1. Given that a shock wave is propagating at $D = 600 \, m/s$ into $N_2$ at rest with $T_1 = 130 \, K$ and $P_1 = 2 \, MPa$, 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, $P_2, T_2, \rho_2, u_2$. 