Group - B (Maruf Ali, Ashutosh mali, Yash Yadaw, Yashwant)

46/50

DEPARTMENT OF PHYSICS , C.M.Dubey P.G College Bilaspur
M.Sc Physics Sem-III, ASSIGNMENT ON STATISTICAL MECHANICS

NOTE: The students are directed to form a group of four for submission of this assignment. The students have to submit their respective groups. The MCQ's are to answered giving proper explanation. In each group, the students have to highlight their contribution in solving the questions. Appropriate HINTS have been provided for assistance in solving the MCQ's, if necessary. Q. No 1-19 carry 2 marks and Q.No 20-23 carry 3 marks. The last date of submitting the assignment is 6-10-2022. TOTAL MARKS=50

1. **The direction of a spontaneous process for a system at constant pressure (P) and temperature (T) is given by**

- $d(U-TS+PV)\geq 0$
- $d(U-TP+VS)\leq 0$
- ✓ $d(U-TS+PV)\leq 0$
- $d(U-TP-VS)\geq 0$

HINT: The direction of a spontaneous process for a system at constant pressure (P) and temperature (T) generally is dictated by the lowering of free energy i.e. $\Delta G_{P,T}\leq 0$.

2. **A box contains red and white marbles. Two marbles are chosen one by one, without replacement. The probability of selecting a red marble and then a white marble is x, and the probability of selecting a red marble on the first draw is y. The probability of selecting a white marble on the second draw, given that the first marble drawn was red is**

- ✓ x/y
- y/x
- x.y
- x+y

HINT: Probability of selecting a red marble on the first draw is P (A)= y
Probability of selecting a red marble and then a white marble is P (A, B) =x
Probability of selecting a white marble on the second draw, given that the first marble drawn was red is P (B|A).

red white (P(A) =

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3. **Suppose you have n dice, each a different colour, all unbiased and 6-sided. Given 2 distinguishable dice, what is the probability of the most probable sum of their face values on a given throw of the pair?**

- 2/3
- 7/36
- 1/36
- 1/6

HINT: Total number of sample space on throwing two unbiased dice is 6*6=36. Given 2 distinguishable dice, calculate the number of ways we can obtain sum of their face values for a throw of the pair. Form a table showing probable sum, possible ways and probability.

4. **If an unbiased green coin and an unbiased red coin are flipped 5 times each, what is the probability of getting 4 red heads and 2 green tails?**

- 50/216
- 25/216
- 25/512
- 50/512

HINT: Use the multiplication rule, N! / r! (n-r)! , P(H)=1/2, P(T)=1/2

5. **Three unbiased coins are tossed. The probability of getting at most two heads is**

- 3/4
- 1/4
- 3/8
- 7/8

HINT: To obtain the probability of getting at most two heads we need to take the sum of all the probabilities i.e., probability of getting zero head + probability of getting one head +probability of getting two heads.

6. **Time average of a dynamical quantity X is defined as**

- $\bar{X} = \lim_{\tau \to \infty} \frac{1}{\tau} \int_{t_0}^{t_0+\tau} ds X(s)$
- $\bar{X} = \lim_{\tau \to \infty} \frac{1}{\tau} \int_{t_0}^{t_0+\tau} ds X(s)$
- $\bar{X} = \lim_{\tau \to 0} \frac{1}{\tau} \int_{t_0}^{t_0+\tau} ds X(s)$
- $\bar{X} = \lim_{\tau \to \infty} \frac{1}{\tau} \int_{t_0}^{t_0+\tau} ds \langle X(s) \rangle$

7. **The entropy of the universe, for a reversible process, remains constant.**

- True
- False

HINT : The total entropy change of the universe for a reversible process is sum of entropy change for system + entropy change in surroundings.

8. **For a system being separated from its surrounding by an impermeable diathermal rigid wall, the state of the system can be completely defined in terms of the following three variables:**

- T, P, N
- T, V, N
- U, V, N
- S, V, N

HINT: When a system is separated from its surrounding by an impermeable, diathermal, rigid wall, then particle exchange and work exchange through volume changes are completely restricted.

