Number versus Pressure for the sequence of doses:

The calculation hinges on the fact that when we expand the gas into the final volume, we expect the pressure to be given by the ideal gas law. However, we must take into account that some of those molecules are "missing" (absorbed on the graphite).

We give a dose of $N_{dose1} = \frac{PVc}{kT}$ before we do any expanding to the graphite. After expanding to the graphite, we see $\frac{P_f(V_c + V_s)}{kT}$ molecules in the gas phase. This is, of course, lower than we would expect since some of the molecules have been adsorbed on the graphite. The number adsorbed is naturally the difference in these quantities. In subsequent dosings, of course, we must also account for the molecules in the gas phase in Vs prior to the dosing.

So, rearranging terms slightly,

Dose #1: $$N_1 = \left(\frac{V_c}{kT}\right)\left[P_0(1) - P_f(1)\right] - \left(\frac{V_s}{kT}\right)\left[P_f(1)\right]$$

Dose #2: $$N_2 = \left(\frac{V_c}{kT}\right)\left[P_0(2) - P_f(2)\right] - \left(\frac{V_s}{kT}\right)\left[P_f(2) - P_f(1)\right]$$

Dose #3: $$N_3 = \left(\frac{V_c}{kT}\right)\left[P_0(3) - P_f(3)\right] - \left(\frac{V_s}{kT}\right)\left[P_f(3) - P_f(2)\right]$$

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Dose #m: $$N_m = \left(\frac{V_c}{kT}\right)\left[P_0(m) - P_f(m)\right] - \left(\frac{V_s}{kT}\right)\left[P_f(m) - P_f(m-1)\right]$$

Summing all “m” doses: $$N_T = \left(\frac{V_c}{kT}\right)\sum_{j=1}^{m}\left[P_0(j) - P_f(j)\right] - \left(\frac{V_s}{kT}\right)\left[P_f(m)\right]$$

Volume versus Pressure for the sequence of doses:

Dose #1:

$$V_1(cm^3) = \frac{273K}{T}\left(\frac{V_c}{760Torr}\right)\left[P_0(1) - P_f(1)\right] - \frac{273K}{T}\left(\frac{V_s}{760Torr}\right)\left[P_f(1)\right]$$

Dose #2

$$V_2(cm^3) = \frac{273K}{T}\left(\frac{V_c}{760Torr}\right)\left[P_0(2) - P_f(2)\right] - \frac{273K}{T}\left(\frac{V_s}{760Torr}\right)\left[P_f(2) - P_f(1)\right]$$

Dose #3

$$V_3(cm^3) = \frac{273K}{T}\left(\frac{V_c}{760Torr}\right)\left[P_0(3) - P_f(3)\right] - \frac{273K}{T}\left(\frac{V_s}{760Torr}\right)\left[P_f(3) - P_f(2)\right]$$

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First data point on plot: V_1 versus $P_f(1)$

Second data point on plot: $V_1 + V_2$ versus $P_f(2)$

Third data point on plot: $V_1 + V_2 + V_3$ versus $P_f(3)$

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