4) $$\varepsilon = \frac{hc}{3V^{1/3}} (n_x^2 + n_y^2 + n_z^2)^{1/2} \quad (1)$$

2|2

$$\Rightarrow n_x^2 + n_y^2 + n_z^2 = \frac{4\varepsilon^2 V^{2/3}}{h^2 c^2}$$

$$\frac{4E^2 V^{2/3}}{h^2 c^2} = \sum_{r=1}^{3N} n_r^2 \equiv R^2 \quad (2)$$

For E & N fixed, the number of states for a single particle is proportional to V, so for N particles we expect Ω to be proportional to V^N. Moreover, the form of (2) shows that Ω will depend on E & V only in the combination $E^2 V^{2/3}$, so we can immediately express Ω in the Functional form

$$\Omega = \tilde{\Omega}(N) V^N E^{3N} \quad (3)$$

$$S = k \ln \Omega \quad , \; k = \text{Boltzmann's constant}$$
$$= k[\ln \hat{\Omega}(N) + N \ln V + (3N/2) \ln E] \quad (4)$$

$$\frac{P}{T} = \left(\frac{\partial S}{\partial V}\right)_{E,N} = \frac{kN}{V}$$

$\Rightarrow PV = kNT$, satisfies the ideal gas law (5)

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$$\frac{1}{T} = \left(\frac{\partial S}{\partial E}\right)_{V,N} = \frac{3Nk}{E}$$

$$E = 3NkT \quad (6)$$

From (6) & (5):

$$P = \frac{3E}{V} \quad (7)$$

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$$C_V = \left(\frac{\partial E}{\partial T}\right)_{V,N}$$

$$= 3NK$$

$$H = E + pV$$

$$= 3NKT + NKT$$

$$H = 4NKT$$

$$C_p = \left(\frac{\partial H}{\partial T}\right)_{p,N} = 4NK$$

$$\Rightarrow \frac{C_p}{C_V} = 4/3 \quad \#$$