Name: ______________________________ Due November 18, 2003 9:20 a.m.

Physics/Astronomy/Planetary Sciences 589 Homework 6

1) Derive from first principles the formula for the accretion rate, $\dot{\mathrm{M}}$, from the ISM:

$$\dot{\mathrm{M}} = 4\pi\lambda(\gamma)\frac{(GM)^2}{c_s^3}\rho_\infty ,$$

in particular $\lambda(\gamma)$.

2) In the above problem, a) if $M = 1\ \mathrm{M}_\odot$, $\rho_\infty \equiv 1.0$ particles per cm^3 (assumed to be pure hydrogen), $\gamma = 1.5$, and $c_s = 1.0$ km s^{-1}, what is $\dot{\mathrm{M}}$? b) What is the density of gas at the sonic point? c) What is the gas speed at the sonic point?

3) Derive the critical condition for a steady-state wind.