "$y$" to be taken as dependent variable in each of these fits.
   (b) Assuming the measured $v$s have constant uncertainty, how should the data in each of these two fits be weighted?
   (c) If these data have proportional uncertainty ($\sigma_v$ $v$), how should the data be weighted in each case?

   (a) nonlinear: $y = v$ straight-line: $y = x\, v^{-1}\, (1–x)^{-1}$

   (b) $w_i$ $1/\sigma_i^2$, so constant weighting 1st case (or unweighted);
   Error prop --> $\sigma_y/y = \sigma_v/v$, leading to $w_i$ $[(1–x)/x]^2\, v^4$ in 2nd.

   (c) $\sigma_y/y = \sigma_v/v$ = const. Thus $w_i$ $1/v^2$ 1st case, $w_i$ $1/y^2 = [(1–x)/x]^2\, v^2$ in 2nd.