9. **A box contains 2 white, 3 red and 2 purple balls. Two balls are drawn at random. What is the probability that none of the balls drawn is purple?**

- 10/21
- 11/21
- 2/7
- 5/7

10. **The phase space dimensions of a system of N particles in three-dimensions is**

- 6N
- 3N
- 9N
- 2N

11. **Equal a priori principle is valid only in**

- Grand canonical ensemble
- Canonical ensemble
- Micro-canonical ensemble
- Isothermal-Isobaric ensemble

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12. Number of ways we can rearrange N number of adsorbed molecules on the solid surface having M number of lattice sites

a) $\frac{N!}{M!(N-M)!}$ b) $\frac{M!}{N!(M-N)!}$ c) $\frac{N!}{(N+M)!}$ d) $\frac{M!}{N!(N-M)!}$

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

13. According to Stirling's approximation:

(a) $\ln N! \approx N\ln\left(\frac{1}{N}\right)$

(b) $\ln N! \approx N\ln N$

(c) $\ln N! \approx N\ln N + N$

(d) $\ln N! \approx N\ln N - N$

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

14. Which of the following relations between pressure P and the micro-canonical partition function W, is true?

(a) $P = -\left(\frac{\partial\Omega}{\partial V}\right)_{E,N}$

(b) $P = -k_B T \ln\Omega$

(c) $P = k_B T\left(\frac{\partial \ln\Omega}{\partial V}\right)_{E,N}$

(d) $P = k_B T^2\left(\frac{\partial \ln\Omega}{\partial V}\right)_{E,N}$

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

HINT: A small variation in entropy due to small variations in control variables E, N and V leads to a relation well-known in thermodynamics.

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15. **For a free particle of mass '*m*' with initial coordinate x_0, p_0 the equation of motion (i.e. with the progress of time '*t*') is**

a) $x(t) = x_0$ b) $x(t) = 0$ c) $x(t) = x_0 t$ d) $x(t) = x_0 + \frac{p_0 t}{m}$

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

HINT: Use Hamilton's equation of motion

16. **Six distinguishable particles are distributed over three non-degenerate levels of energies 0, e and 2e. The total energy of the distribution for which the probability is a maximum, is**

- 10 ε
- 6 ε
- 4 ε
- 0 ε

HINT. Since the levels are non-degenerate, there is only one state associated with each energy. Let, the number of particles in the three energy states be N1, N2 and N3 respectively.

17. **A system of N non-interacting and distinguishable particles of spin 1 is in thermodynamic equilibrium. The entropy of the system is**

(a) $Nk_B \ln 3$

(b) 0

(c) $3k_B \ln N$

(d) $Nk_B \ln 2$

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

HINT: Count the no of microstates

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18. Consider two systems *A* and *B* each having two distinguishable particles. In both the systems, each particle can exist in states with energies 0, e, 2e and 3e with equal probability. The total energy of the combined system is 5e. Assuming that the system *A* has energy 3e and the system *B* has energy 2e, the entropy of the system is

(a) $k_B \ln 6$

(b) $k_B \ln 12$

(c) $k_B \ln 30$

(d) $k_B \ln 24$

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

HINT: Let's consider the two distinguishable particles of System A are denoted by P and Q, while those of System B are represented by R and S respectively. The number of ways in which four distinguishable particles (2 for system A and 2 for system B) can be distributed in four energy states 0, e, 2e and 3e with equal probability, such that the total energy of the combined system is 5e (the energy of System A be 3e and the energy of System B be 2e), is to be calculated.

19. The entropy(*S*) of a system as a function its internal energy (*E*) is given by $S(E) = aE(E_0 - E)$ where *a* and E_0 are positive constants. The temperature of the system is

- zero.
- increases monotonically with energy.
- negative for some energies.
- decreases monotonically with energy.

HINT: Use the definition of temperature in terms of entropy

20. Five identifiable particles are distributed in three non-degenerate levels with energies 0, e and 2e. If the number of particles occupying the three energy states be N_1, N_2 and N_3, the most probable distribution for a total energy 3e is

- $N_1 = 3$, $N_2 = 1$ and $N_3 = 1$
- $N_1 = 2$, $N_2 = 2$ and $N_3 = 1$
- $N_1 = 4$, $N_2 = 1$ and $N_3 = 0$
- $N_1 = 2$, $N_2 = 1$ and $N_3 = 2$

21.

