

Reg. No. :

Name :

V Semester B.Sc. Degree (CBCSS – Reg./Sup./Imp.) Examination,
November 2020

(2014 Admn. Onwards)
CORE COURSE IN PHYSICS
5B07PHY : Thermal Physics

Time : 3 Hours

Max. Marks : 40

Instruction : Write answers in **English** only.

SECTION – A

Very short answer type. **All** questions to be answered. **Each** question carries **1** mark.

1. Which is an extensive coordinate ?
 a) Volume b) Temperature c) Pressure d) None
2. The change in entropy in a reversible cycle is _____
3. During an adiabatic process _____ is constant.
4. At absolute zero all states up to _____ energy level are occupied. **(4×1=4)**

SECTION – B

Short answer type. **7** questions to be answered. **Each** question carries **2** marks.

5. State the third law of thermodynamics.
6. What is a refrigerator and define its coefficient of performance ?
7. Draw the T-S diagram for the Carnot cycle.
8. What is meant by principle of increase of entropy ?
9. Is it possible to obtain 100% efficiency for a heat engine ? Give reason.
10. What are extensive and intensive variables ? Give examples.
11. What do you mean by an indicator diagram ? Explain it.
12. Derive the first TdS equation.
13. What are the postulates of statistical mechanics ?
14. Distinguish between bosons and fermions. **(7×2=14)**

P.T.O.

SECTION - C

Short essay/problem type. **4** questions to be answered. **Each** question carries **3** marks.

15. A Carnot engine takes 200 calories of heat from a source at temperature 400K and rejects 150 calories of heat to sink. What is the temperature of the sink ? Also calculate the efficiency of the engine.
16. A monatomic ideal gas of volume 1 litre at a pressure of 8 atmos. undergoes adiabatic expansion until the pressure drops to 1 atmosphere. How much work is done ? ($1 \text{ atm} = 10^5 \text{ N/m}^2$).
17. Calculate the increase in entropy of 1kg of ice when it is converted into steam. Specific heat of water $1 \text{ Kcal kg}^{-1} \text{ }^\circ\text{C}^{-1}$. Latent heat of ice 80 cal/g and Latent heat of steam 540 cal/g .
18. When a refrigerator is switched off, the ice stored in a cold storage melts at the rate of 36 kg/hour when the external temperature is 30° C . Find the minimum output power of the motor of the refrigerator required to prevent the ice from melting. $L = 80 \text{ cal/g}$, $1 \text{ calorie} = 4.2 \text{ J}$.
19. Calculate the boiling point of water under a pressure of two atm. It is given that the boiling point of water under a pressure of one atmosphere is 373.2 K . Latent heat of vaporization is 539 cal/g . Specific volume of water is 1 cc and specific volume of steam is 1674 cc .
20. Radiation from Big Bang has been Doppler shifted to longer wavelength by the expansion of universe and today has a spectrum corresponding to that of a black body at 2.7 K . Find the wavelength at which the energy density of this radiation is maximum. In what region of this spectrum is this radiation ? $(4 \times 3 = 12)$

SECTION - D

Long essay type. Answer **any 2**. **Each** question carries **5** marks.

21. Derive Maxwell's 4 thermodynamical relations. Use one of them to obtain Clausius-Clapeyron's Latent heat equation.
22. Obtain the expression for entropy of a perfect gas in terms of Pressure, Volume and Specific Heats.
23. State and prove Carnot's theorem.
24. Explain the Diesel cycle and the working of a Diesel engine. Derive an expression for its efficiency.

 $(2 \times 5 = 10)$