

# Phy 410

## Quiz #7, March 19, 2010

The average number of particles of an ideal gas (mass  $m$ ) at temperature  $\tau$  and pressure  $p$  adsorbed on a surface is given by

$$f = \frac{\langle N \rangle}{N_s} = \frac{p}{p + p_0}; p_0 = \tau n_Q e^{-E/\tau},$$

where  $E$  and  $n_Q$  are the binding energy of the atoms to the surface and quantum concentration respectively.

**A) Sketch  $f$  vs  $p$ . Does the slope near  $p = 0$  increase or decrease with  $p_0$ ?**

Slope near  $p=0$  is  $\frac{1}{p_0}$

Therefore slope decreases as  $p_0$  increases

**B) Two types of gases (1 and 2) are exposed to the same surface and have exactly the same  $E$ . At a given  $\tau$ ,  $f$  for 1 rises faster than that for 2 near  $p = 0$ . Which atoms are lighter, 1 or 2?**

**Since  $f$  for 1 rises faster than that for 2 near  $p = 0$  its slope is larger.**

$$p_{0,1} < p_{0,2}$$

*Since  $\tau$  and binding energy are the same*

$$n_{Q,1} < n_{Q,2}$$

*Since  $n_Q \propto m^{3/2}$*

*$m_1 < m_2$ ; Particle 1 is lighter*