For a one-dimensional harmonic oscillator of mass m and frequency ω , the canonical partition is

(a) $Q = \frac{k_B T}{\omega}$

(b) $Q = k_B T$

(c) $Q = \frac{T}{\omega}$

(d) $Q = \frac{k_B T}{\hbar \omega}$

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

22.

For a classical system having N indistinguishable particles, which have coordinates q_i and momenta p_i, partition function is given by

(a) $\frac{1}{h^{3N} N!} \int d^{3N} p \, d^{3N} q \, e^{-\beta H(p,q)}$

(b) $\frac{1}{h^{3N}} \int d^{3N} p \, d^{3N} q \, e^{-\beta H(p,q)}$

(c) $\frac{1}{h^{N}} \int d^{N} p \, d^{N} q \, e^{-\beta H(p,q)}$

(d) $\frac{1}{h^{N} N!} \int d^{N} p \, d^{N} q \, e^{-\beta H(p,q)}$

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

23.

Consider a container divided into two chambers, one chamber of volume V_1 having N_1 molecules of a monatomic ideal gas at temperature T and pressure P, and the other chamber of volume V_2 having N_2 molecules of a *different* monatomic gas at the *same* temperature and pressure. If the partition between the two chambers is now removed, what is the overall change in the entropy?

(a) $\Delta S = N_1 k_B \ln\left(\frac{V_1}{N_1}\right) + N_2 k_B \ln\left(\frac{V_2}{N_2}\right)$

(b) $\Delta S = N_1 k_B \ln\left(\frac{N_1}{V_1}\right) + N_2 k_B \ln\left(\frac{N_2}{V_2}\right)$

(c) $\Delta S = N_1 k_B \ln\left(\frac{V_1 + V_2}{N_1 + N_2}\right) + N_2 k_B \ln\left(\frac{V_1 + V_2}{N_1 + N_2}\right)$

(d) $\Delta S = N_1 k_B \ln\left(\frac{V_1 + V_2}{V_1}\right) + N_2 k_B \ln\left(\frac{V_1 + V_2}{V_2}\right)$

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

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swer - (1). (c). $d(U - TS + PV) \leq 0$.

he Spontaneous process for a system at constant pressure (P) and temparature (T) is determines by gibbs free energy. In the spontaneous process system evolves with time and it releases free energy and it moves to lower or more thermodynamically stable energy state. Gibbs free energy -

$$G \equiv H - TS.$$

$$= U + PV - TS.$$

(at constant P and T).

$$dG = dU - TdS + PdV \leq 0.$$

$$dG \leq 0.$$

G either decreases (spontaneously) or is constant (equilibrium).

- Ashutosh mali.

2

Answer No. - (2). (a). x/y.

2

probability of selecting a red marble on the first draw.

is $P(A) = y$.

Probability of selecting a red marble and then a white is $P(A,B) = x$.

Probability of selecting a white marble on the second draw, given that the first marble drawn was red is $P(B|A)$.

By applying the formula of conditional probability.

$$P(B|A) = \frac{P(A \text{ and } B)}{P(A)}.$$

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- Yash Yadav.

②

Answer - 15. d). $x(t) = x_0 + \frac{P_0 t}{m}$. ✓ ②

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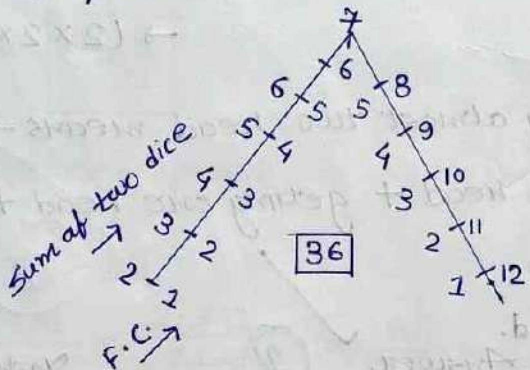
P.T.O. →

Answer - (3). d. $\frac{1}{6}$

we have two dice, total number of sample space on throwing two unbiased dice is $6 \times 6 = 36$.

by chart we calculate the sum of their face values for a throw of the pair.



the sum 7 has 6 favorable cases, therefore the most probable sum of their face values on a given throw of pair will be -

$= \frac{6}{36} = \frac{1}{6}$.

