ST.JOSEPH'S COLLEGE (AUTONOMOUS), BANGALORE-27

B.Sc. – I SEMESTER

SUPPLEMENTARY EXAMINATION – October 2019

PH: 115 : Mechanics, Heat and Thermodynamics

Time : 2½ hrs   **Max. Marks: 70**

*This question paper has **two** printed pages and **three** parts.*

(ATTACH THE QUESTION PAPER WITH THE ANSWER BOOKLET)

PART – A

Answer any **four** of the following: $(10 \times 4 = 40)$

1a) Explain the term - inertial frame of reference. Show that Newton's second law is not valid in a frame of reference which is moving with uniform acceleration with respect to a fixed frame of reference.

b) Distinguish between conservative and non-conservative forces   [7+3]

2a) Mention the difference between elastic and inelastic collision.

b) Show that the centre of mass divides internally the line joining the two particles in inverse ratio of their masses.

[4+6]

3a) State perpendicular axis theorem.

b) Calculate the moment of inertia of a uniform solid sphere about its diameter.   [2+8]

4a) Write the assumptions of kinetic theory of gasses.

b) Based on kinetic theory of gases deduce an expression for pressure exerted by an ideal gas.   [4+6]

5 a) Distinguish between adiabatic and isothermal process.

b) For an adiabatic process prove that PV^{γ} = constant   [3+7]

6a) Explain the thermodynamic potential - enthalpy.

b) Using van der-Waal's equation deduce expressions for critical constants.   [3+7]

PART – B

Answer any **four** of the following: $(5 \times 4 = 20)$

7. A block is given an initial velocity of 5 m/s up a frictionless 30° incline plane. How far up the incline does the block slide before coming to rest?

8. Three particles, each of mass 200 g, are kept at the corners of an equilateral triangle of side 10 cm. Find the moment of inertia of the system about an axis along the line joining two of the particles .

9. A solid cylinder of mass 20 kg rotates about its axis with angular speed 100 rad/s. The radius is 0.25 m. What is the K.E associated with the rotation of the cylinder. What is the magnitude of angular momentum of the cylinder about its axis?

10. The mean speed of a gas molecule is 450 m/s. Calculate the viscosity of the gas. Given the density of the gas = 1.25 kgm^{-3} and mean free path = 8.85 x 10^{-8} m.

11. One litre of hydrogen at 27°C and pressure 10^5 Nm^{-2} expands isothermally until its volume is doubled. Find the final pressure and work done.

12. If the van der Waal's constants for carbon dioxide are a = 1.32 x 10^4 Nm^{4}mol^{-2} and b=3.64 x 10^{-5} m^{3}mol^{-1} and its critical temperature is 132 K, calculate its critical pressure and critical volume.

PART – C

13. Answer any **five** of the following: $(2 \times 5 = 10)$

a) If the sum of all the forces acting on a body is zero is it necessarily be in equilibrium?

b) Is a lift falling down under gravity an inertial frame or non –inertial frame? Give reason.

c) Does the work done in raising a load on to a platform depend upon how fast it is raised? Justify.

d) The number of molecules in a container is doubled. What will be the effect on the speed of the molecules? Give reason.

e) What is meant by "path function"? Give an example.

f) Why does adiabatic demagnetization produce cooling effect?