

AME 538

Homework 23

Due: Friday, 3 November 2000, in class

1. Given that a shock wave is propagating at  $D = 500 \text{ m/s}$  into  $N_2$  at rest with  $T_1 = 130 \text{ K}$  and  $P_1 = 2 \text{ MPa}$ , and that the diatomic nitrogen is well modeled by a van der Waals thermal and caloric state equation

$$P = \frac{\rho RT}{1 - b\rho} - a\rho^2,$$

$$e = e_o + c_v(T - T_o) + a(\rho_o - \rho),$$

find appropriate values for the constants in a thermodynamics text, and solve the Rankine-Hugoniot shock jump equations to describe the shocked state,  $P_2, T_2, \rho_2, u_2$ .