(2)

- Maroof Ali
- Ashutosh

Answer. (4). c. $\frac{25}{512}$

probability formula - $\frac{^nC_r}{2^n}$.

(i). Red coin -

for 4 red heads by flipping the coin 5 times

$\frac{^5C_4}{2^5} = 5/32$

(ii). Green coin -

for 2 green tails by flipping the coin 5 times

$\frac{^5C_2}{2^n} = \frac{10}{32}$.

So, the total probability of getting 4 red heads and 2 green tails will be -

$\frac{5}{32} \times \frac{10}{32} = \frac{25}{512}$.

(2)

- Yashwant Kumar Sidar

Answer -(5). 3 coins are tossed together is equal to is tossed 3 times.

Sample space of coin :-

1 coin → {H, T}

2 coins → {H,H, HT, TH, TT} → (2×2) = 4.

3 coins → or 1 coin of 3 times {HHH, HHT, HTH, THH, HTT, THT, TTH, TTT}

→ (2×2×2) = 8.

The probability of getting almost two head means → (possible outcome of zero head + getting one head + getting two heads)

So, $P(\text{at most } 2H) = \boxed{\frac{7}{8}}$ d. Answer.

(2)

Yashwant Kumar Sidar.

Answer :- (6). A.

Time average of dynamical quantity :-

$$\bar{X} = \lim_{\tau \to \infty} \frac{1}{\tau} \int_{t_0}^{t_0+\tau} ds\, X(s).$$

where, $X(s)$ is the function of phase points.

τ is the time interval.

(2)

- Maruf Ali

Answer No:- 7. True.

The second law of thermodynamics states that in a reversible process, the entropy of the universe is constant.

(2)

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- Yash Kumar Yadav.

Answer-8 d. S, V, N (b T, V, N

System is separated from its surroundings by impermeable, diathermal, rigid wall so, Volume and number of particles will be constant. If temparature of the system is increased while the volume remains constant, the energy of the system is increased and there is an increase in thermal entropy but no change in concentration and no change in configurational entropy. (All)

Answer-9 A. $\frac{10}{21}$

2 white, 3 Red, 2 purple

3 conditions:-

$$\frac{{}^2C_1 \cdot {}^3C_1 \cdot {}^2C_0}{{}^7C_2} = \frac{2\cdot 3\cdot 1}{21} = \frac{6}{21}.$$

$$\frac{{}^2C_2 \cdot {}^3C_0 \cdot {}^2C_0}{21} = \frac{1}{21}.$$

$$\frac{{}^2C_0 \cdot {}^3C_2 \cdot {}^2C_0}{21} = \frac{3}{21}.$$

So, $\frac{6}{21} + \frac{1}{21} + \frac{3}{21} = \frac{10}{21}.$ ✓ (2)

- Yash Yadav

Answer No. 10. (a). 6N (2) - Yash Yadav.

Answer No. 11. (3). microcanonical ensemble (2) - Maruf Ali

Answer No.-12. ~~a. $\frac{N!}{M!(N-M)!}$~~ $\frac{M!}{N!(M-N)!}$ Correct (2)

- Ashutosh Mali

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Answer-13 (d). $\ln N! \approx N\ln N - N$. ② - Yashu

The stirling formula or stirling approximation formula is used the approximate value for function ($n!$) It maks finding out the factorial of larger number

Answer:-14. (c). $P = K_B T\left(\frac{\partial \ln \Omega}{\partial V}\right)_{E,N}$ - Yashu

By Euler Equation

$$E = TS - PV + \mu N.$$

$$\left(\frac{\partial E}{\partial S}\right)_{V,N} = T;\ \left(\frac{\partial E}{\partial V}\right)_{S,N} = -P \text{ and } \left(\frac{\partial E}{\partial N}\right)_{S,V} = \mu.$$

(make a small variation in entropy due to small variations in control variables E, V, N). by calculating we will get the

$$\frac{1}{T} = K_B\left(\frac{\partial \ln \Omega}{\partial E}\right)_{V,N} \Big| \frac{P}{T} = \left(\frac{\partial S}{\partial V}\right)_{N,E} = K_B\left(\frac{\partial \ln \Omega}{\partial V}\right)_{E,N}$$ ②

Answer-16. b. 6e.

