I45

45. If $Z(N,V,T)$ is the partition function of a system with N indistinguishable particles and volume V at temperature T and $Z(1,V,T)$ is the partition function of a system containing one particle in volume V at temperature T. Then, $Z(N,V,T)$ is

(A) $[Z(1,V,T)]^N/N!$
(B) $N[Z(1,V,T)]/N!$
(C) $[Z(1,V,T)]^N$
(D) $N[Z(1,V,T)]$

46. The probability of finding a system in a state with N_r particles and energy E_s is

$$P_{r,s} = \exp(-\alpha N_r - \beta E_s)/Z(z,V,T)$$

If z and $\mathbb{Z}$ are fugacity and grand partition function, $\beta = 1/kT$ and $\alpha = -\mu/kT$, the probability that the system in grand canonical ensemble has exactly N particles is

(A) $Z(N,V,T)/\mathbb{Z}(z,V,T)$
(B) $z^N Z(N,V,T)/\mathbb{Z}(z,V,T)$
(C) $zZ(N,V,T)/[N\mathbb{Z}(z,V,T)]$
(D) $NzZ(N,V,T)/\mathbb{Z}(z,V,T)$

47. A system has a fixed number of particles N. Suppose the energy scale is shifted by an arbitrary constant η so that the single particle levels are shifted by η. The new and the old partition functions, $\tilde{Z}$ and Z will be related as,

(A) $\tilde{Z} = Z$
(B) $\tilde{Z} = e^{-\beta N/\eta}Z$
(C) $\tilde{Z} = e^{-\beta\eta N}Z$
(D) $\tilde{Z} = \eta e^{-\beta N}Z$

48. If S represents entropy of a macrostate and Ω, the number of microstates in it, then

(A) S must be $> k\ln\Omega$
(B) S must be $> k/\ln\Omega$
(C) $S = k/\ln\Omega$
(D) $S = k\ln\Omega$

k is Boltzmann constant.