3 SEM TDC PHYH (CBCS) C 6

2022

(Nov/Dec)

PHYSICS

(Core)

Paper : C-6

(Thermal Physics)

Full Marks : 53
Pass Marks : 21

Time : 3 hours

The figures in the margin indicate full marks for the questions

1. Choose the correct option : 1×5=5

(a) In an isochoric process, the first law of thermodynamics is

(i) $dU = dQ - dW$

(ii) $dU = dQ$

(iii) $dU = dW$

(iv) $dW = dQ$

(b) In a Carnot engine, if the temperature of the source and sink is increased by the same amount, the efficiency of the engine will

(i) increase

(ii) decrease

(iii) remain same

(iv) None of the above

(c) In which of the following processes entropy remains constant?

(i) Isothermal process

(ii) Adiabatic process

(iii) Isochoric process

(iv) Isolated process

(d) Which of the following expressions defines Gibbs' free energy?

(i) $G = PV + TS$

(ii) $G = U - TS + PV$

(iii) $G = U + TS + PV$

(iv) $G = PV - TS$

(e) For an ideal gas, Joule-Kelvin coefficient μ is

(i) 1

(ii) -1

(iii) 0

(iv) None of the above

(Continued)

2. *(a)* What do you mean by thermodynamic equilibrium? 2

(b) What is the basic difference between reversible and irreversible processes? 2

(c) State Kelvin-Planck statement of second law of thermodynamics. 2

(d) Draw the temperature-entropy diagram for Carnot's cycle. 2

(e) What do you mean by adiabatic demagnetization? 2

3. *(a)* Show that entropy of the universe is increasing. 3

(b) Derive Clausius-Clapeyron equation. 3

(c) State Charles' law. Deduce the Charles' law from kinetic theory. 1+2=3

(d) Deduce most probable velocity from Maxwell's velocity distribution function. 3

4. *(a)* Derive an expression for work done during an adiabatic process. 4

(b) Describe the working of refrigerator. Find an expression for its coefficient of performance. 4

Or

State and prove Carnot's theorem.

(c) State and explain the law of equipartition of energy. 4

Or

Derive an expression of coefficient of viscosity using kinetic theory.

(d) Show that Joule-Thomson coefficient

$$\mu = \frac{1}{C_P}\left[T\left(\frac{\partial V}{\partial T}\right)_P - V\right]$$ 4

5. (a) Using Maxwell's thermodynamic relation, show that $C_P - C_V = R$. 5

(b) Discuss the results of Andrews' experiment. 5

Or

Derive Boyle's temperature from van der Waals' equation.

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