SSR DEGREE COLLEGE (AUTONOMOUS) NIZAMABAD
M.SC. PHYSICS
INERNAL – I SEM – II
Subject statistical mechanics
QUESTION BANK

I. Multiple Choices

1. Thermodynamics deals with __ while statistical mechanics deals with __.
A) Microscopic properties, macroscopic properties
B) Macroscopic properties, microscopic behavior of particles
C) Chemical reactions, heat transfer
D) Atomic structure, electric circuits
Answer: B) Macroscopic properties, microscopic behavior of particles

2. Statistical mechanics helps to explain thermodynamic properties based on:
A) Newton's laws only
B) Motion of planets
C) Behavior of a large number of particles
D) Sound waves
Answer: C) Behavior of a large number of particles

3. Which of the following is the main link between thermodynamics and statistical mechanics?
A) Electrical conductivity
B) Average behavior of microscopic particles determines macroscopic properties
C) Magnetic field
D) Nuclear reaction
Answer: B) Average behavior of microscopic particles determines macroscopic properties

4. What is a phase space?
A) Space occupied by a solid
B) A graphical representation of temperature and pressure
C) A space in which all possible states of a system are represented
D) A type of energy space
Answer: C) A space in which all possible states of a system are represented

5. In phase space, the state of a particle is represented by:
A) Only position coordinates
B) Only momentum coordinates
C) Position and momentum coordinates
D) Temperature and pressure
Answer: C) Position and momentum coordinates

6. The quantization of phase space is based on which principle?
A) Newton's law
B) Heisenberg uncertainty principle
C) Ohm's law

D) Faraday’s law
Answer: B) Heisenberg uncertainty principle

7. In quantized phase space, the minimum volume element is approximately equal to:
A)
B)
C)
D)
Answer: A)
8. Quantization of phase space means:
A) Energy becomes continuous
B) Phase space is divided into discrete cells
C) Particles stop moving
D) Pressure becomes zero
Answer: B) Phase space is divided into discrete cells

9. The quantization of phase space is based on which principle?
A) Newton’s law
B) Heisenberg uncertainty principle
C) Ohm’s law
D) Faraday’s law
Answer: B) Heisenberg uncertainty principle

10. In quantized phase space, the minimum volume element is approximately equal to:
A)
B)
C)
D)
Answer: A)

11. Quantization of phase space means:
A) Energy becomes continuous
B) Phase space is divided into discrete cells
C) Particles stop moving
D) Pressure becomes zero
Answer: B) Phase space is divided into discrete cells

12. Which equation represents an ideal gas?
A)
B)
C)
D)
Answer: C)

13. An ideal gas is a gas that:
A) Has strong intermolecular forces
B) Obeys the gas laws perfectly under all conditions

C) Has no molecules
D) Cannot expand
✔nswer: B) Obeys the gas laws perfectly under all conditions

14. Fermi–Dirac statistics is applicable to:
A) Bosons
B) Classical particles
C) Fermions (electrons, protons, neutrons)
D) Sound waves
Answer: C) Fermions (electrons, protons, neutrons)

15. According to Fermi–Dirac statistics, a maximum of __ particle(s) can occupy the same quantum state.
A) Infinite
B) Two
C) One
D) Zero
Answer: C) One

16. Fermi–Dirac statistics is applicable to:
A) Bosons only
B) Classical particles
C) Fermions obeying Pauli exclusion principle
D) Photons only
✔nswer: C) Fermions obeying Pauli exclusion principle

17. Which particles obey Fermi–Dirac statistics?
A) Electrons
B) Photons
C) Phonons
D) Alpha particles
✔nswer: A) Electrons

18 The vibrational partition function of a diatomic molecule mainly depends on:
A) Vibrational temperature
B) Pressure only
C) Volume only
D) Molecular color
✔nswer: A) Vibrational temperature

19. At very low temperatures, the vibrational partition function value is:
A) Very large
B) Approximately equal to 1
C) Equal to zero
D) Infinite
✔nswer: B) Approximately equal to 1

II. Fill in the Blanks

1. Relationship between Thermodynamics and Statistical Mechanics

2. Statistical mechanics explains macroscopic properties in terms of ____ behavior.

Answer: microscopic

3. Thermodynamics deals with ____ properties of matter.

Answer: macroscopic

4. Entropy in statistical mechanics is related to the number of ____ available to a system.

Answer: microstates

Phase Space

5. Phase space is a space in which all possible values of ____ and momentum are represented.

Answer: position

6. A point in phase space represents the ____ of the system.

Answer: state

7. For one particle moving in one dimension, phase space is ____ dimensional.

Answer: two

8. Quantization of Phase Space

According to quantum mechanics, phase space is divided into small cells of volume ____.

Answer: h^3

9.Quantization of phase space is based on ____ principle.

Answer: uncertainty

10. The minimum volume element in phase space is determined by ____ constant.

Answer: Planck's

11. Entropy of a perfect gas increases with increase in ____.

Answer: temperature

12.Entropy is represented by the symbol ____.

Answer: S

13.For a reversible process, change in entropy is given by dQ/T, where Q is ____.

Answer: heat

14.An ideal gas obeys ____ law.

Answer: gas

15. The equation of state of an ideal gas is ____.

Answer: PV = nRT

16. In an ideal gas, intermolecular forces are assumed to be ____.

Answer: absent

17. Fermi–Dirac statistics applies to particles called ____.

Answer: fermions

18. Electrons obey ____ statistics.

Answer: Fermi–Dirac

19. According to Pauli exclusion principle, no two fermions can occupy the same ____ state.

Answer: quantum

20. Vibrational partition function depends mainly on ____ of the system.

Answer: temperature

21. At low temperature, vibrational motion is nearly ____.

Answer: frozen

III. Descriptive Question

1. There is the relationship between thermodynamics and statistical mechanics
2. Explain phase space
3. What is meant by quantization of phase space
4. Write the equation of entropy of a perfect gas
5. Explain fermi dirac statistical equation in detail