

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

SUBJECT CODE : PH/MC/TS24

B.Sc. DEGREE EXAMINATION APRIL 2010
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 co-efficient of thermal conductivity of a gas is
a) $K \propto \sqrt{T}$ b) $K = T^{3/2}$ c) $K = T^2$ d) $K = \sigma T^4$
- The change in entropy ds is expressed as
a) $ds = \frac{dQ}{T}$ b) $S = \frac{Q}{t}$ c) $ds = \frac{dv}{dt}$ d) $S = \frac{dw}{T}$
- According to Stefan's law
a) The emission of radiant energy by unit area of a perfectly blackbody is directly proportional to the fifth power of its absolute temperature.
b) The emission of radiant energy by unit volume of a perfectly blackbody is inversely proportional to the fourth power of its absolute temperature.
c) The rate of emission of radiant energy by unit area of a perfectly blackbody is directly proportional to the fourth power of its absolute temperature.
d) The rate of emission of radiant energy by unit area of a perfectly blackbody is directly proportional to the fifth power of its temperature in centigrade scale.
- The zeroth law of thermodynamics highlights
a) only thermal equilibrium
b) conversion of heat into energy
c) Workdone - temperature relation
d) Workdone energy relation
- Refrigerator is a device works on
a) first b) second c) third d) zeroth law of thermodynamics
- When gas expands suddenly, the associated change will be termed as
a) adiabatic b) Isothermal

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- c) Isochoric and Isothermal d) Adiabatic and Isobaric
7. The unit of entropy is
 a) J/Kg b) J/K c) J/K/S d) J/Kg/Sec
8. Thermodynamic potential G is defined as
 a) U-TS+PV b) U+TS+PV c) U-TS-V d) U+TS-PV
9. A system that cannot exchange only energy with the surroundings is
 a) open b) closed c) Ideal d) Isolated
10. According to Planck's law of radiation $E_n = nh\nu$ where
 a) $n = \frac{1}{2}, \frac{3}{4}, \frac{3}{8}, \dots, \infty$ b) $n = 1, 2, \dots, \infty$
 c) $-\infty$ to $+\infty$ d) $n = -1, -2, \dots, \infty$
11. The Clapeyron's equation may be written as
 a) $\frac{dp}{dT} = \frac{L_2}{T(V_2 - V_1)}$ b) $\frac{dT}{dp} = \frac{T}{L(V_2 - V_1)}$
 c) $\frac{dp}{dT} = \frac{L}{T^2(V_2 - V_1)}$ d) $\frac{dp}{dT} = \frac{L}{T(V_2 - V_1)}$
12. According to Maxwell's Law of distribution of velocities
 a) Particles in the system are large, non identical and indistinguishable.
 b) Particles are little, identical and distinguishable.
 c) Particles are large, identical and indistinguishable.
 d) Particles are large, identical and distinguishable.
13. Phase space is a
 a) six dimensional space of distance as coordinates.
 b) Three dimensional space of distance, time and energy as coordinates.
 c) Three dimensional or six dimensional of any coordinates.
 d) six dimensional space of 3 distances and 3 momentum coordinates.
14. Paramagnetic material can have susceptibility
 a) large, +ve b) large, -ve c) small, -ve d) small, +ve
15. Regarding Helium I and Helium II
 a) above 2.91 k is called helium I and below it is helium II.
 b) above 2.91 k is called helium II and below it is helium I
 c) above 2.19k is called helium I and below it is called helium II
 d) above 2.19k is called helium II and below it is called helium I

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II STATE WHETHER TRUE OR FALSE:

16. Black body is only good absorber not a emitter.
 17. The efficiency of a carnot engine cannot be above 90% and below 99% only.

18. Reversible process is not a natural process.
19. F-D statistics applicable for fermions only.
20. Low temperature can be achieved by increasing pressure.

III FILL IN THE BLANKS:

21. The particles which obey Bose-Einstein statistics are called
22. is a measure of total heat of a system.
23. In adiabatic process, changes of entropy is
24. At absolute zero, the kinetic energy of a gas molecules is equal to
25. Entropy of the Universe

IV ANSWER BRIEFLY:

26. State Second law of thermodynamics.

27. Define Mean Free path.

28. What is intrinsic energy?

29. What is thermodynamic probability?

30. Distinguish between Helium I and II.

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TIME : 2 ½ HOURS MAX. MARKS : 70

SECTION – B

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

1. Calculate the average Kinetic energy of gas molecule at a temperature of 600k.
2. A quantity of air at 27° c and atmospheric pressure is suddenly compressed to half its volume. Find the final a) Pressure
b) temperature.
3. Show that $C_2 - C_1 = \frac{dL}{dT} - \frac{L}{T}$.
4. Calculate the pressure in which water boils at 150° C . You are given that the change in specific volume when 1 gram of water is converted into steam is 1676cc. Latent heat of vaporization of water at 100° C 2.26x10⁶J/Kg.
5. In an experiment the viscosity of the gas was found to be 2.25x10⁻⁹ NSM². The RMS velocity of the molecule is 4.5x10²m/sec. The density of the gas is 1.25 kg/m³. Calculate the mean free path of the molecule and frequency of collision.
6. Derive the relation Cp-Cv=-TE α²V .
7. Compare Bose-Einstein, Maxwell-Boltzman statistics.

SECTION – C

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

8. Describe an experiment for the verification of Stefan's law.
9. Derive an expression for thermal conductivity of gas using Kinetic theory of gases.
10. Derive Maxwells thermodynamical relations.
11. Derive the distribution law of Fermi- Dirac statistics.
12. Describe the method of measuring low temperature by adiabatic demagnetization.

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