K17U 2318

Reg. No. : ....

Name : ....

V Semester B.Sc. Degree (CCSS – Sup./Imp.) Examination, November 2017
CORE COURSE IN PHYSICS
5B07 PHY : Thermal Physics
(2011 and Earlier Admission)

Time : 3 Hours   Total Weightage : 30

SECTION – A

Each bunch of **four** questions carries a weight of **1**.

Choose the correct answer from the given list of 4 alternatives :

1. i) For a monoatomic gas the adiabatic relation between pressure and volume is

   a) PV = Const   b) $PV^{5/3}$ = Const

   c) $PV^{7/5}$ = Const   d) $PV^{2/3}$ = Const

   ii) The temperature of an ideal gas is 300K. By adiabatic expansion its volume becomes double. The final temperature is nearly (r = 1).

   a) 213 K   b) 500 K

   c) $PV^{5/3}$ = Const   d) 300 K

   iii) A refrigerator is

   a) A heat engine   b) An air cooler

   c) An electric motor   d) A heat engine working in reverse order

   iv) The law which leads to the conclusion that its impossible to convert all heat extracted from a hot source to work is

   a) Zeroth law   b) First law

   c) Third law   d) Second law

2. i) A phase space has ________ dimensions.

   a) 3   b) 4

   c) 2   d) 6

P.T.O.

ii) An example of an intensive parameter of a thermodynamic system is

a) Volume b) Area

c) Entropy d) Pressure

iii) MB distribution function holds for

a) Identical but distinguishable particles

b) Identical and indistinguishable particles

c) All particles

d) None of the above

iv) The Clausius-Claperyon equation is $\frac{dP}{dT} =$

a) $\frac{L}{T(V_2 - V_1)}$ b) $TL(V_2 - V_1)$

c) $\frac{L}{L(V_2 - V_1)}$ d) None of these

(2×1=2)

SECTION – B

Answer **any six** questions. **Each** question carries a weight of **1**.

3. Define intensive and extensive variables.

4. Write down the Maxwell's four Thermodynamic relations.

5. Define thermodynamic potentials U, F, G and H.

6. What is a TS diagram ?

7. Show that heat and work both are path dependent functions with the help of indicator diagrams.

8. Briefly explain Kelvin's thermodynamic scale of temperature.

9. Derive Stefan's law from Planck's radiation formula.

10. State the third law of thermodynamics.

(6×1=6)

SECTION – C

Answer **any nine** questions. **Each** question carries a weight of **2.**

11. A Carnots refrigerator takes heat from water at 0°C and discards it to a room temperature at 27°C. 1 kg of water at 0°C is to be changed into ice si 0°C. How many calories of heat are discarded to the room ? What is the work done by the refrigerator in this process ? What is the coefficient of performance of the machine ? (1 calorie = 4.2 Joule)

12. 50 grams of water at 0°C is mixed with an equal mass of water at 80°C. Calculate the resultant increase in entropy.

13. Deduce the temperature at which a black body loses thermal energy at the rate of 1 watt/cm^2.

14. Calculate the number of modes in a chamber of volume 50 cc in the frequency range 4×10^{14} and 4.01×10^{14} sec^{-1}.

15. A Carnots 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.

16. Given $Z = V\left(\frac{2\pi mkT}{h^2}\right)^{3/2}$ as the partition function of a system, find out the internal energy and entropy of the system.

17. What is a perfect black body ? Draw the curves for the distribution of energy in the spectrum of a black body for two different temperatures.

18. Establish the relation for efficiency of a Carnot's engine using T-S diagram in $\eta = \frac{T_1 - T_2}{T_1}$.

19. Using Maxwell's thermodynamical relations show that

$$\left(\frac{\partial C_v}{\partial V}\right) = T\left(\frac{\partial^2 S}{\partial V.\partial T}\right) = T\left(\frac{\partial^2 P}{\partial T^2}\right)_V$$