U.G. 2nd Semester Examination - 2020

PHYSICS

[PROGRAMME]

Course Code : PHYG/CC-T-02

(Thermal Physics)

SET-I

Full Marks : 40 Time : $2\frac{1}{2}$ Hours

The figures in the right-hand margin indicate marks.

Candidates are required to give their answers in their own words as far as practicable.

GROUP - A

1. Answer any **five** questions: 2×5=10

a) Define isothermal and adiabatic processes.

b) State first law of thermodynamics and explain each of its terms.

c) Define mean free path of gas molecules. How does it vary with temperature?

d) Can a kitchen be cooled by leaving the door of a refrigerator open?

e) Calculate the temperature after adiabatic compression of air (γ=1.4) to 10 atm from initial pressure of 1 atm and temperature 300 K.

f) What would happen to the entropy when two identical gases get inter-mixed?

g) What is the probability of a molecule travelling a distance x without any collision?

h) Find the number of degrees of freedom of a diatomic molecule (except vibration).

GROUP-B

2. Answer any **two** questions: 5×2=10

a) State and prove Carnot's theorem. 1+4

b) Deduce the expression for the pressure exerted by gas molecules on the wall of the containing vessel. Hence find the expression of RMS velocity of molecule using perfect gas equation. 3+2

c) Define Boyle temperature. Describe Andrew's experimental curves on CO_2 gas. 2+3

d) What is the origin of the continual motion of the Brownian particles? In an experiment with colloidal particles suspended in a liquid at temperature 27 degree Celsius, the mean square displacement in unit time was found to be $1.5\times10^{-6}cm^2$. Find the radius of a suspended particle, given $N = 6.023\times10^{23}, \eta = 0.01$ cgs. 2+3

GROUP-C

3. Answer any **two** questions: 10×2=20

a) Give Kelvin-Planck and Clausius Statements of second law of thermodynamics and prove their equivalence. Prove that entropy change due to a reversible cyclic process is zero. 1+1+4+4

b) Using thermodynamic potentials derive Maxwell's four relations. $2\frac{1}{2}+2\frac{1}{2}+2\frac{1}{2}+2\frac{1}{2}$

c) Find the general relation between C_p and C_v. Hence calculate $(C_p - C_v)$ for van-der Waal's Gas. 5+5

d) What do you mean by enthalpy function? Show that in throttling process (J-T effect), the enthalpy in the final equilibrium state is equal to the enthalpy in the final equilibrium state is equal to the enthalpy in the initial equilibrium state. Find the expression of inversion temperature for van-der Waal's gas. 2+3+5

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