

**Faculty of Science**  
**B. Sc (Physics) I-Year, CBCS –II Semester**  
**Regular Examinations -June/July, 2022**  
**PAPER: Thermal Physics**

Time: 3 Hours

Max Marks: 80

**Section-A**

- I. Answer any *eight* of the following (8x4=32 Marks)
1. Distinguish between isothermal and adiabatic processes.
  2. State and explain the first law of Thermodynamics.
  3. Calculate the value of rms speed for Hydrogen molecule at 4727°C.
  4. Derive an expression for the difference of two specific heats.
  5. Describe how Helium can be liquefied by Kapitza's method.
  6. Calculate the Temperature of inversion of He gas ( $a = 3.44 \times 10^{-3} \text{ N-m}^4/\text{mol}^2$  and  $b = 0.0237 \times 10^{-3} \text{ m}^3/\text{mol}$  and  $R = 8.31 \text{ J/mol-K}$ ).
  7. State and explain Stefan's law.
  8. Write a short note on solar constant.
  9. Calculate the surface temperature of the sun, if  $\lambda_m = 4573 \text{ \AA}$ ,  $\lambda_m$  being the wavelength of the maximum intensity of emission.
  10. Explain the different types of ensembles.
  11. Explain the state of 'statistical equilibrium' of the system.
  12. Write short note on white dwarfs.

**Section-B**

- II. Answer the following questions (4x12=48 Marks)
- 13.(a) Write the Maxwell's law of distribution of molecular speeds in a gas and obtain expressions for the average speed, root-mean square speed and most probable speed in terms of gas parameters.  
(OR)  
(b) What is Entropy – Temperature diagram? Obtain the equation  $\eta = 1 - \frac{T_2}{T_1}$  for acarnot engine from T – S diagram.
  - 14.(a) Obtain Maxwell's thermodynamic equations using the thermodynamic potentials.  
(OR)  
(b) What is adiabatic demagnetization? How is the principle used in producing low temperatures?
  - 15.(a) Explain Planck's postulates of radiation. Derive an expression for Planck's black body radiation.  
(OR)  
(b) Explain the construction and working of disappearing filament optical pyrometer with neat diagram.
  - 16.(a) Give a comparison of Maxwell-Boltzman, Bose-Einstein, Fermi-Dirac statistics.  
(OR)  
(b) Derive an expression for Bose – Einstein distribution law and obtain Planck's radiation law from it.

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## Faculty of Science

## B.Sc (Physics) I-Year, CBCS –II Semester Backlog Examinations –Jan, 2023

## PAPER: Thermal Physics

Time: 3 Hours

Max Marks: 80

## Section-A

- I. Answer any *eight* of the following questions (8x4=32 Marks)
1. State the postulates of kinetic theory of gases.
  2. Explain first law of thermodynamics and its limitations.
  3. Calculate the change in entropy when 10gm of ice at  $0^{\circ}\text{C}$  changes into steam at  $100^{\circ}\text{C}$  [Latent heat of ice =  $80\text{ cal gm}^{-1}$ , Specific heat of water =  $1\text{ cal gm}^{-1} \text{ }^{\circ}\text{C}^{-1}$  Latent heat of steam =  $540\text{ cal gm}^{-1}$ ].
  4. Define thermodynamic potentials. What is their significance.
  5. Describe Kapitza method for liquefaction of Helium.
  6. Calculate the temperature of inversion of Helium gas. Given  $a=3.44 \times 10^{-3} \text{ N-m}^4/\text{mol}^2$  and  $b=0.237 \times 10^{-3} \text{ m}^3/\text{mol}$  and  $R=8.31 \text{ J/mol-K}$
  7. Deduce Stefan's law from Planck's law of radiation.
  8. Describe the working of optical pyrometer.
  9. Find the wavelength at which maximum energy is radiated by a black body of having a temperature  $327^{\circ}\text{C}$ . Wien's constant =  $2.897 \times 10^{-3} \text{ mK}$ .
  10. Differentiate between classical and quantum statistical mechanics.
  11. What is black hole? Write a note on neutron star.
  12. Calculate the number of modes in a chamber of volume 50 c.c. in the frequency range  $4 \times 10^{14}$  and  $4.01 \times 10^{14} \text{ sec}^{-1}$ .

