Name: ______________________________ Due October 21, 2003 9:30 a.m.

Physics/Astronomy/Planetary Sciences 589 Homework 4

1) Derive the density jump condition ($\rho_2/\rho_1 = ?$) for a shock wave in which the adiabatic index is γ and the pre- and post-shock pressures are P_1 and P_2, respectively. Assume that $\epsilon = P/(\gamma-1)\rho$.

2) Prove that if a piston moves into a cylinder at constant speed U, the pressure behind the shock is:

$$P_2 = P_1 + U^2(\gamma+1)/4V_1 + \gamma P_1 U/C_1\sqrt{(}1 + ((\gamma+1)U/4C_1)^2)$$

Show that this formula goes to the appropriate weak and strong shock limits.

3) Use the Hugoniot relation involving ϵ and the ideal gas law to show that in the limit $q >> P_1V_1$, the detonation speed is

$$D = \sqrt{(}2(\gamma^2-1)q)\,.$$