

# Physics 225

## Homework Assignment 7

Due 18 March

### 1 Tube resonator and $Q$

Consider an open-closed tube. Suppose its lowest resonance frequency is 200 Hertz and its resonant  $Q$  is 100.

- How long is the tube?
  
  
  
  
  
  
  
  
  
  
- If there is already sound inside the tube but there is no sound source, what is the decay time  $\tau$  for the sound intensity to die away? How long does it take to lose 20 dB of intensity?
  
  
  
  
  
  
  
  
  
  
- Suppose that we drive the resonance in the tube by playing a sound outside the tube. Compare the loudness inside the tube at three frequencies, 180 Hertz, 190 Hertz, and 200 Hertz. First, figure out how many times larger the pressure is at 190 Hertz compared to 180 Hertz, and at 200 Hertz compared to 180 Hertz. Then convert each answer into how many times larger the intensity is (190 Hertz versus 180 Hertz, and 200 Hertz versus 180 Hertz). Re-express the answers in decibels (difference). [Recall that the number of decibels difference between two sounds of intensity  $I_1$  and  $I_2$  is  $10 \log_{10}(I_1/I_2)$ .]

## 2 Viscosity and pipes

Suppose that your shower does not provide very much water. You want a faster water flow. You call two plumbers.

The first plumber says that your water pressure is low. He can install a pump which will double the water pressure. How many times more water will come out of your shower if you do this?

The second plumber says that your house is plumbed using  $3/8$  inch pipes. She recommends that you replace them with  $1/2$  inch pipes, and that this will improve your water flow. How many times more water will come out from your shower if you make this change?