Six distinguishable particles are distributed over there non-degenerate level, Since the levels are non-degenerate there is only one state associated with each energy. Let the number of the particles is 3 energy state be $N_1; N_2$ and N_3 respectively. where, $N_1 + N_2 + N_3 = 6$.

As the particles are distinguishable, the number of microstates the number of ways of choosing N_1, N_2 and N_3 particles from 6 particles is -

$$W = \frac{6!}{N_1!\, N_2!\, N_3!}$$

W = It is maximum when $N_1!\,N_2!\,N_3!$ is minimum where,

$N_1 = N_2 = N_3 = 2$.

The corresponding total energy of distribution is

$$= 0 \times N_1 + \epsilon \times N_2 + 2\epsilon \times N_3.$$

$$= 6e.$$

②

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- maruf Ali

No. - 17 | (a). $NK_B \ln 3$.

Calculating the number of microstates -

$\Omega = (2S+1)^N = 3^N$ (for N number of particles).

so, by entropy Eq^n $S = K_B \ln \Omega$.

$S = NK_B \ln 3$. ✓ (2)

- Ashutosh mali.

Answer No. - 18 | (b). $K_B \ln 12$

System A → a, b. $E_A = 3$ units, $E_B = 2$ units

System B → c, d. $E_A + E_B = 5$ units. (by entropy equation)

for A, Entropy, $S_A = K_B \ln \lambda_A$ ∴ λ_A → No. of microstates of the system A.

λ_B → No. of microstates of the system B.

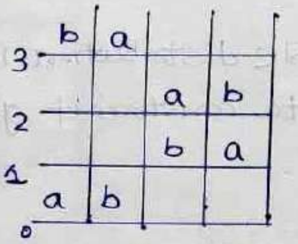
$\therefore S = S_A + S_B$.

$= K_B \ln \lambda_A + K_B \ln \lambda_B$.

$= K_B[\ln \lambda_A + \ln \lambda_B]$.

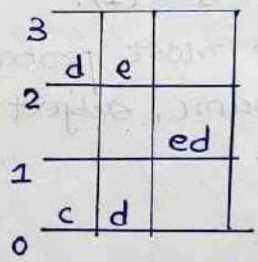
$\Rightarrow K_B \ln \lambda = K_B[\ln \lambda_A \lambda_B]$.

$\lambda = \lambda_A \times \lambda_B$.



$E_A = 3$ units

$\lambda_A = 4$



$E_B = 2$ unit

$\lambda_B = 3$

total number of microstate will be 12.

so, Entropy $= K_B \ln 12$. (2) (not solved)

Answer - (19). | C. negative for some energies. | - Ashutosh

by the thermodynamic relation :-

$dU = TdS - PdV + \mu dN$.

and $\left.\frac{dS}{dE}\right|_{V,N} = \frac{1}{T}$

so, $S = aE(E_0 - E)$.

$a(E_0 - E) + aE(-1) = -2aE + aE_0$.

$T = \frac{1}{a(E_0 - 2E)}$.

for some energies $E > E_0$.

and therefore Temperature (-ve) will be negative. so the answer C.

negative for some energies. (2)

Answer-20. A. $N_1=3$, $N_2=1$ and $N_3=1$

As the levels are non-degenerate there is only one state for energy.

Let the number of particles occupying the 3 energy states be N_1, N_2, and N_3 respectively. where,

$N_1+N_2+N_3=5$.

The particles are identifiable, the number of ways of choosing the particles is

$$W=\frac{5!}{N_1!\,N_2!\,N_3!}$$

The energy of system is -

$0\times N_1+E\times N_2+2E\times N_3=3E$ (given).

$N_2+2N_3=3$ — (1).

Now the most probable distribution is the one which W is a maximum, subject to constraint given by equation-(1).

Thus if-

$N_2=1$,

$N_3=\frac{(3-1)}{2}=1$.

and $N_1=5-(N_1+N_2)=5-2=3$.

if $N_2=3$, $N_3=0$.

and $N_1=5-(3+0)=2$.

