Roll No. A.....

CBC-612-T

B.Sc./B.Sc B.Ed.

Third Semester (End Semester) Examination, Dec., 2018

PHYSICS

Paper - PHY-CC-311

(Thermal Physics and Statistical Mechanics)

Time : Three Hours] [Maximum Marks : 60

Note :– Attempt questions of each section as per instruction given.

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Section-A
(Objective Type Questions) 10×1=10

Note :– Attempt all questions of this section. Choose the correct option.

1. Chemical potential can be expressed as :

(a) $\mu = \left(\frac{\partial F}{\partial N}\right)_{P,N}$

(b) $\mu = \left(\frac{\partial F}{\partial N}\right)_{T,V}$

(c) $\mu = \left(\frac{\partial F}{\partial P}\right)_{T,V}$

(d) $\mu = \left(\frac{\partial F}{\partial T}\right)_{V,N}$

2. The efficiency of a heat engine operating between source temperature T_H and Sink temperature TC is :

(a) $\eta = 1 + \frac{T_C}{T_H}$

(b) $\eta = 1 - \frac{T_H}{T_C}$

(c) $\eta = 1 - \frac{T_C}{T_H}$

(d) $\eta = 1 + \frac{2T_C}{4T_H}$

3. Temperature is difined as :

(a) $T = \left(\frac{\partial U}{\partial V}\right)_{N,S}$

(b) $T = \left(\frac{\partial U}{\partial S}\right)_{N,V}$

(c) $T = \left(\frac{\partial U}{\partial P}\right)_{N,V}$

(d) $T = \left(\frac{\partial U}{\partial V}\right)_{P,S}$

4. Gubbs free energy and Enthalpy are related with each other by the equation :

(a) $G = H - TS$

(b) $G = H + PV$

(c) $G = H - PN$

(d) $G = H - 2\,TS$

5. Which of the following statements is correct :

(a) Entropy of the Universe is exponentially decaying function

(b) Entropy of the Universe is always increasing

(c) Entropy remains unchanged for an irreversible thermodynamic process

(d) heat can transfer from a cold body to a hot body Spontenously.

6. Photons is :

(a) Classical Particles

(b) Distinguishable particles

(c) Fermions

(d) Bosons

7. The Spin of Fermions :

(a) Integral multiple of

(b) Half odd integral multiple of $1\hbar$:

(c) $O\hbar$

(d) It can take any value.

8. In a black body radiation :

(a) Total number of photons remain conserved

(b) Total energy of the System remain conserved

(c) Total entropy remains unchanged

(d) Presscore remain constant.

9. The Coefficient of Value expansion is defined as :

(a) $B = \frac{1}{V}\left(\frac{\partial V}{\partial T}\right)_P$

(b) $B = \frac{1}{T}\left(\frac{\partial V}{\partial P}\right)_T$

(c) $B = \frac{1}{T}\left(\frac{\partial V}{\partial T}\right)_P$

(d) $B = -\frac{1}{P}\left(\frac{\partial V}{\partial T}\right)_T$

10. Which of the following Cyclic relation is true.

(a) $2\left(\frac{\partial V}{\partial P}\right)_N\left(\frac{\partial T}{\partial V}\right)_P = -\left(\frac{\partial P}{\partial T}\right)_N$

(b) $\left(\frac{\partial P}{\partial V}\right)_T\left(\frac{\partial V}{\partial T}\right)_P = -\left(\frac{\partial P}{\partial T}\right)_V$

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(c) $\left(\frac{\partial P}{\partial V}\right)_T\left(\frac{\partial V}{\partial T}\right)_P = \left(\frac{\partial P}{\partial T}\right)_V$

(d) $\left(\frac{\partial P}{\partial S}\right)_T\left(\frac{\partial S}{\partial T}\right)_P = \left(\frac{\partial P}{\partial T}\right)_V$

Section 'B'

(Short Answer Type Questions) 4×5=20

Note :- Attempt any four questions.

1. By Using first law of thermodynamics show that the relation between Specific heat at constant pressure (Cp) and specific heat at constant volume (Cv) is related by :

$$Cp = Cv + \left[P + \left(\frac{\partial U}{\partial V}\right)_T\right]\left(\frac{\partial V}{\partial T}\right)_P$$

2. Find the efficiency of a heat engine.

3. Establish the Maxwell relation :

$$\left(\frac{\partial T}{\partial P}\right)_S = \left(\frac{\partial V}{\partial S}\right)_P$$

4. State the difference between Bosons and fermions.

5. Show that :

$$S = -\left(\frac{\partial G}{\partial T}\right)_{P,N}$$

$$V = -\left(\frac{\partial G}{\partial P}\right)_{T,N}$$

$$P = \left(\frac{\partial G}{\partial P}\right)_{T,P}$$

6. Establish Planck's Law for black body radiation.

Section 'C'

(Long Answer Type Questions) 3×10=30

Note:- Attempt any three questions

1. Show that for a Carnot cycle the change in internal energy is Zero.
2. Show that the equation of state of an ideal gas going through adiabatic process is :

TV^{r-1} = Constant

3. Establish Four Maxwell's relation.

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4. Establish Bose – Einstein distribution function and show that Chemical potential of boson is always negative.
5. Derive Stetan Boltzmann law and Wien's displacement law for Black body radiation. Explain Ultraviolate catastrophe.

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