Chapter 4.8: Photons as bosonic particles

$$\varepsilon_{\vec{k},\alpha} = c\hbar\left|\vec{k}\right|$$

$$g(\varepsilon) = \sum_{\vec{k},\alpha} \delta(\varepsilon_{\vec{k},\alpha} - \varepsilon) = \frac{V}{\pi^2 c^3 \hbar^3}\varepsilon^2$$

$$\ln \mathbf{Z}_{\mathrm{B}} = -\sum_r \ln(1 - z e^{-\beta\varepsilon_r}) \quad = \quad -\int_0^\infty d\varepsilon \, \ln(1 - e^{-\beta\varepsilon}) g(\varepsilon)$$

$$E = -\left(\frac{\partial \ln \mathbf{Z}}{\partial \beta}\right)_{\alpha,V}$$

$$p = -\left(\frac{\partial \Phi}{\partial V}\right)_{\alpha,T}$$

$$N = \sum_r \langle n_r \rangle \quad = \quad \int_0^\infty d\varepsilon \, \frac{g(\varepsilon)}{e^{\beta\varepsilon} - 1}$$