Week 3 Assignment 1

The due date for submitting this assignment has passed. Due on 2018-02-28, 23:59 IST.

Submitted assignment

1) Consider we have an Einstein solid with 8 1-D SHOs and 8 quanta of energy (here SHO means simple harmonic oscillator and the energy is considered to be over and above the zero point energy). The total number of possible micro-states is –

- (a) \(16C_8^8\)
- (b) \(15C_8^8\)
- (c) \(16C_7^8\)
- (d) \(15C_9^8\)

No, the answer is incorrect.
Score: 0
Accepted Answers:
(b) \(15C_8^8\)

2) For a composite Einstein solid having 3 1-D SHOs in sub-system A and 2 1-D SHOs in sub-system B, what is the probability of observing a macro-state having 6 quanta of energy in sub-system A given the total energy of the whole system is 8 quanta?

- (a) 0.169
- (b) 0.220
- (c) 0.149
- (d) 0.113

No, the answer is incorrect.
Score: 0
Accepted Answers:
(a) 0.169

3) For a composite Einstein solid having ‘n’ 1-D SHOs in sub-system A and ‘n’ 1-D SHOs in sub-system B, the probability distribution with respect to \(\varepsilon_A\) will peak at (given the total energy of the system 2\(\varepsilon\)):

- (a) \(\varepsilon_A = \varepsilon\)
- (b) \(\varepsilon_A = \frac{\varepsilon}{2}\)
- (c) \(\varepsilon_A = \frac{3\varepsilon}{2}\)
- (d) \(\varepsilon_A = \sqrt{\varepsilon}\)

No, the answer is incorrect.
Score: 0
Accepted Answers:
4) For a system having 6 single particle states and 5 electrons, the total number of micro-states is (electrons are indistinguishable) -

- (a) 1
- (b) \( \binom{6}{2} \)
- (c) \( \binom{10}{5} \)
- (d) \( \binom{6}{5} \)

No, the answer is incorrect.
Score: 0
Accepted Answers:
(a) \( \binom{6}{5} \)

5) For 9 photons in a system of 12 single particle states, \( \Gamma_{tot} \) is:

- (a) \( \binom{12}{9} \)
- (b) \( 9! \)
- (c) \( \binom{20}{9} \)
- (d) \( \binom{20}{12} \)

No, the answer is incorrect.
Score: 0
Accepted Answers:
(c) \( \binom{20}{9} \)

6) For a system with fundamental equation \( S = S(U,V,N) \), related to the following thermodynamic variable:

- (a) \( P \)
- (b) \( \mu \)
- (c) \( \frac{P}{\mu} \)
- (d) \( T \)

No, the answer is incorrect.
Score: 0
Accepted Answers:
(d) \( T \)

7) An equal a priori probability hypothesis is applicable for the following given condition:

- (a) \( N,V,T \)
- (b) \( N,P,T \)
- (c) \( N,V,S \)
- (d) \( N,P,S \)

No, the answer is incorrect.
Score: 0
Accepted Answers:
(c) \( N,V,S \)

8) Under the approximation \( \frac{\varepsilon}{N} \gg 1 \), the entropy of an Einstein solid can be written in terms of \( \varepsilon \) and \( N \) as

- (a) \( s = k_B \left[ 1 + \ln \frac{N}{\varepsilon} \right] \)
- (b) \( s = Nk_B \left[ 1 + \ln \frac{\varepsilon}{N} \right] \)
- (c) \( s = Nk_B \left[ 1 + \ln \frac{\varepsilon}{N} \right] \)


9) For an isolated system, the most probable macro-state is associated with -

- (a) half of the total energy
- (b) highest number of microscopic states
- (c) lowest number of microstates
- (d) not dependent on number of microstates

No, the answer is incorrect.
Score: 0
Accepted Answers:
(b) highest number of microscopic states

10) For a composite system, where the two sub-systems (A and B) are at thermal equilibrium, which of the following condition is true?

No, the answer is incorrect.
Score: 0
Accepted Answers:
(a) $\frac{\partial \ln \Gamma (\varepsilon_A)}{\delta \varepsilon_A} = \frac{\partial \ln \Gamma (\varepsilon_B)}{\delta \varepsilon_B}$