No other distribution are possible for $N_1=3$, $N_2=1$, and $N_3=1$.

$W=\frac{5!}{3!}=20$.

So, most probable distribution is -

$N_1=3$, $N_2=1$, $N_3=1$.

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(not solved)

Q.21 **d**

using general partition function

$$Z = \sum_{n=0}^{x} g_j e^{-\beta E_s}.$$

By using the energy of simple harmonic oscillator

$$E = \frac{P_x^2}{2m} + \frac{1}{2} kx^2$$

Let $E = E_s$

And the volume in phase space is $dx\,dP_x$ and density of states [no. of phase points] $g_j = \frac{dx\,dP_x}{h}$

further solving the general partition fu^n using above values, it gives

$$Z = \frac{K_B T}{\hbar\omega}$$

or $$Q = \frac{K_B T}{\hbar\omega}$$

how

- Yashwant Kumar
- maruf ali.

Ans. 22 → (a)

If there is N distinguishable particles in classical system & the coordinates q_i and momenta p_i

The partition function is given by

$$'Z' = \frac{1}{h^{3N} N!} \int d^{3N}p \cdot d^{3N}q \cdot e^{-\beta H(p,q)}$$

where $\beta = \frac{1}{K_B T}$

& H is classical hamiltonian.

Here we use 'N!' factor because the particles in classical system are indistinguishable.

– Ashutosh mali.

Ans. No. 23 → d.

– Yashwant
– Marut Ali

Given that the container divided into 2 chamber 1st have volume V_1 & N_1 particles of a monoatomic gas; at temp. 'T' & pressure 'P'

& the 2nd chamber having volume V_2 & N_2 particles of different monoatomic gas. having same temperature 'T' & pressure 'P' as 1st chamber.

V_1 N_1	V_2 N_2
T P	T P

Before mixing

V_1+V_2	N_1+N_2
T	P

After mixing.

$V = V_1 + V_2$

If the partition is removed the total change in entropy will

$S_T = S_1 + S_2$

Volume change V after mixing

but no. of particle doesn't mix with each other

$$S_1 = N_1 K_B \ln V_1 + \frac{3}{2} N_1 K_B \left[1 + \ln \frac{2\pi m_1 K_B T}{h_0^2}\right]$$

[entropy of 1st chamber]

& $$S_2 = N_2 K_B \ln V_2 + \frac{3}{2} N_2 K_B \left[1 + \ln \frac{2\pi m_2 K_B T}{h_0^2}\right]$$

[entropy for 2nd chamber]

Now $S_T = S_1 + S_2$ [Entropy of composite system before mixing]

$$= \sum_{i=1}^{2} S_i$$

$$= \sum_{i=1}^{2} N_i K_B \ln V_i + \frac{3}{2} N_i K_B \left[1 + \ln \frac{2\pi m_i K_B T}{h_0^2}\right]$$

Entropy after mixing is

$$S_T = \sum_{i=1}^{2} N_i K_B \ln V + \frac{3}{2} N_i K_B \left[1 + \ln \frac{2\pi m_i K_B T}{h_0^2}\right]$$

Then the total change in entropy

$$\Delta S = S_T - \sum_{i=1}^{2} S_i$$

$$= \sum_{i=1}^{2} N_i K_B \ln V - \sum_{i=1}^{2} N_i K_B \ln V_i$$

$$= N_1 K_B \ln V - N_1 K_B \ln V_1 + N_2 K_B \ln V - N_2 K_B \ln V_2$$

$$= N_1 K_B \ln \left(\frac{V}{V_1}\right) + N_2 K_B \ln \frac{V}{V_2}$$

$$= N_1 K_B \ln \left(\frac{V_1 + V_2}{V_1}\right) + N_2 K_B \ln \left(\frac{V_1 + V_2}{V_2}\right)$$

