**D 100634** **(Pages : 2)** **Name.....**

**Reg. No.....**

**SIXTH SEMESTER U.G. (CBCSS–UG) DEGREE EXAMINATION, MARCH 2024**

Physics/Applied Physics

PHY6B10/APH 6B10—THERMODYNAMICS

(2019 Admission onwards)

Time : Two Hours Maximum : 60 Marks

*The symbols used in this question paper have their usual meanings*

**Section A - (Short Answer type)**

*Answer* **all** *questions in two or three sentences, each correct answer carries a maximum of* 2 *marks.*

1. State and explain Zeroth law of thermodynamics.
2. What do you mean by quasi static process and mentions its features ?
3. Distinguish between first and second order phase transitions.
4. Plot the TS diagram for various reversible processes of a hydrostatic system.
5. Write down the Clausius-Clayperon equation and its applications.
6. State Second law of thermodynamics. What is the significance of Second law of thermodynamics ?
7. What is entropy ? Explain the entropy of reversible and irreversible processes.
8. What is thermal efficiency ? Write its expression.
9. What is Joule- Thomson expansion ? What is its use ?
10. Compare the slopes of adiabatic and isothermals.
11. Which are the macroscopic quantities, required to describe the materials in a cylinder of an automobile engine ?
12. Write short note on internal energy.

(Ceiling 20 marks)

**Section B (Paragraph / Problem type)**

*Answer* **all** *questions in a paragraph of about half a page to one page, each correct answer carries a maximum of* 5 *marks.*

13. What are virial coefficients ? Give their significance.
14. When 50 g of water is heated from 10°C to 90°C, by how much does its entropy change ?

**Turn over**

15. A quantity of air at 27°C is suddenly compressed to half its original volume. Find the final pressure and temperature. $\left(\text{Given } \gamma = 1.42^{1.4} = 2.64\right)$.

16. Show that for a perfect gas $\left(\frac{\partial u}{\partial v}\right)_T = 0$.

17. Find the efficiency of a Carnot's engine working between 127°C and 27°C. It absorbs 80 cal of heat. How much heat is rejected ?

18. Find the change in entropy when a perfect gas expands isothermally and adiabatically.

19. Calculate the specific heat of saturated steam. Given that the specific heat of water at 100°C = 1.01 and latent heat of vaporization decreases with increase in temperature at the rate of 0.64 cal/K. Latent heat of vaporization of steam is 540 cal.

(Ceiling = 30 marks)

**Section C (Essay type)**

*Essays - Answer in about two pages, any* **one** *question.*

*Answer carries* 10 *marks.*

20. Derive the Maxwell's thermodynamic relations from thermodynamic potentials functions?

21. Discuss with necessary theory the construction, working of a Carnot engine and derive an expression for its efficiency.

(1 × 10= 10 marks)

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# SIXTH SEMESTER U.G. DEGREE EXAMINATION MARCH 2023

(CBCSS—UG)

Physics/Applied Physics

PHY 6B 10/APH 6B 10—THERMODYNAMICS

(2019 Admission onwards)

Time : Two Hours Maximum : 60 Marks

*The symbols used in question paper have their usual meanings.*

## Section A (Short Answer Type)

*Answer* **all** *questions in two* **or** *three sentences, each correct answer carries a maximum of* 2 *marks.*

1. Prove that all Carnot engines operating between the same two reservoirs have the same efficiency.
2. What are the features of thermodynamic temperature scale ?
3. Plot the TS diagram of a Carnot's cycle.
4. What are the insights obtained from the relation $dU = đW + đQ$ ?
5. What is Helmholtz function ? Why is it important ?
6. Derive Clausius theorem.
7. What are the general characteristics of macroscopic co-ordinates ?
8. Distinguish between the systems separated by adiabatic walls and diathermic walls.
9. How is external work different from internal work ?
10. Differentiate between isobaric and isochoric processes.
11. State and explain the second law of thermodynamics.
12. Comment on the molar heat capacities of monatomic gases.

