HW 6 – due Tuesday, October 7, 2003:

1. Use both of the expressions presented in class on Thursday, October 02, 2003 to calculate the shock distance D in water (B/A = 5) at 20°C for 1MHz plane waves generated with the following initial excess pressures:

a) 0.1 MPa
b) 1 MPa
c) 10 MPa
d) 100 MPa

2. Given a plane wave, SPL = 85dB (re 20μPa RMS) and radian frequency $\omega = 6000$ rad/sec, propagating in a gas with sound speed $c_0 = 500$ m/s, equilibrium density $\rho_0 = 0.18$ kg/m^3, and ratio of specific heats $\gamma = 1.2$, determine the following parameters:

a) frequency (Hz)
b) wavenumber (rad/m)
c) wavelength (m)
d) equilibrium pressure (Pa)
e) isothermal bulk modulus (Pa)
f) adiabatic bulk modulus (Pa)
g) peak particle displacement amplitude (m)
h) peak particle velocity amplitude (m/s)
i) peak particle acceleration amplitude (m/s^2)
j) peak condensation amplitude
k) peak acoustic pressure amplitude (Pa)
l) characteristic acoustic impedance (rayl)
m) nonlinearity parameter B/A

3. Given a plane wave, frequency f = 22kHz and equilibrium pressure 200kPa, propagating in a liquid with sound speed $c_0 = 1200$ m/s, equilibrium density $\rho_0 = 870$ kg/m^3, peak particle velocity amplitude 0.1m/s, and ratio of specific heats $\gamma = 1.27$, determine the following parameters:

a) radian frequency (rad/s)
b) wavenumber (rad/m)
c) wavelength (m)
d) SPL (re 1μPa RMS)
e) isothermal bulk modulus (Pa)
f) adiabatic bulk modulus (Pa)
g) peak particle displacement amplitude (m)
h) peak particle acceleration amplitude (m/s^2)
i) peak condensation amplitude
j) peak acoustic pressure amplitude (Pa)
k) characteristic acoustic impedance (rayl)