SUBJECT CODE : 11PH/MC/TS24

B.Sc. DEGREE EXAMINATION APRIL 2012
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:**

1. According to Stefan-Boltzman law the relation between the heat energy radiated per unit area of black body (E) and its temperature T is
   a) $E\alpha T^2$ b) $E\alpha T^4$ c) $E\alpha \frac{1}{T^4}$ d) $E\alpha \frac{1}{T^2}$

2. The coefficient of thermal conductivity of a gas is directly proportional to
   a) $\sqrt{T}$ b) T   c) T^2 d) T^4

3. The door of running refrigerator inside a room is left open. Mark the correct statement
   a) the room will be cooled slightly
   b) the room will be warmed up gradually
   c) the room will be cooled to the temperature inside the refrigerator
   d) the temperature of the room will remain unaffected

4. The first law of Thermodynamics is written mathematically
   a) $dQ = du + dw$ b) $dw = dQ + du$
   c) $dw = dQ + du$ d) $dQ = du - dw$

5. The ratio between adiabatic elasticity and isothermal elasticity of a gas is equal to
   a) $\frac{C_v}{C_p}$ b) $\frac{C_p}{C_T}$ c) $\frac{C_p}{C_V}$ d) $C_P C_V$

6. Coefficient of performance is given as
   a) $\frac{Q_1 - Q_2}{Q_2}$ b) $\frac{Q_2}{Q_1 - Q_2}$ c) $\frac{Q_1 - Q_2}{Q_1}$ d) $\frac{Q_1 + Q_2}{Q_1}$

7. Unit of entropy is
   a) JK   b) JK^{-1} c) $J^{-1}K$ d) J^2K

8. At absolute zero temperature, the entropy tends to ………….. and the molecule of a substance are in perfect……………….
   a) Zero, order   b) infinity, order   c) Zero, disorder   d) infinity, disorder

9.   The temperature- entropy diagram is used in
      a) engineering   b) meterology   c) both   d) none

10.   Using adiabatic demagnetization, the minimum temperature produced is
      a) 1^*K   b) 10^{-2}K   c) 10^{-3}K   d) 0 K

11.   The clapeyron's latent heat equation is
      a) $\frac{dP}{dT} = \frac{L}{T}$ b) $\frac{dT}{dP} = \frac{L}{T(V_2-V_1)}$ c) $\frac{dP}{dT} = \frac{L}{T(V_2-V_1)}$ d) $\frac{dP}{dT} = \frac{T}{L}$

12.   Rayliegh- Jeans law of radiation applies to ………….. wavelength
      a) longer   b) shorter   c) medium   d) none

13.   The particles which obey Bose-Einstein Statistics are known as
      a) Bosons   b) Fermions   c) Neutron   d) Proton

14.   According to which statistics, the energy of absolute zero cannot be zero
      a) M-B   b) B.E.   c) F.D   d) none

15.   The ratio of most probable speed and average speed of a gas enclosed in a vessel is
      a) $\frac{\sqrt{\Pi}}{4}$ b) $\frac{\sqrt{\Pi}}{2}$ c) $\frac{2}{\sqrt{\Pi}}$ d) 4Π

II   STATE WHETHER TRUE OR FALSE:

16.   According to Wien's law the amount of energy radiated by a black body is uniformly
      distributed over all the wavelengths emitted by the body but is minimum for a
      particular wavelength.

17.   Thermodynamic system will be thermal equilibrium if there is no transfer of heat
      energy from one part of the system to the other.

18.   When steam is converted into water and then into ice the entropy and disorder of the
      molecules decrease.

19.   The temperature of the paramagnetic substance decreases on decreasing the
      magnetizing field H.

20.   For a gas at N.T.P. V_{rms} is minimum

III   FILL IN THE BLANKS:

21.   The coefficient of viscosity of a gas is directly proportional to ……………… in K.
22.   Internal energy of a real gas depends upon ……………. of the molecule.
23.   Entropy is maximum in ……………….. state.
24.   The Clausius latent heat equation is ………………………
25.   The ensemble is divided into …………….. types.

..3

IV   ANSWER BRIEFLY:

26.   What does a black body mean?

27.   State zeroth law of thermodynamics

28.   What is reversible process?

29.   What is called magnetic caloric effect?

30.   Write any two differences between F.D. and B.E.

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STELLA MARIS COLLEGE (AUTONOMOUS) CHENNAI – 600 086.
(For candidates admitted during the academic year 2011-2012)

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BRANCH III - PHYSICS
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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.   Two stars radiate maximum energy at wavelengths $4000°A$ and $5000°A$ respectively. What is the ratio of their temperature?

2.   A Carnot's engine has the same efficiency working between the temperature limits, 2500K and 1000K and between OK and 2000K. Find the value of θ.

3.   Calculate the change in entropy when 10 gram of ice at $0°C$ is converted into water at the same temperature.

4.   Describe how helium is liquefied experimentally.

5.   Write the peculiar properties of Helium II.

6.   Find the increase in the boiling point of water at $100°C$ when the pressure is increased by one atmosphere. Latent heat of vaporization of steam is 540 cal/gram and one gram of steam occupies a volume of 1677 cm^3.

7.   A carnot's refrigerator takes heat from water at $0°C$ and discards it to a room temperature at $27°C$. One kgm of water at $0°C$ is to be changed into ice at $0°C$. How many calories of heat are discarded to the room? What is the work done by the refrigerator in this process? What is the co-efficient of performance of the machine? (1 cal = 4.2 J)

SECTION – C
ANSWER ANY THREE QUESTIONS: **(3 x 15 = 45)**

8.   Derive an expression for coefficient of viscosity of a gas in terms of mean free path of its molecule.

9.   Define concept of entropy. Show that the entropy of a perfect gas remains constant in a reversible process but increases in an irreversible process.

10. State the two laws of thermodynamics and explain their significance. Derive an expression for the efficiency of a Carnot's engine.

11. Deduce Maxwell's thermodynamic relations.

12. Using Maxwell's Law of distribution of speed in a gas obtain an expression for most probable speed, average speed and root mean square speed.

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