ECE/TAM 473
Homework Assignment #4
Due: Friday, September 28, 2018

1. Problem 5.6.1 in Kinsler et al.

2. Problem 5.7.3 in Kinsler et al.

3. Calculate the missing values for the three gases.

	Gas 1	Gas 2	Gas 3
frequency (Hz)	3000		
angular frequency (rad/s)			2000
propagation speed (m/s)	300	343	1000
wavenumber (1/m)		110	
wavelength (m)			
equilibrium density (kg/m^3)	1.21	1.40	0.090
ratio of specific heats (γ)	1.40	1.30	1.20
equilibrium pressure (kPa)			
isothermal bulk modulus (kPa)			
adiabatic bulk modulus (kPa)			
peak particle displacement amplitude (mm)			
peak particle velocity amplitude (cm/s)			220
peak particle acceleration amplitude (m/s^2)			
peak condensation amplitude			
peak acoustic pressure amplitude (kPa)	0.03		
peak excess density amplitude (kg/m^3)			
SPL (re: 20 μPa_{rms})		93	
characteristic acoustic impedance (rayl)			

4. The atmosphere on some distant body consists of 30% CO2, 30% N2 and 40% O_2 with a temperature of -10°C and equilibrium pressure of 500 Pa. At an acoustic frequency of 2000 Hz for a plane wave that has a peak acoustic pressure of 3.56e-3 Pa and ratio of specific heats 1.35. Determine:
    a) the speed of sound (in m/s).
    b) the equilibrium density (in kg/m^3).
    c) the rms acoustic pressure amplitude (in Pa).
    d) the rms excess density amplitude (in kg/m^3).
    e) the rms adiabatic temperature rise (in °K).
    f) the rms particle displacement amplitude (in µm).
    g) the rms particle velocity amplitude (in µm/s).
    h) the rms particle acceleration amplitude (in m/s^2).
    i) the rms condensation amplitude.
    j) the characteristic acoustic impedance (in rayl).

5. Problem 5.7.5 in Kinsler et al.