## Section-B

- II. Answer the following questions (4x12=48 Marks)
13. (a) Define and explain the term mean free path. Derive an expression for viscosity of a gas in terms of mean free path of its molecules.  
(OR)  
(b) What is T-S diagram? Find the expression for efficiency of a reversible Carnot's engine with the help of T-S diagram.
  14. (a) Explain the Joule-Kelvin effect. Derive expression for Joule-Kelvin co-efficient for an ideal gas and for a Vander wall's gas.  
(OR)  
(b) What do you mean by adiabatic demagnetization .How is it used to produce lowest temperature?
  15. (a) Deduce Planck's law of radiation. Derive Wien's law and Rayleigh-Jeans law from Planck's law.  
(OR)  
(b) Define solar constant. Obtain an expression for calculating the temperature of sun with the help of solar constant.
  16. (a) Deduce Maxwell-Boltzmann velocity distribution for classical particles.  
(OR)  
(b) State the conditions for the F-D statistics. Derive an expression for the F-D distribution.

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## Faculty of Science

## B.Sc (Physics) I-Year, CBCS –II Semester Regular Examinations -June, 2023

## PAPER: Thermal Physics

Time: 3 Hours

Max Marks: 80

## Section-A

I. Answer any *eight* of the following questions (8x4=32 Marks)

1. What is mean free path? Derive an expression for it.
2. State and explain second law of thermodynamics.
3. Calculate the change in entropy when 10gm of ice at  $0^{\circ}\text{C}$  changes into steam at  $100^{\circ}\text{C}$  [Latent heat of ice= $80\text{calgm}^{-1}$ , Specific heat of water= $1\text{calgm}^{-1} \text{ }^{\circ}\text{C}^{-1}$  Latent heat of steam = $540\text{calgm}^{-1}$ ].
4. What are thermodynamic potentials? Write expressions.
5. Explain the Porus- Plug experiment.
6. Calculate the temperature of inversion of Helium gas. Given  $a=3.44\times 10^{-3}\text{ N-m}^4/\text{mol}^2$  and  $b=0.237\times 10^{-3}\text{ m}^3/\text{mol}$  and  $R=8.31\text{ J/mol-K}$ .
7. Deduce Stefan's law from Planck's law of radiation.
8. Describe the working of Optical Pyrometer.
9. Find the wavelength at which maximum energy is radiated by a black body of having a temperature  $327^{\circ}\text{C}$ . Wien's constant= $2.897 \times 10^{-3}\text{mK}$ .
10. Differentiate between classical and quantum statistical mechanics.
11. Write a note on white dwarf star.
12. For a distribution of 2 identical particles in 4 equally probable energy states. Calculate the number of possible arrangements according to B-E statistics.

## Section-B

II. Answer the following questions (4x12=48Marks)

- 13.(a) Give the postulates of kinetic theory of gases. Derive an expression for the viscosity of a gas on the basis of kinetic theory.  
(OR)  
(b) What is T-S diagram? Find the expression for efficiency of a reversible Carnot's engine with the help of T-S diagram.
- 14.(a) Explain the Joule-Kelvin effect. Derive expression for Joule-Kelvin co-efficient for an ideal gas and for a Vander wall's gas.  
(OR)  
(b) Define refrigeration? Explain the principle of working of a vapour compression machine.
- 15.(a) What is Planck's hypothesis? Derive Planck's formula for the distribution of energy in blackbody radiation.  
(OR)  
(b) Define solar constant. Obtain an expression for calculating the temperature of sun with the help of solar constant.
- 16.(a) Deduce Maxwell-Boltzmann velocity distribution for classical particles.  
(OR)  
(b) State the conditions for the F-D statistics. Derive an expression for the F-D distribution.

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