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Peer Assessment

Class: M.Sc. Physics Semester-III Date: 6/1/22

Name of the Student: Tanishka Rathore

Title of the Presentation: Macrostate, microstate

Category	Scoring Criteria	Total Points	Score
Organization (10 points)	Information is presented in a logical sequence.	5	3
	Whether outline of the presentation was highlighted.	5	2
Content (15 points)	Introduction is attention-getting.	5	3
	Technical terms are well-defined in language appropriate for the target audience.	5	3
	There is an obvious conclusion summarizing the presentation.	5	2
Presentation (25 points)	Speaker maintains good eye contact with the audience and is appropriately animated (e.g., gestures, moving around, etc.).	5	3
	Speaker uses a clear, audible voice.	5	4
	Delivery is controlled and smooth.	5	4
	Good language skills and pronunciation are used.	5	3
	Length of presentation is within the assigned time limits.	5	5
Score	**Total Points**	**50**	33

Assessed by:

Name of Students	Signature
Ashutosh Mali	Ashu.
Manjul Kiran	M Kiran
~~Tanishka Rathore~~	~~Tanishka~~
SUNAYNA TOPPO	Sunayna
Sadanani	Gupta
Trileshwar	[illegible]
Ayush.	Ayush.

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Bilaspur (C.G.)

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C. M. Dubey Post Graduate College

Peer Assessment

Class: M.Sc. Physics Semester-III Date: 06/08/22

Name of the Student: Ashutosh Mali

Title of the Presentation: LASER

Category	Scoring Criteria	Total Points	Score
Organization (10 points)	Information is presented in a logical sequence.	5	4
	Whether outline of the presentation was highlighted.	5	4
Content (15 points)	Introduction is attention-getting.	5	3
	Technical terms are well-defined in language appropriate for the target audience.	5	4
	There is an obvious conclusion summarizing the presentation.	5	3
Presentation (25 points)	Speaker maintains good eye contact with the audience and is appropriately animated (e.g., gestures, moving around, etc.).	5	3
	Speaker uses a clear, audible voice.	5	3
	Delivery is controlled and smooth.	5	3
	Good language skills and pronunciation are used.	5	4
	Length of presentation is within the assigned time limits.	5	4
Score	Total Points	50	35

Assessed by:

Name of Students	Signature
Sadanani	Gupta
Gagandeep	Gagan
SUNAYNA TOPPO	Sunayna
Manju Kiran Yadav	M Kiran
Ayush + Trilochan	Ayush
Tanisha Rathore	Tanisha

T.S. T.S. [illegible]

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Peer Assessment

Class: M.Sc. Physics Semester-III Date: 6/8/22

Name of the Student: Manjul Kiran Yadav

Title of the Presentation: Harmonic Perturbation

Category	Scoring Criteria	Total Points	Score
Organization (10 points)	Information is presented in a logical sequence.	5	4
	Whether outline of the presentation was highlighted.	5	3
Content (15 points)	Introduction is attention-getting.	5	4
	Technical terms are well-defined in language appropriate for the target audience.	5	2
	There is an obvious conclusion summarizing the presentation.	5	3
Presentation (25 points)	Speaker maintains good eye contact with the audience and is appropriately animated (e.g., gestures, moving around, etc.).	5	3
	Speaker uses a clear, audible voice.	5	3
	Delivery is controlled and smooth.	5	4
	Good language skills and pronunciation are used.	5	4
	Length of presentation is within the assigned time limits.	5	4
Score	**Total Points**	**50**	34

Assessed by:

Name of Students	Signature
Ashutosh Mali.	Omali.
Sadanani	Gupta
Gagandeep	Gaga
SUNAYNA TOPPO	Sunayna
Manjul Kiran	[illegible]
Ayush Kumar Sarkar	Ayush.

T.S. [illegible] [illegible]

[illegible signature]

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Class: M.Sc. Physics Semester-III Date: 06/08/2022

Name of the Student: Trileshwar Singh Rajput

Title of the Presentation: Introduction of Solid State (Part - II)

Category	Scoring Criteria	Total Points	Score
Organization (10 points)	Information is presented in a logical sequence.	5	4
	Whether outline of the presentation was highlighted.	5	4
Content (15 points)	Introduction is attention-getting.	5	4
	Technical terms are well-defined in language appropriate for the target audience.	5	4
	There is an obvious conclusion summarizing the presentation.	5	3
Presentation (25 points)	Speaker maintains good eye contact with the audience and is appropriately animated (e.g., gestures, moving around, etc.).	5	4
	Speaker uses a clear, audible voice.	5	4
	Delivery is controlled and smooth.	5	3
	Good language skills and pronunciation are used.	5	3
	Length of presentation is within the assigned time limits.	5	4
Score	Total Points	50	37

