SN – 327

I Semester B.Sc. Examination, Nov./Dec. 2017
(CBCS) [F + R] [2016-2017 and Onwards]
PHYSICS – I
Mechanics – I, Heat and Thermodynamics – I

Time : 3 Hours Max. Marks : 70

Instruction : *Answer **five** questions from **each** Part.*

PART – A

Answer **any five** questions. **Each** question carries **eight** marks : **(5×8=40)**

1. a) Define Terminal Velocity.
   b) Derive an expression for the velocity and acceleration of a body moving through a resistive medium at low speed under gravity. **(1+7)**
2. Derive an expression for Radial and Transverse Components of velocity and acceleration for a particle moving along a curve. **8**
3. a) State and explain Work-Energy Theorem.
   b) Distinguish between conservative and Non Conservative forces with examples. **(4+4)**
4. a) State Stefan's law of Radiation.
   b) Define solar constant. Estimate the Surface Temperature of Sun. **(2+6)**
5. a) Derive an expression for the mean free path of a gas molecule.
   b) Mention the factors affecting the mean free path of gas molecules. **(6+2)**
6. Describe Andrew's experiment on the isothermals of Carbon dioxide and discuss its results. **8**
7. a) Distinguish between isothermal and adiabatic processes.
   b) Obtain an expression for the amount of work done by the Ideal gas during adiabatic expansion. **(3+5)**

P.T.O.

8. a) What is meant by entropy ?
   b) Calculate the change in entropy during reversible and irreversible processes. **(2+6)**

PART – B

Solve **any five** of the following problems. **Each** problem carries **four** marks. **(5×4=20)**

9. A 10 kg block is placed on a horizontal table and is attached to 5 kg block with the help of a string passing over a frictionless massless pulley. Calculate the acceleration produced. Given the coefficient of static friction is 0.2 between block and the table.

10. Calculate the escape velocity at which the planet has to be launched from the surface of earth so that it escapes from earth's gravitational force.

    Given : Radius of earth $R_E = 6400$ km $g = 9.8\ ms^{-2}$.

11. A Rocket of mass 400 kg has 3,600 kg fuel. The exhaust velocity of fuel is 3.2 km/s. Calculate the rate of consumption of fuel so that Rocket may rise from the ground. Also calculate the time taken for the consumption of fuel, if the rate of consumption of fuel is 20 kg/s.

12. Calculate the surface temperature of the sun from the following data :

    Stefans constant $\sigma = 5.7 \times 10^{-8}\ Wm^{-2}\ K^{-4}$ solar constant $S = 1500\ Wm^{-2}$. Radius of the Sun $r = 7 \times 10^8$ m distance between sun and earth is $R = 15 \times 10^{10}$ m.

13. Find the temperature at which root mean square velocity of the molecules of gas would become twice its value at 77°C.

14. For a gas critical pressure is $1.3 \times 10^6\ Nm^{-2}$ and critical volume for a mole of gas is $70 \times 10^{-6}\ m^3$. Calculate van der Waals constants a and b.

15. A Carnots engine with Sink temperature 27°C has 40% efficiency. By how much the temperature of the source has to be changed so as to increase the efficiency to 50%.

16. Calculate the change in entropy when 0.125 kg of ice at 273 K is converted into steam at 373 K.

Given : Specific heat of water = 4200 $JKg^{-1}K^{-1}$ specific latent heat office = 336×10^3 JKg^{-1} specific latent heat of steam is 227×10^4 J Kg^{-1}.

PART – C

Answer **any five** of the following. **Each** question carries **2** marks : **(5×2=10)**

17. a) Can you stop the Car on a friction less horizontal road by applying brakes ? Explain.

b) No work is done in moving a particle from one point to another on the surface of a smooth spherical shell. Justify.

c) Can a body have energy without momentum ? Explain.

d) Can the centre of mass lie outside the body ? Give an example.

e) Why hydrogen has highest Co-efficient of Thermal Conductivity ?

f) Can a gas in thermal equilibrium conduct heat from one point to another point ? Explain.

g) Entropy of the Universe tends to maximum. Justify.

h) Can the efficiency of Carnot's engine be greater than one ? Explain.