Mid-West University

Examinations Management Office

Surkhet ,Nepal

Final Examinations -2079

Bachelor level/ B.Sc / 2nd Semester — Full Marks : 60

Time: 3 hrs — Pass Marks :30

Subject : Thermal Physics (PHY421/321)

Candidates are required to give their answer in their own words as far as practicable. The figures in the margin indicate full marks

GROUP – A

Attempt all long questions **[4x6=24]**

1. What is transport phenomenon? Derive an expression for coefficient of viscosity on the basis of kinetic theory of gases. How does the coefficient of viscosity of a gas depend upon temperature of the gas?
2. Discuss the distribution of energy in the spectrum of black body on the basis of the spectrum obtained in the experiment performed by Lummer and Pringsheim.
3. Discuss Brownian motion. Describe how the experimental study of this motion yielded the value of Avogadro number.
4. What is thermo-dynamical potential? Derive Maxwell's first and second thermo-dynamical relation of thermo-dynamical variables.

OR

What do you mean by phase space, microstate and macrostate? Derive the Maxwell Boltzmann law for the occupation number n_i for the ith cell in which each molecule has an energy equal to ε_i.

GROUP – B

Attempt all shirt questions **[6x4 = 24]**

5. A vessel contain is CO_2 at a temperature of 137°C. The specific volume is 0.0700 litre/gm mole. Compute the pressure in atmospheres (a) from the ideal gas equation (b) from Vander Waal's equation. (Given for CO_2, a= 0.366 Nm^4/mol , b = 0.0429 x 10^{-3} m^3/mol and R= 8.31 J/mol K)
6. The melting point of 1 gm is 232oC, its latent heat of fusion 14 cal/gm and the specific heat of solid and molten tin 0.055 and 0.064 cal/gm °C respectively. Calculate the change in entropy. When 1 gm of tin is heated from 150°C to 314°C.
7. The viscosity of a gas (oxygen) at a temperature of 16°C is 169 micro-poise. Calculate the diameter of the molecules of the gas. Avogadro's number = 6.02 x10^{23}, molecular weight of oxygen = 32 and Boltzmann's constant (k) = 1.38 x 10^{-23} J/K.
8. Calculate the fall in temperature of helium initially at 15°C, when it is suddenly expanded at 8 times its volume. The ratio of specific heats = 1.66.
9. The density of zinc is 7.13 g/cm^3 and its atomic weight is 65.4. Calculate its Fermi energy. The effective mass of a free electron in zinc crystal is 7.7 x 10^{-31} kg and the Avogadro's number is 6.023 x10^{23} atoms/grams-atom.

OR

Calculate the diameter of a molecule of benzene, if $n = 2.79 \times 10^{19}$ molecule/c.c. and mean free path λ fro benzene $= 2.2 \times 10^{-6}$ cm.

10. A black body of thermal capacity 1000 cal/°C and surface area 500 cm^2 is kept inside an evacuated enclosure at 27°C . Find the rate of cooling of the body when its temperature is 127°C . Given Stefan's constant $\sigma = 1.36 \times 10^{-12} \text{cal}/(cm^2.sec.\,°C^4)$

GROUP – C

Attempt all Very shirt questions **[6x2 = 12]**

11. Write the significance of first law of thermodynamics.
12. Differentiate between isothermal and adiabatic change. Give examples.
13. Show that the coefficient of diffusion of gas is proportional to $T^{3/2}$.
14. State and explain Zeroth law of thermodynamics.
15. Write the importance of Kirchaff's law of radiation.
16. Define Microstate and accessible state.
17. What is free electron gas?
18. Explain Gibb's functions G and prove that G remains constant if a thermodynamics process remains isothermal as well as isobaric.

THE END