D 140214 **(Pages : 2)** **Name.....**

Reg. No.....

SIXTH SEMESTER (CBCSS—U.G.) DEGREE EXAMINATION
APRIL 2026

Physics/Applied Physics

PHY6B10/APH6B10—THERMODYNAMICS

(2020 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. Define the Zeroth Law of Thermodynamics.
2. Differentiate between macroscopic and microscopic points of view in thermodynamics.
3. What is an ideal-gas temperature scale ?
4. Define intensive and extensive properties with examples.
5. What is a quasi-static process?
6. State the First Law of Thermodynamics in its mathematical form.
7. What is meant by heat capacity ? How is it related to specific heat ?
8. Write the equation of state for an ideal gas.
9. Define a heat engine and give an example.
10. State the Kelvin-Planck statement of the Second Law of Thermodynamics.
11. Write down the Clausius-Clayperon equation and its applications ?
12. Define enthalpy and give its mathematical expression.

(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. Show that the hydrostatic work depends on the path taken in a PV diagram.

14. A gas expands from an initial state of 2 atm and 3 liters to a final state of 1 atm and 6 liters quasi-statically. Calculate the work done by the gas.

15. Derive an expression for the internal energy of an ideal gas using the kinetic theory of gases.

16. Calculate the depression of melting point of ice by 1 atm increase of pressure, given latent heat of ice = 3.35×10^{5} J/Kg and the specific volumes of 1 Kg. of ice and water at 0°C are $1.090 \times 10^{-3} m^3$ and 10^{-3} m^3 respectively.

17. Explain the concept of reversibility and irreversibility in thermodynamic processes.

18. A Carnot's engine whose lower temperature reservoir is at 7 °C has an efficiency of 50 %. It is desired to increase the efficiency to 70 %. By how many degrees should the temperature of the high temperature reservoir be increased ?

19. What is the principle of increase of entropy ? Illustrate with an example.

(Ceiling - 30)

Section C (Essay Type)

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

20. Derive the mathematical formulation of the First Law of Thermodynamics and explain its significance.

21. Derive Maxwell's relations and discuss their applications in thermodynamics.

(1 × 10 = 10 marks)

D 120204 **(Pages : 2)** **Name.....**

Reg. No.....

SIXTH SEMESTER (CBCSS—UG) DEGREE EXAMINATION
MARCH 2025

Physics/Applied Physics

PHY6B10/APH 6B 10—THERMODYNAMICS

(Admissions Year—2019 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. Derive the first and second TdS equations.
2. What is meant by a thermodynamic system ?
3. Is it possible to get a Carnot's engine with 100 % efficiency ? Explain.
4. State and explain the zeroth law of thermodynamics.
5. What is a refrigerator and define its co-efficient of performance ?
6. Compare the slopes of adiabatic and isothermals ?
7. What do you mean by an indicator diagram ? Explain it.
8. What is the significance of PV diagram ?
9. State Kelvin-Planck and Clausius statement of Second law of thermodynamics ?
10. What do you mean by quasi static process ?
11. Which are the macroscopic quantities, required to describe the materials in a cylinder of an automobile engine ?
12. Distinguish between reversible and irreversible processes.

(Ceiling = 20 marks)

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. Deduce the second latent heat equation of Clausius $C_2 - C_1 = \left(\frac{dL}{dT}\right) - \left(\frac{L}{T}\right)$ where C_1 and C_2 represent the specific heat of a liquid and its saturated vapour and L is the latent heat of the vapour.

14. A carnot's engine whose temperature of the source is 400 K takes 200 calories of heat at this temperature and rejects 150 calories of heat to the sink. What is the temperature of the sink ? Also calculate the efficiency of the engine.

15. Show that during a reversible adiabatic process, the entropy of the system remains constant.

16. 1 kg of water at 273 K is brought in contact with a heat reservoir at 373 K. What is the change in entropy of water as it reaches 373 K ?

17. Calculate the change in temperature of boiling water when the pressure is increased by 27.12 mm. of Hg. The normal boiling point of water at atmospheric pressure is 100°C. Latent heat of steam = 537 cal/g and specific volume of steam = 1674.

18. Using Maxwell's thermodynamic relations, prove that for any substance, the ratio of the adiabatic and isothermal elasticities is equal to the ratio of the two specific heats.

19. Air at N.T.P is compressed to half of its volume. Calculate the change in its temperature.

(Ceiling = 30 marks)

Section C (Essay Type)

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

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

21. What are isothermal and adiabatic processes ? Derive the equation for work done in isothermal and adiabatic processes ?

(1 × 10 = 10 marks)

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)

C 40625 (Pages : 2) Name.....

Reg. No.....

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 91×10^{-6} m^3. Given latent heat of ice = 3.36×10^5 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 = 1.81×10^{-4} K^{-1} and the isothermal compressibility = 4.01×10^{-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)

C 20658 (Pages : 2) Name.....

Reg. No.....

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)