Q.P. Code – 22239

Second Semester B.Sc. Degree Examination, September 2020

(Non-CBCS – Semester Scheme)

Physics

Paper II (201) – PROPERTIES OF MATTER, HEAT AND THERMODYNAMICS

Time : 3 Hours] *[Max. Marks : 60*

Instructions to Candidates : Answers should be written completely in English.

PART – A

I. Answer any **FIVE** of the following questions. Each question carries **6** marks : **(5 × 6 = 30)**

1. (a) Define the three moduli of elasticity.

   (b) Derive an expression for work done in stretching of a wire. **(3 + 3)**

2. What is Viscosity? Derive an expression for the coefficient of viscosity by Stoke's method. **(6)**

3. (a) What are the factors affecting surface tension?

   (b) Explain with necessary theory why a large force is required to draw apart normally two glass plates enclosing a thin water film. **(2 + 4)**

4. Define the mean free path of the gas molecules. Obtain an expression for it. **(6)**

5. (a) Distinguish between extensive and intensive variables.

   (b) Derive an expression for the work done during an adiabatic change. **(2 + 4)**

6. (a) What is a heat engine?

   (b) Obtain an expression for the efficiency of a Carnot heat engine in terms of the temperature of the source and sink. **(1 + 5)**

7. (a) Write the four Maxwell's thermodynamic relations.

   (b) Obtain the Clausius-Clapeyron's equation from the Maxwell's thermodynamic relation. **(2 + 4)**

8. (a) Derive an expression for the Joule-Thomson coefficient.

   (b) What is the value of the coefficient for a (i) perfect gas (ii) real gas? **(4 + 2)**

PART – B

II. Answer any **FOUR** of the following questions. Each question carries **5** marks : **(4 × 5 = 20)**

9. A uniform rod of length 1.2 m and radius 0.01 m is clamped horizontally at one end. A load of 0.2 kg is attached to the free end of the rod. Calculate the depression at the midpoint of the rod.

   Young's modulus of the material of the rod = 1×10^{10} N/m^2.

10. For O_2 gas at NTP calculate :

   (a) V_{mp}

   (b) V_{av}

   (c) V_{rms}

   Given Boltzmann's constant

   $K = 1.38 \times 10^{-23}$ JK^{-1}

   Avogadro's number = 6.02×10^{23} /mole

11. A gas occupies one litre at 0.8 m pressure and is expanded adiabatically to 1190 cc. If the pressure falls to 0.60 m in the process, deduce the value of 'r',

12. Calculate the change in entropy when 0.1 kg of ice at 0°C is converted into steam at 100°C. Given

   Latent heat of water = 3.4×10^5 J/kg

   Latent heat of steam = 2.25×10^6 J/kg

   Specific heat of water = 4200 J kg^{-1} K^{-1}

13. Calculate under what pressure ice freezes at 272 K, if the change in specific volume when 1 kg of water freezes is 1.098×10^{-6} m^3. Given latent heat of ice = 3.36×10^5 J kg^{-1}.

14. Calculate the change in temperature when carbondioxide gas suffers Joule-Thomson expansion at 300 K, the pressure difference on both sides of the plug being 5 atmosphere.

   $a = 0.303$ Nm^4 mol^{-2}

   $b = 4.27 \times 10^{-5}$ m^3 mole^{-1}

   $R = 8.31$ J mole^{-1} K^{-1}

   $C_p - 8.75 \times 4.18$ J mole^{-1} K^{-1}

PART – C

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

15. (a) A person standing near a fast moving train has a danger of falling towards the train. Explain.

(b) Poisson's ratio of a material cannot be negative. Justify.

(c) Ploughing of field retain moisture in them. Why?

(d) How is the coefficient of thermal conductivity dependent on pressure, temperature and mass?

(e) What is the change in internal energy of an ideal gas in the isothermal process?

(f) Distinguish between a refrigerator and a heat pump.

(g) There is always a heating during adiabatic compression of a gas. Explain.

(h) Temperature –118°C, –240°C and –268°C represent critical temperature and three familiar gases. What are they?
