



RAN-2103000206021004

T. Y. B. Sc. (Sem. - VI) Examination September - 2025

Physics (Paper - IX - PH-609)

Statistical Mechanics and Special Theory of Relativity

Time: 2 Hours]

[Total Marks: 50

સૂચના : / Instructions

(1)

નીચે દર્શાવેલ નિશાનીવાળી વિગતો ઉત્તરવહી પર અવશ્ય લખવી.

Fill up strictly the details of signs on your answer book

Name of the Examination:

T. Y. B. Sc. (Sem. - VI)

Name of the Subject :

Physics (Paper - IX - PH-609) Statistical Mechanics and Special Theory of Relativity

Subject Code No.: **2103000206021004**

Seat No.:

--	--	--	--	--	--

Student's Signature

- (2) Draw neat diagrams wherever necessary.
- (3) Symbols used in the paper have their usual meaning.
- (4) Figures to the right indicate full marks of the question.

Q. 1. Answer the following questions in brief.

(10)

1. In relativity can we accelerate a particle to infinite speed?
2. Define the thermodynamic probability?
3. What do you mean by partition function?
4. What is the value of C_V of hydrogen gas at room temperature?
5. Phonons are _____. (Fermions, Bosons)
6. Give the transformation equations for the component of momentum.
7. Give the value of potential energy of an ideal gas.
8. Write a four or five sentences on mass in relativity.
9. Explain how the kinetic Energy varies with velocity.
10. What is the difference between kinematics and dynamics?

Q. 2. A. Answer any one question: (07)

1. Derive the expression for thermodynamic probability of N-distinguishable particle for a classical statistics.
2. Derive the Bose-Einstein distributive law.

Q. 2. B. Answer any one question: (03)

1. The system consisting of two particles which can exist in three different energy state. Calculate the number of ways in which these particles can be distributed in a given state for Fermi-Dirac statistics.
2. Write a short note on comparison of different distribution function.

Q. 3. A Answer any one question: (07)

1. Derive the equation of internal energy for an ideal gas.
2. What is Gibb's paradox? Explain in detail.

Q. 3. B. Answer any one question: (03)

1. Explain stimulated emission with diagram.
2. Derive the expression $S = Nk_B \ln z + \beta k_B U$.

Q. 4. Answer any one question: (10)

1. Explain in detail why the redefining of momentum in relativity is required.
2. Derive relativistic expression of total energy of particle.

Q. 5. Answer any one question:

1. Derive the transformation equation for magnetic field. (10)

OR

1. Derive the equation for electric field of a uniformly moving charge. (07)
2. Prove that in relativity acceleration is not parallel to applied force. (03)