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Courses » **Micro and nano scale energy transport**

Announcements **Course** Forum Progress Mentor

Unit 6 - Week 5

Course outline

How to access the portal ?

Week 1

Week 2

Week 3

Week 4

Week 5

- Fundamentals of statistical thermodynamics part 1
- Fundamentals of statistical thermodynamics part 2
- Fundamentals of statistical thermodynamics part 3
- Quiz : Week 5 Assignment 1
- Feedback for week 5

Week 6

Week 7

Week 8

Week 9

Week 10

Week 11

Week 12

Week 5 Assignment 1

The due date for submitting this assignment has passed. **Due on 2017-09-04, 23:59 IST.**

Submitted assignment

1) The Fermi-Dirac distribution function will approximate Boltzmann distribution when *1 point*

- $E\text{-}\mu >> K_BT$
- $E\text{-}\mu = K_BT = 0$
- $E\text{-}\mu << K_BT$
- $E\text{-}\mu = K_BT$

No, the answer is incorrect.
Score: 0

Accepted Answers:
$E\text{-}\mu >> K_BT$

2) Which of the following is a correct statement *1 point*

- Maxwell- Boltzmann distribution is a classical distribution function
- As the temperature increases, the number distribution function of the phonons approaches maximum value for larger values of frequency
- For hv >> KBT , Bose-Einstein distribution function approximates Boltzmann distribution
- A distribution function gives the information of number of energy carriers which can occupy particular energy state

No, the answer is incorrect.
Score: 0

Accepted Answers:
Maxwell- Boltzmann distribution is a classical distribution function
For hv >> KBT , Bose-Einstein distribution function approximates Boltzmann distribution
A distribution function gives the information of number of energy carriers which can occupy particular energy state

3) The probability of occupancy of the particles is much higher in *1 point*

- Lower energy levels
- Higher energy levels
- Uniformly distributed among energy levels
- Equally in higher and lower energy levels

No, the answer is incorrect.
Score: 0

Accepted Answers:
Lower energy levels

4) Bose-Einstein distribution function is applicable for *1 point*

- Molecules
- Phonons
- Photons
- Electrons

No, the answer is incorrect.
Score: 0

Accepted Answers:
Phonons
Photons

5) The distribution functions for distinguishing particles without any limit of number of particles occupying an energy level are *1 point*

- Bose-Einstein
- Maxwell-Boltzmann
- Fermi-Dirac
- All the above

No, the answer is incorrect.
Score: 0

Accepted Answers:
Maxwell-Boltzmann

6) Statistical thermodynamics deals with **1 point**

- Distribution of the particles in energy levels
- Calculation of macro scale properties using micro states information
- Ensembles of particles in quantum space
- None of the above

No, the answer is incorrect.
Score: 0

Accepted Answers:
Distribution of the particles in energy levels
Calculation of macro scale properties using micro states information
Ensembles of particles in quantum space

7) Using Maxwell-Boltzmann approximation, identify the correct statements for ideal gas system **1 point**
(N- total number of molecules per unit volume K_B - Boltzmann constant R_u – Universal gas constant U- internal energy per unit volume C_v – heat capacity per unit volume)

- $U = 1.5NK_B$
- $U = 1.5NR_uT$
- $C_v = 1.5R_u$
- $U = 1.5NK_BT$

No, the answer is incorrect.
Score: 0

Accepted Answers:
$C_v = 1.5R_u$
$U = 1.5NK_BT$

8) For a diatomic ideal gas system, identify the wrong statements **1 point**

- Only translational kinetic energy contributes to internal energy at lower temperatures
- Both rotational and vibrational energies contributes to internal energy at lower temperatures
- Rotational kinetic energy also contributes to internal energy at higher temperatures
- Translational energy also contributes to internal energy at higher temperatures

No, the answer is incorrect.
Score: 0

Accepted Answers:
Both rotational and vibrational energies contributes to internal energy at lower temperatures

9) While deriving expression for internal energy of phonon gas the following assumptions are considered **1 point**

- Bose-Einstein distribution is used
- Fermi-Dirac distribution is used
- Monoatomic crystalline structure with three acoustic phonons
- Debye approximation

No, the answer is incorrect.
Score: 0

Accepted Answers:
Bose-Einstein distribution is used
Monoatomic crystalline structure with three acoustic phonons
Debye approximation

10) **1 point**

Calculate the number of arrangements (probability Ω) of microstates when 4 carriers are distributed among 3 energy level in the order of 2 in lower energ and 1 each in other energy levels

- 4
- 8
- 12
- 16

No, the answer is incorrect.
Score: 0

Accepted Answers:
12

11) **1 point**

The distribution (n_i in energy level 'i' with energy ε_i) which maximises Ω given as following (where α and β are Langrange multipliers)

- $\exp(\alpha+\beta\varepsilon_i)$

- $\exp(-\alpha+\beta\varepsilon_i)$
- $\exp(-\alpha-\beta\varepsilon_i)$
- $\exp(\alpha-\beta\varepsilon_i)$

No, the answer is incorrect.
Score: 0

Accepted Answers:
$\exp(-\alpha-\beta\varepsilon_i)$

12) Which of the following is true *1 point*

- With increase in ε_i, the number density of the state will decreases
- With increase in ε_i, the number density of the state will increases
- With increase in ε_i, the number density of the state will be uniform
- None of these

No, the answer is incorrect.
Score: 0

Accepted Answers:
With increase in ε_i, the number density of the state will decreases

13) Identify the correct pairs *1 point*

- Micro canonical - isolated system
- Canonical - open system
- Grand canonical - closed system
- Canonical - closed system

No, the answer is incorrect.
Score: 0

Accepted Answers:
Micro canonical - isolated system
Canonical - closed system

14) Langrangian multipliers for canonical ensemble are *1 point*

- $\alpha = 0, \beta = 0$
- $\alpha = K_B T, \beta = 0$
- $\alpha = 0, \beta = K_B T$
- $\alpha = 0, \beta = (K_B T)^{-1}$

No, the answer is incorrect.
Score: 0

Accepted Answers:
$\alpha = 0, \beta = (K_B T)^{-1}$

15) Choose the correct statements *1 point*

- Bose Einstein distribution – phonons
- Fermi Dirac distribution – electrons
- Maxwell Boltzmann distribution – ideal gas
- Fermi Dirac distribution – photons

No, the answer is incorrect.
Score: 0

Accepted Answers:
Bose Einstein distribution – phonons
Fermi Dirac distribution – electrons
Maxwell Boltzmann distribution – ideal gas

Previous Page End