1 Using Gibbs Free Energy

You are given the following Gibbs free energy:

$$G = -kTN \ln\left(\frac{aT^{5/2}}{p}\right),$$

where a is a constant (whose dimensions make the argument of the logarithm dimensionless).

(a) Compute the entropy.

(b) Work out the heat capacity at constant pressure C_p.

(c) Find the connection among V, p, N, and T, which is called the equation of state (Hint: find the volume as a partial derivative of the Gibbs free energy). Simplify the final expression as much as possible.

(d) Find the internal energy U from the expression for G that you were given in the main prompt. Simplify the final expression as much as possible.