# Unit 8 - Week 6



## 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 $H = H_t + H_r + H_v$. If $Q_t$, $Q_r$ and $Q_v$ be the corresponding partition functions, the partition function of the system can be written as *1 point*

(a) $Q = Q_t + Q_r + Q_v$

(b) $Q = Q_t \times Q_r \times Q_v$

(c) $Q = Q_t \times Q_r + Q_v$

(d) $Q = Q_t + Q_r \div Q_v$

- (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 *1 point*

(a) $\frac{1}{1-e^{\varepsilon/k_BT}}$

(b) $\frac{1}{1+e^{-\varepsilon/k_BT}}$

(c) $\frac{1}{1+e^{\varepsilon/k_BT}}$

(d) $\frac{1}{1-e^{-\varepsilon/k_BT}}$

- (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, $\varepsilon = \frac{h^2}{8\pi^2 I k_B T}$) *1 point*

(a) $1+3e^{-2\varepsilon}$

(b) $1+e^{-2\varepsilon}$

(c) $1+3e^{-3\varepsilon}$

(d) $1+2e^{-2\varepsilon}$

- (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? *1 point*

- 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 *1 point*

- $3k_BT$
- $2k_BT$
- $5k_BT$
- $k_BT$

No, the answer is incorrect.
Score: 0
Accepted Answers:
*$2k_BT$*

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 $\beta = \frac{1}{k_BT}$ *0 points*

(a) $\left(P+\frac{N^2a}{V^2}\right)(V-Nb) = Nk_BT$

(b) $\left(P+\frac{N^2a}{V^2}\right)V = Nk_BT$

(c) $P(V-Nb) = Nk_BT$

(d) $PV = Nk_BT$

- (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 point*

- >1
- 1
- -1
- 0

No, the answer is incorrect.
Score: 0
Accepted Answers:
*0*

8) At T = 300 K, the thermal energy ( $k_BT$ ) in $cm^{-1}$ is approximately, *1 point*

- 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. *1 point*

- True
- False

No, the answer is incorrect.
Score: 0
Accepted Answers:
*True*

10) The total number of states consistent with lattice energy $\varepsilon$ in two-dimensions for one particle of mass '$m$' within a square box of side length "$a$' is *1 point*

(a) $\frac{\pi}{6}\left(8ma^2\varepsilon/\hbar^2\right)$

(b) $\frac{\pi}{4}\left(8ma^2\varepsilon/\hbar^2\right)$

(c) $\frac{\pi}{6}\left(8ma^2\varepsilon/\hbar^2\right)^{3/2}$

(d) $\frac{\pi}{4}\left(8ma^2\varepsilon/\hbar^2\right)$

- (a)
- (b)
- (c)
- (d)

No, the answer is incorrect.
Score: 0
Accepted Answers:
*(b)*