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SUBJECT CODE NO: - Y-2014
FACULTY OF SCIENCE AND TECHNOLOGY
B.Sc. F.Y (Sem-I)
Examination March / April - 2023
Physics Paper-II Heat and Thermodynamics

[Time: 1:30 Hours]**[Max. Marks: 50]**

Please check whether you have got the right question paper.

N. B

- 1) Attempt all questions.
- 2) Use of logarithm table & electronic pocket calculator is allowed.

Q1 a) Derive the Fourier's differential equation by using. Rectilinear flow of heat along a metal bar. 10

b) Derive an expression for the viscosity (η) of a gas in terms of mean free path of its molecules. 10

OR

c) Describe Carnot's cycle and deduce the efficiency of an ideal heat engine. 10

d) prove that the thermodynamics relations. 10

i) $T \cdot ds = CvdT + T\left(\frac{\partial P}{\partial T}\right)_V dv$

ii) $T \cdot ds = CvdT - T\left(\frac{\partial P}{\partial T}\right)_P dp$

Q2 a) Write a short note on transference of Heat. 05

b) The opposite faces opposite face of a metal plate of 0.3cm thickness are at a difference of temperature of 100°C and the area of the plate is 200 sq. cm. Find the quantity of heat that will flow through the plate in one minute if (K=0.2 CGS units). 05

c) Explain the concept of reversible and irreversible process. 05

d) Calculate the work done when a gram molecule of a gas expands isothermally at 27°C to double its original volume. Given R=8.3 Joule deg⁻¹ mole⁻¹ 05

OR

a) Give the reason for modification of a gas equation. 05

- b) Calculate the mean free path of a gas molecule. Given that the radius of a gas molecule is 3Å. U. and number of molecules is 1.8×10^{25} per m^3 05
- c) Explain second law of thermodynamics in terms of entropy. 05
- d) Calculate the change in entropy when log of ice at 0°C is converted into water at same temperature (Latent heat of ice = 80 cal/g) 05

Q3 Multiple choice questions.

10

1. The dimension of thermal resistance is
 a) $M^{-1}L^{-2}T^3\theta^1$ b) $M^1L^1T^{-3}\theta^{-1}$
 c) $M^1L^{-2}T^{-3}\theta^1$ d) $M^2L^2T^{-3}\theta^{-2}$
2. In Ingen-Hauz experiment the thermal Conductivity 'k' and length 'l' of the rod up to which wax melts are related as.
 a) $\frac{k}{l} = \text{constant}$ b) $\frac{k}{l^2} = \text{constant}$
 c) $\frac{k^2}{l} = \text{constant}$ d) $kl = \text{constant}$
3. Vander Waal's equation is
 a) $\left(P + \frac{a}{v^2}\right)(v + b) = RT$ b) $(p - b)\left(V + \frac{a}{v^2}\right) = RT$
 c) $\left(P + \frac{v^2}{a}\right)(v - b) = RT$ d) $\left(P + \frac{a}{v^2}\right)(v - b) = RT$
4. The coefficient of viscosity is independent on
 a) Temperature b) pressure c) density d) mean free path
5. An ideal heat engine exhausting heat at 127°C is to have 27% efficiency. It must take heat at
 a) 127.9°C b) 137.9°C c) 247°C d) 327°C
6. The work done during an adiabatic process is
 a) $W = \frac{p_1v_1 - p_2v_2}{\gamma - 1}$ b) $W = \frac{p_1v_1 - p_2v_2}{1 - \gamma}$
 c) $W = \frac{nR(T_1 - T_2)}{\gamma - 1}$ d) Both a and c
7. A gas expands by 0.25m^3 at constant pressure 10^5N/m^2 . The work done by the gas is
 a) 250J b) 2500J c) 25000J d) 250000J

8. Which of the following represent a reversible process?

- a) $ds < 0$ b) $ds = 0$ c) $ds > 0$ d) $ds \geq 0$

9. The clausius clapeyron equation is

- a) $\frac{dP}{dT} = T \cdot L(v_2 - V_1)$ b) $\frac{dP}{dT} = \frac{T}{L(v_2 - V_1)}$
b) c) $\frac{dP}{dT} = \frac{L}{T(v_1 - V_2)}$ d) $\frac{dP}{dT} = \frac{L}{T(v_2 - V_1)}$

10. Entropy is maximum in which state

- a) Solid b) Liquid c) gas d) All of these