13MY 44 – II (08)

B.Sc. II Semester Degree Examination, May 2013
PHYSICS
Paper – 2.1 : Heat and Thermodynamics, Waves and Oscillations

Time : 3 Hours Max. Marks: 80

Instructions : *1) Section **I** is **compulsory**.*
*2) Answer **any four** questions from Section **II** and **four** questions from Section **III**.*

SECTION – I

1. A) Answer **any twelve** of the following : **(1×12=12)**

i) Maxwell's law of distribution of velocities gives :
   a) Velocity of individual molecule
   b) Probability of velocity of molecule
   c) Velocity of all molecule
   d) All of these

ii) Change in entropy in a process is given by
   a) $ds = \frac{dT}{dQ}$ b) $ds = \frac{dQ}{T}$ c) $ds = \frac{T}{dQ}$ d) $ds = \frac{TQ}{m}$

iii) In Joule Thomson process, if $\frac{2a}{T} < b$, then
   a) Heating effect is observed b) Cooling effect is observed
   c) No effect d) Both a) and b)

iv) At resonance, the intensity of the resultant sound is
   a) Zero b) Minimum c) Maximum d) Unpredictable

B) Fill in the blanks :
   i) R. M.S. velocity of a gas molecule is directly proportional to _____ of gas.
   ii) Below _____ temperature, the gas can be liquefied by the application of pressure alone.
   iii) When the temperature of a black body is doubled the total radiation emitted by the black body increases by _____ times initial value.
   iv) In damped oscillations amplitude of the wave _____

P.T.O.

C) State **True** or **False** :

i) During adiabatic, entropy remains constant.

ii) Boiling point of a given liquid decreases with increasing pressure.

iii) The velocity of sound increases with increasing pressure of the medium.

D) Answer the following in **one** or **two** sentences :

i) State third law of thermodynamics.

ii) What happens to the entropy during reversible process ?

iii) What are heats ?

iv) Define over tones.

SECTION – II

(4×4=16)

2. What is mean free path ? Obtain an expression for it.

3. Obtain an expression for work done in an isothermal process.

4. Describe Linde's process for the liquefaction of air.

5. Write a note on pressure exerted by the radiation.

6. Explain Sabine's reverbation formula and define Reverbation.

7. Derive an expression for velocity of transverse waves along a stretched string.

SECTION – III

8. a) Describe the working of Carnot engine and derive an expression for efficiency of heat engine.

   b) A carnot engine whose law temperature reservoir is at 7°C has an efficiency of 50%. It is desired to increase the efficiency to 70%. By how many degrees should the temperature of high temperature reservoir be increased. **(9+4=13)**

9. a) Deduce Clausius-Clapeyron latent heat equation and discuss the effect of change of pressure on the melting and boiling point of the substance.

   b) Calculate the change in temperature of boiling water, when the pressure is increased by 27.12 mm of Hg ? The normal boiling point of water at atmospheric pressure is 100°C.
   Given : Latent heat of Steam = 537 Cal/gm and specific volume of steam = 1674 cm^3.

(9+4=13)

10. a) Give the theory of porous plug experiment. Discuss the experimental results.

    b) At what temperature will the oxygen molecular have the same R.M.S. velocity as that of hydrogen molecule at 0°C.

    Given : Molecular weight of oxygen = 32

    Molecular weight of hydrogen = 2. **(9+4=13)**

11. a) Derive Planck's law of radiation.

    b) Calculate the energy radiated per minute from the filament of an incandescent lamp at 2000 K if the surface area is 5×10^{-5} m^2 and its relative emittance is 0.85. **(9+4=13)**

12. a) Define free, damped and forced vibrations. Give the theory of damped vibrations.

    b) At what temperature will the speed of sound in air becomes double its speed at 0°C. **(9+4=13)**

13. a) What are Lissajous figures ? Find the resultant of two S.H.M. of equal period, when they act at right angles to each other. Discuss the cases.

    b) When a simple harmonic wave is propagated through a medium the displacement of a particle in cm at any instant of time is given by

    $y = 10 \sin \frac{2\pi}{100} (36{,}000t - 20)$, calculate the wavelength and frequency of the vibrating particle. **(9+4=13)**