

(A)

$$\sum_N(E) \approx \left(\frac{V}{h^3}\right)^N \frac{(2\pi m E)^{\frac{3N}{2}}}{\left(\frac{3N}{2}\right)!}$$

$$\ln \sum_N(E) = \ln \left[\left(\frac{V}{h^3}\right)^N \frac{(2\pi m E)^{\frac{3N}{2}}}{\left(\frac{3N}{2}\right)!} \right]$$

$$\ln \left(\left(\frac{V}{h^3}\right)^N (2\pi m E)^{\frac{3N}{2}} \right) - \ln \left(\frac{3N}{2} \right)!$$

$$\ln n! \approx n \ln n - n$$

$$\ln \left[\left(\frac{V}{h^3}\right)^N (2\pi m E)^{\frac{3N}{2}} \right] - \frac{3N}{2} \ln \frac{3N}{2} + \frac{3N}{2} + \ln \left(\frac{3N}{2} \right)^{-\frac{3N}{2}} \quad \ln \frac{1}{\left(\frac{3N}{2}\right)^{\frac{3N}{2}}} = \ln \left(\frac{2}{3N} \right)^{\frac{3N}{2}}$$

$$\ln \left[\left(\frac{V}{h^3}\right)^N (2\pi m E)^{\frac{3N}{2}} \left(\frac{2}{3N} \right)^{\frac{3N}{2}} \right] + \frac{3N}{2}$$

$$\ln \left[\left(\frac{V}{h^3}\right)^N \left(\frac{4\pi m E}{3N} \right)^{\frac{3N}{2}} \right] + \frac{3N}{2}$$

$$\boxed{\ln \sum_N(E) \approx N \ln \left[\left(\frac{V}{h^3}\right) \left(\frac{4\pi m E}{3N} \right)^{\frac{3}{2}} \right] + \frac{3}{2} N}$$