

Unit 8 - Week 6

Course outline
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<input type="radio"/> Lecture 26: Ideal Gas of Diatomic Molecules: Microscopic Expression for Rotational and Vibrational Entropy and Specific Heat Part 4
<input checked="" type="radio"/> Lecture 27: Ideal Gas of Polyatomic molecules
<input type="radio"/> Lecture 28: Cluster Expansion and Mayer's Theory of Condensation Part 1
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<input checked="" type="radio"/> Lecture 30: Cluster Expansion and Mayer's Theory of Condensation Part 3
<input checked="" type="radio"/> Quiz : Assignment 6
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Assignment 6

The due date for submitting this assignment has passed.
As per our records you have not submitted this assignment.

Due on 2020-10-28, 23:59 IST.

- 1) The Hamiltonian of a system consists of contributions from three different modes and is written as $H = H_x + H_y + H_z$. If Q_x , Q_y , and Q_z be the corresponding partition functions, the partition function of the system can be written as
- (a) $Q = Q_x + Q_y + Q_z$
 (b) $Q = Q_x \times Q_y \times Q_z$
 (c) $Q = Q_x \times Q_y + Q_z$
 (d) $Q = Q_x + Q_y + Q_z$
- (a)
 (b)
 (c)
 (d)
- No, the answer is incorrect.
Score: 0
Accepted Answers: (b)
- 2) The molecular partition function for a system in which the energy levels are equispaced by ϵ is
- (a) $\frac{1}{1 - e^{-\epsilon/k_B T}}$
 (b) $\frac{1}{1 + e^{-\epsilon/k_B T}}$
 (c) $\frac{1}{1 + e^{\epsilon/k_B T}}$
 (d) $\frac{1}{1 - e^{-\epsilon/k_B T}}$
- (a)
 (b)
 (c)
 (d)
- No, the answer is incorrect.
Score: 0
Accepted Answers: (d)
- 3) The rotational partition function of a diatomic molecule with rotational energy levels corresponding to $J=0$ and 1, is (where, $\epsilon = \frac{h^2}{8\pi^2 I k_B T}$)
- (a) $1 + 3e^{-2\epsilon}$
 (b) $1 + e^{-2\epsilon}$
 (c) $1 + 3e^{-\epsilon}$
 (d) $1 + 2e^{-2\epsilon}$
- (a)
 (b)
 (c)
 (d)
- No, the answer is incorrect.
Score: 0
Accepted Answers: (a)
- 4) The characteristic rotational temperatures for NO_2 are 11.5 K, 0.624 K and 0.590 K. What is the rotational partition function at 300 K?
- 2525.5
 4474.8
 2237.4
 438.06
- No, the answer is incorrect.
Score: 0
Accepted Answers: 2237.4
- 5) For two-dimensional harmonic oscillator, average energy according to equipartition principle is
- $3k_B T$
 $2k_B T$
 $5k_B T$
 $k_B T$
- No, the answer is incorrect.
Score: 0
Accepted Answers: $2k_B T$
- 6) $Q(N, V, \beta) = \frac{1}{N!} \left[\frac{2\pi m}{h^2 \beta} \right]^{3N/2} (V - Nb)^N e^{-\beta a \frac{N^2}{V}}$, where a , b are constants and $\beta = \frac{1}{k_B T}$
- (a) $\left(P + \frac{N^2 a}{V^2} \right) (V - Nb) = N k_B T$
 (b) $\left(P + \frac{N^2 a}{V^2} \right) V = N k_B T$
 (c) $P(V - Nb) = N k_B T$
 (d) $PV = N k_B T$
- (a)
 (b)
 (c)
 (d)
- No, the answer is incorrect.
Score: 0
Accepted Answers: (a)
- 7) For the non-interacting case, Mayer f-function is
- >1
 1
 -1
 0
- No, the answer is incorrect.
Score: 0
Accepted Answers: 0
- 8) At $T = 300$ K, the thermal energy ($k_B T$) in cm^{-1} is approximately,
- 5000
 200
 8000
 20000
- No, the answer is incorrect.
Score: 0
Accepted Answers: 200
- 9) The second virial coefficient of van der Waals gas is temperature dependent.
- True
 False
- No, the answer is incorrect.
Score: 0
Accepted Answers: True
- 10) The total number of states consistent with lattice energy ϵ in two-dimensions for one particle of mass ' m ' within a square box of side length ' a ' is
- (a) $\frac{\pi}{6} \left(8ma^2 \epsilon / h^2 \right)$
 (b) $\frac{\pi}{4} \left(8ma^2 \epsilon / h^2 \right)$
 (c) $\frac{\pi}{6} \left(8ma^2 \epsilon / h^2 \right)^{3/2}$
 (d) $\frac{\pi}{4} \left(8ma^2 \epsilon / h^2 \right)$
- (a)
 (b)
 (c)
 (d)
- No, the answer is incorrect.
Score: 0
Accepted Answers: (b)