

[tex171] **Some fantasy gas**

Consider a thermal system characterized by the grand potential,

$$\Omega(T, V, \mu) = -bT^2 V e^{2\beta\mu}, \quad \beta \doteq \frac{1}{k_B T},$$

where b is a constant.

- (a) Calculate the Helmholtz free energy $A(T, V, N)$ and the Gibbs free energy $G(T, p, N)$.
 - (b) Calculate the internal energy $U(T, N)$.
 - (c) Calculate the thermodynamic equation of state (relation between p , V , T , and N).
- All results must be stated as explicit expressions of the variables indicated.

Solution: