QP CODE: 22100925

22100925

Reg No : .....

Name : .....

B.Sc DEGREE (CBCS) REGULAR / REAPPEARANCE EXAMINATIONS, APRIL 2022

Sixth Semester

CORE COURSE - PH6CRT09 - THERMAL AND STATISTICAL PHYSICS

Common for B.Sc Physics Model I, B.Sc Physics Model II Applied Electronics, B.Sc Physics Model II Computer Applications & B.Sc Physics Model III Electronic Equipment Maintenance

2017 Admission Onwards

78D89FB1

Time: 3 Hours Max. Marks : 60

Part A

*Answer any **ten** questions.*

*Each question carries **1** mark.*

1. Explain thermodynamic system and thermodynamic variables.
2. Define isothermal compressibility.
3. Define molar specific heat capacity at constant volume.
4. Deduce the relation between, coefficient of performance of refrigerator and efficiency of heat engine
5. What is meant by Kelvin's absolute scale of temperature?
6. Briefly explain the concept of entropy.
7. What is enthalpy?
8. Deduce equation for thermal conductivity.
9. State Stefan's law.
10. What is meant by thermodynamic probability?
11. Define Canonical ensemble.
12. What are the characteristics of Bose particles?

(10×1=10)

Part B

*Answer any **six** questions.*

*Each question carries **5** marks.*

13. Explain Andrew's experiment on carbon dioxide. Discuss the results obtained.

14. Derive the general expression for work done by a thermodynamic system of gas in a cylinder. Show the work is a path dependent function.

15. An ideal gas expands to 6 times its initial volume at constant temperature. If the pressure after expansion is 18 Pa, find the initial pressure.

16. A Carnot engine operates between 27^{o} C and 127^{o} C. In each cycle, it receives 800 calories heat from the source. Calculate the amount of heat rejected to the sink in each cycle. Calculate the efficiency of the engine and the work done in each cycle.

17. 10 gm of water is heated from 40^{0} C to 80^{0} C. Calculate the change in entropy.

18. Find the expression for efficiency of a reversible Carnot's engine with the help of T-S diagram.

19. Prove that it is impossible to obtain absolute zero temperature.

20. A system has two energy levels with an energy gap of 1.2×10^{-21}J. The upper level is two - fold degenerate. Calculate the probability that lower level is occupied if the system is in thermal contact with heat reservoir at 150 K.

21. A certain energy level allowed for a fermion has degeneracy g=10. Find the number of ways 4 such identical fermions can be filled in this energy level?

(6×5=30)

Part C

*Answer any **two** questions.*

*Each question carries **10** marks.*

22. What are critical constants of a gas? Deduce the expression for critical constants in terms Van der Waals constants.

23. Define heat capacity and internal energy? Derive (i) difference of heat capacity equations(C_p-C_v) using Tds equations and (ii) first energy equation.

24. Describe Lee's disc method to determine the thermal conductivity of a bad conductor.

25. Derive Maxwell Boltzmann distribution law.

(2×10=20)

23105164

QP CODE: 23105164

Reg No : .....

Name : .....

B.Sc DEGREE (CBCS) REGULAR / REAPPEARANCE EXAMINATIONS, MARCH 2023

Sixth Semester

CORE COURSE - PH6CRT09 - THERMAL AND STATISTICAL PHYSICS

Common for B.Sc Physics Model I, B.Sc Physics Model II Applied Electronics, B.Sc Physics Model II Computer Applications & B.Sc Physics Model III Electronic Equipment Maintenance

2017 Admission Onwards

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Time: 3 Hours Max. Marks : 60

Part A

*Answer any **ten** questions.*

*Each question carries **1** mark.*

1. What is critical temperature?
2. State the significance and limitations of first law of thermodynamics.
3. What is an indicator diagram? What is its significance?
4. State second law of thermodynamics.
5. Explain Carnot theorem.
6. Define entropy of a thermodynamic system.
7. What is enthalpy?
8. What is meant by zero point energy?
9. Define coefficient of thermal conductivity. What are its dimensions?
10. Define Grand Canonical ensemble.
11. Differentiate between classical statistics and quantum statistics.
12. Write down BE distribution law and explain the symbols.

(10×1=10)

Part B

*Answer any **six** questions.*

*Each question carries **5** marks.*

13. The van der Waals constants for Carbon dioxide are a=1.32 x10^4N $m^4$$mole^{-2}$ and b=3.64 x10^{-5} $m^3$$mole^{-1}$. Calculate the critical pressure and temperature.

14. Explain thermal equilibrium. State and explain Zeroth Law of thermodynamics. Introduce the concept of temperature based on this law.

15. Discuss in detail coefficient of expansivity and compressibility.

16. Apply first law of thermodynamics to derive C_p-C_v =R

17. Calculate the increase in entropy of 1 kg of ice when it is converted into steam. Given the specific heat of water is 1 kcal/kg-^{0}C, latent heat of ice is 80 k cal/kg and the latent heat of steam is 540 k cal/kg.

18. Prove that in a T-S diagram the slope of isochoric curve is T/C_v and that of isobaric curve is T/C_p.

19. Write down the Maxwell's relations and use them to show that the internal energy is a function of T only.

20. Flip a coin 6 times. Calculate the total number of microstates and also the most probable microstate.

21. The first vibrational energy of a diatomic molecule is 600 cm^{-1} above the ground state. Calculate the relative population in these levels at 127^0 C.

(6×5=30)

Part C

*Answer any **two** questions.*

*Each question carries **10** marks.*

22. Explain the working of a Carnot's Engine. Arrive at an expression for the work done in a cycle.

23. a) What do you mean by thermal radiations? Explain the nature and properties of thermal radiations. b) Explain the terms emissive power, absorbtive power and radiant emittance,

24. State Stefan- Boltzmann law of radiation. Deduce this law on thermodynamic considerations.

25. What is FD statistics? What are the basic postulates used? Derive an expression for the most probable distribution of the particles governed by FD statistics.

(2×10=20)

K/03

20100435

QP CODE: 20100435

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Reg No : .....

Name : .....

BSc DEGREE (CBCS) EXAMINATION, MARCH 2020

Sixth Semester

Core course - PH6CRT09 - THERMAL AND STATISTICAL PHYSICS

B.Sc Physics Model I, B.Sc Physics Model II Computer Applications, B.Sc Physics Model III Electronic Equipment Maintenance, B.Sc Physics Model II Applied Electronics

2017 Admission Onwards

1C131905

Time: 3 Hours Maximum Marks :60

Part A

Answer any ***ten*** *questions.*

Each question carries 1 mark.

1. Explain the state of thermodynamic equilibrium.
2. What is irreversible process? Give examples of irreversible process.
3. What is a cyclic process? Give example.
4. Define molar specific heat capacity at constant volume.
5. Define efficiency of heat engine.
6. What is the importance of T-S diagram ?
7. What is the physical significance of thermodynamic potentials?
8. Write heat capacity equations.
9. Define coefficient of thermal conductivity. What are its dimensions?
10. Write down the expression for average energy of a particle and explain the symbols.
11. Grand canonical ensemble can be considered as an open system. Why?
12. Give two examples of bosons.

(10×1=10)

Part B

Answer any six questions

Each question carries 5 marks

13. Explain Andrews's experiment on carbon dioxide. Discuss the results obtained

14. Why it is necessary to modify the ideal gas equation of state? Describe how van der Waals corrections are introduced in the ideal gas equation.

15. An ideal gas expands to 6 times its initial volume at constant temperature. If the pressure after expansion is 18 Pa, find the initial pressure.

16. Derive Clausius –Clapeyron Latent heat Equation.

17. State and prove the principle of increase of entropy.

18. Assuming the specific heat capacity of water, find the change in entropy when 0.1 kg of water at 15^0 C is mixed with 0.16kg of water at 40^0 C.

19. Calculate the maximum amount of heat which may be lost per second by radiation from a sphere of 5cm in diameter at a temperature of 600K when placed in an enclosure at a temperature of 300K. (σ=5.7X10 $^{-12}$).

20. A free particle moves along a line of length L in the positive X-direction. Let the momentum of the particle be p_x and energy be $E = c\, p_x$ where c is a constant. Obtain the density of states.

21. An atom has two energy levels E_1 = 0.2 eV and E_2 = 0.4 eV with degeneracies g_1 = 1 and g_2 = 2. In equilibrium at temperature T=300 K, the number of atoms in the lower energy level E_1 is n1=100,000. Find the number of atoms in the higher energy level E_2 using Maxwell-Boltzmann statistics. (Round-off the answer to nearest integer)

(6×5=30)

Part C

*Answer any **two** questions.*

*Each question carries **10** marks.*

22. Explain the working of a Carnot's Engine. Arrive at an expression for the work done in a cycle.

23. Explain thermodynamic potential and their relations with thermodynamic variables.

24. State Stefan- Boltzmann law of radiation. Deduce this law on thermodynamic considerations.

25. What is FD statistics? What are the basic postulates used? Derive an expression for the most probable distribution of the particles governed by FD statistics.

(2×10=20)

QP CODE: 21101105

21101105

Reg No : .....

Name : .....

B.Sc DEGREE (CBCS) EXAMINATION, APRIL 2021

Sixth Semester

CORE - PH6CRT09 - THERMAL AND STATISTICAL PHYSICS

Common for B.Sc Physics Model I, B.Sc Physics Model II Applied Electronics, B.Sc Physics Model II Computer Applications & B.Sc Physics Model III Electronic Equipment Maintenance

2017 Admission Onwards

F7510057

Time: 3 Hours Max. Marks : 60

Part A

*Answer any **ten** questions.*

*Each question carries **1** mark.*

1. How does a real gas differ from an ideal gas?
2. What is meant by quasi-static process? Can it be achieved in practice?
3. Explain internal energy of a system.
4. Prove the equivalence of Clausius and Kelvin- Planck's statement of the second law of thermodynamics.
5. Discuss the reversibility of a Carnot's cycle.
6. Define entropy of a thermodynamic system.
7. Represent Carnot Cycle on a temperature-entropy diagram.
8. Write Maxwell's four thermodynamic relations.
9. What is Stefan's constant? What is its unit?
10. Calculate the volume of a phase cell in mu space.
11. Give two examples of fermions.
12. What are the postulates used in BE statistics?

(10×1=10)

Part B

*Answer any **six** questions.*

*Each question carries **5** marks.*

13. Explain thermal equilibrium. State and explain Zeroth Law of thermodynamics. Introduce the concept of temperature based on this law.

14. Deduce the equation for enthalpy from molar specific heat at constant pressure and molar specific heat at constant temperature.

15. Calculate the work done when unit mass of an ideal gas expands isothermally at 27^oC to double its original volume. [R= $8.3145 Jmol^{-1}K^{-1}$]

16. Define thermodynamic scale of temperature and show that this scale agrees with that of perfect gas scale.

17. Show that for a perfect gas $(\partial U/\partial V)_T = 0$.

18. Derive Clausius - Clapeyron latent heat equation using first Tds equation.

19. An ice box is built of wood of 1.75 cm thick, lined inside with cork of 3cm thick. If the temperature of the inner surface of cork is 0^0 C and that of outer surface of wood is 12^0 C. What is the temperature of interface? The thermal conductivity of wood and cork are 0.0006 and 0.00012 CGS units respectively.

20. The first vibrational energy of a diatomic molecule is 600 cm^{-1} above the ground state. Calculate the relative population in these levels at 127^0 C.

21. Explain in detail the three types of ensembles.

(6×5=30)

Part C

*Answer any **two** questions.*

*Each question carries **10** marks.*

22. Derive and discuss Van der Waals equation of state of a gas. Discuss the limitation of Van der Waals equation.

23. What happens to the change in entropy of a system when it undergoes (a) a reversible change (b) an irreversible change (c) an adiabatic process.

24. a) What do you mean by thermal radiations? Explain the nature and properties of thermal radiations.
    b) Explain the terms emissive power, absorbtive power and radiant emittance.

25. Derive Maxwell Boltzmann distribution law.

(2×10=20)