

B.Sc. DEGREE EXAMINATION APRIL 2011
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:

- In diffusion, the transport of the following occurs
a) momentum b) mass c) energy d) temperature
- Average energy of a Planck's oscillator is
a) $E = hv$ b) $E = \frac{hv}{mc^2}$ c) $E = \frac{hv}{e^{hv/KT}-1}$ d) $E = mc^2$
- The absolute temperature of a perfectly black body is increased to twice its value. The rate of emission of energy per unit area will be
a) 2 times b) 4 times c) 8 times d) 16 times
- Out of the following, the physical quantity that relates with first law of thermodynamics is
a) temperature b) pressure c) energy d) Number of moles
- Internal energy of a real gas depends upon
a) size of the molecule b) only on the volume of the gas
c) only on the pressure of the gas d) only on the temperature of the gas
- 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.
- The unit of entropy is
a) Joule/Kelvin b) Cal/Kelvin c) Both a and b d) none of the above
- Entropy is maximum in _____ state
a) gas b) solid c) liquid d) can be any

IV ANSWER BRIEFLY:

26. State Zeroth law of Thermodynamics.
27. Define mean free path.
28. Define entropy.
29. Write any two methods of liquefaction of gases.
30. The average kinetic energy of a gas molecule at a certain temperature is 6.21×10^{-21} joule. Find the temperature. (Boltzmann's constant $K = 1.38 \times 10^{-23}$ joule k^{-1}).



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

SUBJECT CODE : PH/MC/TS24

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SECTION – B

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

1. What is a perfectly black body? Draw curves for the distribution of energy in the spectrum of a black body for two temperatures. Explain the important results obtained from these curves.
2. Calculate the energy of an Planck's oscillator of frequency $0.60 \times 10^{14} \text{ sec}^{-1}$ at $T = 1800 \text{ K}$.
3. A Carnot's refrigerator takes heat from water at 0°C and discards it to a room temperature at 27°C . 1 kg 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 workdone by the refrigerator in this process? What is the coefficient of performance of the machine? (1 cal = 4.2 joule)
4. 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 1 gram of steam occupies a volume of 1677 cm^3 .
5. Explain the term of macrostate and microstate with the help of an example.
6. Explain the peculiar properties of Helium II.
7. Prove that the adiabatic elasticity of a gas is γ times the isothermal elasticity.

SECTION – C

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

8. Derive an expression η of a gas in terms of mean free path of its molecule. Discuss the effect of pressure and temperature on coefficient of viscosity.
9. (i) What is internal energy of a system? Internal energy is state function and not path function explain.
(ii) What is the principle used in the working of a refrigerator? Define coefficient of performance. Is it greater than 1 explain.
10. Show that entropy remains constant in reversible process but increases in irreversible process.
11. Using Maxwell's law of distribution of speeds of molecules in a gas obtain expressions for most probable speed, average speed and root mean square speed.
12. Describe the Joule-Thomson porous plug experiment with necessary theory.

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