Assessed by:

Name of Students	Signature
Ashutosh Mal	Omal
Sadanani	Gupta
Gagandeep	Gaga
Manjul Kiran	Kiran
Tanisha R. khore	Tanisha
SUNAYNA TOPPO	Sunayna
Ayush	Ayush

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Class: M.Sc. Physics Semester-III Date: 6/08/2022

Name of the Student: Gagandeep Singh Arora

Title of the Presentation: Bloch Theorem & Block function

Category	Scoring Criteria	Total Points	Score
Organization (10 points)	Information is presented in a logical sequence.	5	3
	Whether outline of the presentation was highlighted.	5	3
Content (15 points)	Introduction is attention-getting.	5	4
	Technical terms are well-defined in language appropriate for the target audience.	5	3
	There is an obvious conclusion summarizing the presentation.	5	3
Presentation (25 points)	Speaker maintains good eye contact with the audience and is appropriately animated (e.g., gestures, moving around, etc.).	5	5
	Speaker uses a clear, audible voice.	5	4
	Delivery is controlled and smooth.	5	3
	Good language skills and pronunciation are used.	5	4
	Length of presentation is within the assigned time limits.	5	2
Score	**Total Points**	**50**	34

Assessed by:

Name of Students	Signature
Ashutosh Mali	Omali.
SUNAYNA TOPPO	Sunayna
Tailesh[illegible]	[illegible]
N. Manju Kiran	N Kiran
Sadawani	Gupta
T. S. Rajput	[illegible]
Ayush	Ayush.

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Class: M.Sc. Physics Semester-III Date: 06/08/2022

Name of the Student: Ayush Kumar Sarkar

Title of the Presentation: Explaination of Ensemble

Category	Scoring Criteria	Total Points	Score
Organization (10 points)	Information is presented in a logical sequence.	5	4
	Whether outline of the presentation was highlighted.	5	3
Content (15 points)	Introduction is attention-getting.	5	4
	Technical terms are well-defined in language appropriate for the target audience.	5	4
	There is an obvious conclusion summarizing the presentation.	5	3
Presentation (25 points)	Speaker maintains good eye contact with the audience and is appropriately animated (e.g., gestures, moving around, etc.).	5	4
	Speaker uses a clear, audible voice.	5	4
	Delivery is controlled and smooth.	5	3
	Good language skills and pronunciation are used.	5	3
	Length of presentation is within the assigned time limits.	5	4
Score	Total Points	50	36

Assessed by:

Name of Students	Signature
Ashutosh Mali	Omali.
Gagandeep Singh	Gagan
~~Aayush~~ Trilochan	[illegible]
Mayul Kiran	M Kiran
Tanistha Rathore	Tanistha
Sadanani	Gupta
SUNAYNA TOPPO	Sunayna

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Class: M.Sc. Physics Semester-III Date: 06/08/22

Name of the Student: SUNAYNA TOPPO

Title of the Presentation: PHASE SPACE

Category	Scoring Criteria	Total Points	Score
Organization (10 points)	Information is presented in a logical sequence.	5	3
	Whether outline of the presentation was highlighted.	5	3
Content (15 points)	Introduction is attention-getting.	5	4
	Technical terms are well-defined in language appropriate for the target audience.	5	3
	There is an obvious conclusion summarizing the presentation.	5	3
Presentation (25 points)	Speaker maintains good eye contact with the audience and is appropriately animated (e.g., gestures, moving around, etc.).	5	4
	Speaker uses a clear, audible voice.	5	5
	Delivery is controlled and smooth.	5	4
	Good language skills and pronunciation are used.	5	4
	Length of presentation is within the assigned time limits.	5	4
Score	**Total Points**	**50**	37

Assessed by:

Name of Students	Signature
Ashutosh mali	Amal.
Gagandeep ~~[illegible]~~ Singh	Gagan
AAfish Sarkar.	Piyush.
manjul	Akiran
Tanisha	Tanisha
T.S.	[illegible]

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