Name: ______________________________ Due November 4, 2003 9:20 a.m.

Physics/Astronomy/Planetary Sciences 589 Homework 5

1) A one megatonne H-bomb explodes in the atmosphere ($\rho = 1.3 \times 10^{-3}$ gm cm^{-3}). What are the shock pressure and the peak wind speed at 100 meters and 1 kilometer from the blast? Asume that $\gamma = 1.2$ and that you can use the Sedov solution.

2) Derive the relations:

$$v = -\frac{2}{(1+\gamma)}(c_0 - \frac{x}{t})$$

and

$$P = P_0\Big(1 - \frac{(\gamma-1)}{2}\frac{|v|}{c_0}\Big)^{2\gamma/(\gamma-1)}$$

for 1D rarefaction flow into a vacuum. Sketch the flow field (v vs. x/t). What is the maximum velocity with which the gas can exit into the vacuum?

3) Derive the approximate formula for the Sedov parameter:

$$\xi_0 = \Big(\frac{75}{16\pi}\frac{(\gamma-1)(\gamma+1)^2}{(3\gamma-1)}\Big)^{1/5}.$$

Make all the steps clear. Show that this formula gives reasonable numbers for six different values of γ. Does a “soft” EOS allow the shock to travel further in a given time than a “hard” EOS?