

**SSR DEGREE COLLEGE (AUTONOMOUS) NIZAMABAD**  
**B.SC. PHYSICS**  
**SEMESTER – II INTERNAL – II EXAMINATION**  
**THERMAL PHYSICS**  
**QUESTION BANK**

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**I. Multiple Choice**

1. A black body is one which
  - a) Reflects all radiation
  - b) Absorbs radiation of all wavelengths
  - c) Emits only visible radiation
  - d) Emits radiation only at high temperature
2. The nearest practical approximation of a black body is
  - a) Platinum foil
  - b) Polished copper
  - c) Lamp black
  - d) White paper
3. The distribution of black body radiation depends only on
  - a) Nature of surface
  - b) Size of the body
  - c) Temperature of the body
  - d) Shape of the body
4. The area under the black body radiation curve represents
  - a) Maximum wavelength
  - b) Intensity at a point
  - c) Total energy emitted
5. Wien's displacement law relates
  - a) Energy and temperature
  - b) Wavelength and temperature
  - e) Energy and wavelength
  - d) Frequency and temperature
6. According to Wien's displacement law, when temperature increases
  - a) Peak wavelength increases
  - b) Peak wavelength decreases
  - c) Intensity decreases
  - d) Energy becomes constant
7. Stefan-Boltzmann law states that radiant energy is proportional to
  - a)  $T$
  - b)  $T^2$
  - c)  $T^3$
  - d)  $T^4$
8. The Stefan-Boltzmann constant is denoted by
  - a)  $k$
  - b)  $h$
  - c)  $c$
  - d)  $b$
9. Rayleigh-Jeans law is valid for
  - a) Short wavelengths
  - b) All wavelengths
  - c) Long wavelengths
  - d) Infrared only
10. The failure of Rayleigh-Jeans law at short wavelengths is called
  - a) Black body anomaly
  - b) Wien shift
  - c) Ultraviolet catastrophe
  - d) Radiation breakdown
11. Statistical mechanics connects:
  - A) Microscopic behavior with microscopic laws
  - B) Macroscopic properties with microscopic behavior

- C) Thermodynamics with electricity  
D) Classical mechanics with relativity
12. A microstate refers to:  
A) Overall measurable properties  
B) Detailed particle configuration  
C) Average properties  
D) Only momentum details
13. A macrostate is defined by:  
A) Positions of all particles  
B) Momentum of all particles  
C) Thermodynamic variables  
D) Quantum numbers
14. Entropy in statistical mechanics is given by:  
A)  $S = kT$   
B)  $S = k \ln$   
C)  $S = AkT$   
D)  $1 = kS$
15. The most fundamental postulate of statistical mechanics is  
A) All macrostates are equally probable  
B) All microstates are equally probable  
C) All systems have the same energy  
D) Entropy is always decreasing
16. A microcanonical ensemble has:  
A)  $T, V, N$  constant  
B)  $E, V, N$  constant  
C)  $\mu, V, T$  constant  
D)  $E, \mu, T$  constant
17. A canonical ensemble is defined by:  
A) Constant energy  
B) Constant particle number  
C) Constant temperature  
D) Both B and C
18. Grand canonical ensemble allows exchange of:  
A) Energy only  
B) Particles only  
C) Both energy and particles  
D) Neither energy nor particles
19. Maxwell-Boltzmann statistics applies to:  
A) Indistinguishable particles  
B) Bosons only  
C) Fermions only  
D) Distinguishable classical particles
20. Fermi-Dirac statistics applies to particles with  
A) Integral spin  
B) Zero spin  
C) Half-integral spin  
D) No spin

## II. Fill in the blanks

- A black body is a perfect \_\_\_\_\_.
- The radiation emitted by a black body depends only on its \_\_\_\_\_.
- The wavelength corresponding to maximum intensity decreases with increase in \_\_\_\_\_.

4. Wien's displacement constant is denoted by \_\_\_\_\_
5. The total energy emitted by a black body is proportional to the \_\_\_\_\_ power of temperature.
6. Rayleigh-jeans law is valid for \_\_\_\_\_ wavelengths
7. The failure of classical theory is known as \_\_\_\_\_
8. Planck introduced the concept of \_\_\_\_\_ energy.
9. The energy of a quantum is given by \_\_\_\_\_
10. Planck's constant is denoted by \_\_\_\_\_
11. The relation between entropy and the number of microstates is given by \_\_\_\_\_
12. A macrostate corresponds to a fixed value of macroscopic quantities such as \_\_\_\_\_
13. A microstate represents a specific arrangement of \_\_\_\_\_ and \_\_\_\_\_ of all particles.
14. In an isolated system, all accessible microstates have \_\_\_\_\_ probability.
15. The Maxwell-Boltzmann statistics applies to \_\_\_\_\_ and \_\_\_\_\_ particles.
16. In Bose-Einstein statistics, the particles obey \_\_\_\_\_ exclusion principle.
17. Particles that obey Fermi-Dirac statistics are called \_\_\_\_\_
18. The Maxwell-Boltzmann velocity distribution depends on the quantity \_\_\_\_\_ of the gas.
19. The most probable speed, average speed, and rms speed satisfy the relation \_\_\_\_\_
20. The degeneracy of an energy level means the number of \_\_\_\_\_ that have the same energy.

### III. Descriptive Questions

1. Derive the expression for Wien's displacement law of black body radiation.
2. Define solar constant. Explain how the solar constant is determined with necessary theory.
3. Explain about classical and quantum statistics
4. State Maxwell-Boltzmann distribution law. Give its mathematical expression.
5. State Bose-Einstein distribution law. Give its mathematical expression.