

**B.Sc. DEGREE EXAMINATION APRIL 2009**

BRANCH III - PHYSICS  
SECOND SEMESTER

REG. No. \_\_\_\_\_

COURSE : MAJOR – CORE  
PAPER : THERMAL PHYSICS AND STATISTICAL MECHANICS  
TIME : 30 MINS. MAX. MARKS : 30

**SECTION – A**

TO BE ANSWERED IN THE QUESTION PAPER ITSELF

ANSWER ALL QUESTIONS: (30 x 1 = 30)

I CHOOSE THE CORRECT ANSWER:

- The equation of adiabatic process is  
a)  $PV^\gamma = \text{constant}$     b)  $PV = \text{constant}$     c)  $P r = k$     d)  $PV = k$
- Black body is  
a) good radiator and absorber    b) radiator  
c) absorber    d) reflector
- Weins displacement law is  
a)  $\lambda_m T k$     b)  $\lambda_m = k$     c)  $\lambda_m k = T$     d)  $\lambda_m = \frac{1}{T}$
- The coefficient of viscosity of gas is directly proportional to square root of its  
a) temperature    b) pressure    c) volume    d) velocity
- For a cyclic process  
a)  $\oint du = 0$     b)  $\oint dv = 0$     c)  $\oint ds = 0$     d)  $\oint \Delta w = 0$
- The carnots engine is perfectly  
a) reversible    b) irreversible    c) cyclic    d) non-cyclic
- The efficiency of carnots engine working between 127°C and 27°C is  
a)  $\eta = 25\%$     b)  $\eta = 50\%$     c)  $\eta = 75\%$     d)  $\eta = 100\%$
- Change in entropy is  
a)  $ds = \frac{\Delta V}{T}$     b)  $ds = \frac{\delta H}{T}$     c)  $ds = \frac{\delta M}{T}$     d)  $ds = \frac{\delta M}{T}$

9. The energy of molecules at absolute zero temperature is called  
 a) zero point energy                      b) zero energy  
 c) energy                                      d) work done
10. Phase space is  
 a) six dimensional phase                      b) three dimensional phase  
 c) one dimensional                              d) two dimensional
11. According to Plank's hypothesis  
 a)  $E = nh\nu$                       b)  $nh$                       c)  $n\nu$                       d)  $\frac{n}{\nu}$
12. Stirling's approximation is  
 a)  $\log_e x! = x \log_e x - x$                       b)  $\log x = 1/e$   
 c)  $\log x = 1/x$                               d)  $\log_e x = x \log x$
13. Instrument used to measure low temperature is called  
 a) Cryostat                      b) Thermostat                      c) Electrostat                      d) Rheostat
14. The lowest temperature corresponding to 0°k called  
 a) absolute zero                              b) zero  
 c) absolute scale                              d) main temperature
15. Temperature below .4K can be reached by  
 a) adiabatic demagnetisation                      b) demagnetization  
 c) isothermal expansion                              d) isothermal demagnetization

II STATE WHETHER TRUE OR FALSE:

16. Heat is disorder
17. In Maxwell – Boltzmann distribution particles are distinguishable
18. In adiabatic process temperature does not remain constant.
19. The gas equation is  $PV = RT$
20. Rayleigh Jean law is  $E_\lambda = \frac{8\Pi kT}{\lambda^4}$

III FILL IN THE BLANKS:

21. The particles which obey Bose Einstein statistics are called \_\_\_\_\_
22. The unit of Thermal conductivity is \_\_\_\_\_
23. The external physical properties of a substance is called \_\_\_\_\_ state.

24. Energy associated with each degree of freedom is \_\_\_\_\_.

25.  $E = \sigma T^4$  is called \_\_\_\_\_ law.

IV ANSWER BRIEFLY:

26. State Zeroth law of Thermodynamics.

27. What is meant by entropy.

28. Define Inversion temperture.

29. What are Fermions.

30. State Wien's law.

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STELLA MARIS COLLEGE (AUTONOMOUS) CHENNAI – 600 086.  
(For candidates admitted during the academic year 2008-09)

SUBJECT CODE : PH/MC/TS24

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BRANCH III - PHYSICS

**SECOND SEMESTER**

COURSE : MAJOR – CORE  
PAPER : THERMAL PHYSICS AND STATISTICAL MECHANICS  
TIME : 2 ½ HOURS MAX. MARKS : 70

**SECTION – B**

ANSWER ANY FIVE QUESTIONS: (5 x 5 = 25)

1. Calculate the average kinetic energy of a molecule of a gas at a temperature of 300K.
2. Calculate the mean free path of a gas molecule given that the molecule diameter is  $2 \times 10^{-6}$  cm and the number of molecule per CC is  $3 \times 10^{10}$ .
3. Calculate the change in entropy when 0.5kg of water at its boiling point, becomes steam at some temperature (Latent heat of steam =  $23 \times 10^5$  Joule / kg).
4. In a heat engine of efficiency 0.2, the source temperature is 500k. Find the efficiency of the engine when the source temperature is doubled.
5. Calculate the radiant emittance of a black body at a temperature of (i) 400k (ii) 4000k  $\sigma = 5.672 \times 10^{-8}$  mks units.
6. Compare Bose – Einstein, Maxwell – Boltzmann and Fermi Dirac statistics.
7. Describe the experimental method of liquefying Helium.

**SECTION – C**

ANSWER ANY THREE QUESTIONS: (3 x 15 = 45)

8. Obtain expression for viscosity of gas using kinetic theory of gases.
9. From the first principle obtain Planck's law. Obtain Weins and Rayleigh Jeans law from Planck's law.
10. Deduce Maxwell's thermodynamical relations.
11. Write note on a) black body radiation b) Thermodynamic potentials c) Importance of T-S diagram.
12. Explain adiabatic demagnetisation of para magnetic salt with theory and experiment.

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