**PHY2010 HW 8 - Answers**

1. You want to beef up the bass absorption of your foam absorber, to increase its absorption around 100 Hz. How far from the wall should you mount it?
   **Answer: You want to mount it a quarter wavelength from the wall.**
   **At 100Hz, $\lambda$ = (1140ft)/(100) = 11.4 ft.**
   **So $\lambda/4$ = 2.85 ft, or 2.9ft**

2. Briefly explain the physical principles by which porous absorbers absorb sound.
   **Answer: Porous absorbers convert sound energy to heat, via the air particles penetrating the interstices of the absorbing material and doing work on the material. Moving the material is a form of *work* against *friction*, which results in the dissipation of energy as heat.**

3. You get a bunch of pegboard to make a perforated panel absorber. The perforation percentage is $p$, the thickness is $t$ and the depth of the air gap is $d$. You find upon installation that the frequency it's absorbing is twice what it needs to be. Your friend wants to drill hundreds of new holes to increase the perforation percentage, but you remark that might would be much simpler to….? How would you "minimally" modify the absorber to lower the frequency by a factor of two?
   **Answer: Since the resonant frequency is inversely proportional to the square root of both the thickness and the air gap, the easiest thing to do would be to <u>increase the air gap by a factor of four</u>.**

4. You've got some plywood with a surface density of 7 Oz/ft$^2$, and you want to make a "piece-o-wood" panel absorber to absorb frequencies around 75Hz. How deep should you make the airspace?

$$f_0 = \frac{170}{\sqrt{md}},$$

where $f_0$ is in Hz, $m$ is in lb/ft$^2$, and $d$ is in inches.

$$m = \frac{7\ \text{Oz/ft}^2}{16\ \text{Oz/lb}} = 0.4375\ \text{lb/ft}^2,$$

$$\text{so}\quad d = \frac{(170)^2}{mf_0^{\,2}} = \frac{1}{0.4375}\left(\frac{170}{75}\right)^2 = \frac{5.14}{0.4375} = 11.7\ \text{in.}$$