. (Ceiling 20)

**Turn over**

## Section B (Paragraph/Problem Type)

*Answer* **all** *questions in a paragraph of about* **half a page** *to* **one page**, *each correct answer carries a maximum of* 5 *marks.*

13. Under what pressure ice freezes at 271 K if the change in specific volume when 1 kg. of water freezes is $91 \times 10^{-6}$ $m^3$. Given latent heat of ice = $3.36 \times 10^5$ $Jkg^{-1}$.

14. Prove the principle of increase of entropy.

15. What is a hydrostatic system ? Briefly explain.

16. Show that adiabatics are steeper than isothermals.

17. A mass of mercury at standard atmospheric pressure and a temperature of 25 °C is kept at constant volume. If the temperature is raised to 27°C, what will be the final pressure ? For mercury, volume expansivity = $1.81 \times 10^{-4}$ $K^{-1}$ and the isothermal compressibility = $4.01 \times 10^{-11}$ $Pa^{-1}$.

18. Determine the work done in an adiabatic process in terms of temperature.

19. Derive the relation connecting Cp and Cv.

(Ceiling 30)

## Section C (Essay Type)

*Essay-Answer in about* **two pages**, *any* **one** *questions.*
*The question carries* 10 *marks.*

20. Discuss the equality of the ideal gas and thermodynamic temperatures.

21. Explain the PV diagram and PT diagram of $H_2O$.

(1 × 10 = 10 marks)

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# SIXTH SEMESTER U.G. DEGREE EXAMINATION, MARCH 2022

(CBCSS—UG)

Physics/Applied Physics

PHY 6B 10/APH 6B 10—THERMODYNAMICS

(2019 Admissions)

Time : Two Hours Maximum : 60 Marks

*The symbols used in question paper have their usual meanings*

## Section A (Short Answer Type)

*Answer at least* **eight** *questions.*
*Each question carries* 3 *marks.*
*All questions can be attended.*
*Overall Ceiling* 24.

1. Distinguish between reversible and irreversible processes.
2. Is it possible to get a Carnot's engine with 100 % efficiency ? Explain.
3. Plot the TS diagram for various reversible processes of a hydrostatic system.
4. State the mathematical form of entropy principle and explain it.
5. What is Joule- Thomson expansion ? What is its use ?
6. Distinguish between first and second order phase transitions.
7. Which are the macroscopic quantities, required to describe the materials in a cylinder of an automobile engine ?
8. State and explain the zeroth law of thermodynamics.
9. Explain thermal equilibrium.
10. What are the features of quasi-static process ?
11. Give the mathematical formulation of the first law of thermodynamics and its related ideas.
12. Comment on the molar heat capacities of ideal gases.

(8 × 3 = 24 marks)

**Turn over**

## Section B (Paragraph/Problem Type)

*Answer at least* **five** *questions.*
*Each question carries* 5 *marks.*
*All questions can be attended.*
*Overall Ceiling* 25.

13. Explain the isotherms of $H_2O$.

14. Write down the equations representing the hydrostatic properties of a pure substance and then express Maxwell's thermodynamic relations.

15. Find the change in entropy when a perfect gas expands isothermally and adiabatically.

16. The pressure of 10 g of copper is increased at ice point from 0 to 1000 times the atmospheric pressure. Calculate the work done. Given the density of copper 8930 $kgm^{-3}$, its isothermal compressibility $7.16 \times 10^{-12} Pa^{-1}$.

17. What are virial coefficients ? Give their significance.

18. Show that the adiabatic curve has a steeper negative slope than does an isothermal curve at the same point.

19. Explain the microscopic theories which help to give information about thermal properties of systems.

(5 × 5 = 25 marks)

## Section C (Essay Type)

*Answer any* **one** *question.*
*The question carries* 11 *marks.*

20. Analyse the working of a Carnot's engine, calculating expression for its efficiency.

21. Discuss first order phase transition and derive the Clausius-Clapeyron equation.

(1 × 11 = 11 marks)