Examen Statmech

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1 Oral Part

1.1 Classical

Prove the ideal gas law $PV = Nk_BT$ in the canonical and grand-canonical ensemble.
In general the ensembles are equivalent to each other in the sense that relative fluctuations $\frac{\sigma_X^2}{<X>^2}$ vanish. Give an example of this for an ideal gas int the canonical or grand-canoncical ensemble.

1.2 Quantum

Sketch the derivation of Plack's law.

$$\epsilon(\omega) = \frac{\hbar}{\pi^2 c^3} \frac{\omega^3}{e^{\beta\hbar\omega} - 1} \tag{1}$$

What does this mean? The density of states is the following

$$g(\omega) = \frac{V}{\pi^2 c^3}\omega^2 \tag{2}$$

How is your result dependent on the temperature? How would you derive $\epsilon(\omega)$ classicaly?