11221

B.Sc. Second Semester Degree Examination, May/June 2016
PHYSICS
Paper 2.1 – Heat, Thermodynamics, Waves and Oscillations

Time : 3 Hours Max. Marks : 80

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

SECTION – I

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

A) Choose the correct answer

i) At what temperature is the r.m.s. speed of molecules of hydrogen is twice that at S.T.P. ?

a) 273 K b) 546 K c) 819 K d) 1092 K

ii) The conversion of water into ice is a

a) isothermal process b) isochoric process
c) isobaric process d) adiabatic process

iii) If the temperature of the source increases, the efficiency of a Carnot engine

a) increases b) decreases
c) remains unchanged d) none of these

iv) For a perfect gas, the Joule-Thomson co-efficient is

a) positive b) negative c) zero d) none of these

B) Fill in the blanks :

i) Entropy remains constant in _____

ii) The relation between inversion temperature and critical temperature is given by _____

iii) Temperature of sun is measured by _____

iv) In S.H.M. the velocity is maximum when displacement is _____

C) State **true** or **false** :

i) Work done on a system is represent by negative sign.

ii) The speed of transverse wave produced in a string does not depend upon the applied tension.

iii) Microphone converts sound energy into electrical energy.

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

i) State the first law of thermodynamics

ii) Define mean free path.

iii) What is a black body ?

iv) What is meant by resonance ?

SECTION – II

(4×4=16)

2. Write the postulates of kinetic theory of gases.
3. State the law of equipartition of energy. Prove that the energy associated with each degree of freedom is $\frac{1}{2}kT$.
4. Explain the results of Andrew's experiment on carbon dioxide.
5. Derive the relation $\frac{d^2y}{dt^2} = v^2 \frac{d^2y}{dx^2}$.
6. Give the construction and working of moving coil loudspeaker.
7. Mention the requisites of good acoustics.

SECTION – III

8. a) Obtain an expression for the efficiency of a Carnot's heat engine in terms of temperatures of the source and sink. . 9

   b) Find the increase in entropy when 1.68 kg of ice at 273 K melts into water at the same temperature. Given latent heat of fusion of ice = 335×10^3 J/kg. 4

9. a) Deduce Claussius and Clapeyron equation. Explain the effect of pressure on boiling point and melting point. 9

   b) Derive an expression for work done by a gas during isothermal changes. 4

10. a) Describe a method of liquefying oxygen. 9

    b) Obtain the relation between temperature of inversion and critical temperature. 4

11. a) Derive Planck's law of radiation. How does it explain Wien's displacment law and Rayliegh-Jean's law ? 9

    b) A black body at 500°C has a surface area of $0.5m^2$ and radiate heat at the rate of 1.02×10^4 joule per second. Calculate the Stefan's constant. 4

12. a) Deduce the frequency of longitudinal vibrations of a bar fixed at both ends. 9

    b) A stone dropped from the top of a tower 300 m high splashes into the water of a pond near the base of the tower. When is the splash heard at the top? Velocity of sound = 340 ms^{-1} and g = 9.8 ms^{-2}. 4

13. a) What are beats ? How are they produced ? Derive an expression for the frequency of the beats. 9

    b) A sound note of frequency 200 Hz is produced in hydrogen. Find its wavelength, assuming velocity of sound in air is 332 ms^{-1} and density of air is 14.4 times that of hydrogen. 4
