

2020

CE (14)

Time : 3 Hours

Full marks : 70

Group A
(compulsory)1. Answer the following multiple choice questions $2 \times 10 = 20$

(i) The number of coordinates in the phase space of a single particle is

- (a) 2 (b) 3 (c) 5 (d) 6

Ans \rightarrow (d) 6

(ii) In an irreversible process, the entropy of universe

- (a) remain constant (b) increases (c) decreases

- (d) Sometime increases sometime decreases

Ans \rightarrow (b) increases

(iii) Gibbs' Paradox arises due to

- (a) indistinguishability of classical particles

- (b) distinguishability of classical particles

- (c) absence of inter particle interaction

- (d) None of above

Ans (b) distinguishability of classical particles

(iv) which statistics will apply to deuterons and α particles?

- (a) B-E statistics (b) F-D statistics

- (c) M-B statistic (d) None of these

Ans \rightarrow (a) B-E statistics

(v) Einstein's formula for heat capacity

(a) fails at higher temperature

(b) fails at lower temperature because it goes as T instead of T^3

(c) fails at lower temperature because it decreases exponentially instead of T^3 .

(d) fails at all temperature range

Ans \rightarrow (c) fails at lower temperature because it decreases exponentially instead of T^3 .

(vi) According to Planck's theory of black body radiation, the energy density of a black body radiation is proportional to

(a) T (b) T^2 (c) T^3 (d) T^4

Ans \rightarrow (d) T^4

(vii) As the wavelength of the radiation decreases, the intensity of the black body radiations

(a) Increases (b) decreases (c) First increases and then decrease (d) First decrease then increase

Ans \rightarrow (c) First increases and then decreases

(viii) What is relation between emissivity e , and absorptive power, a , is given by Kirchhoff's law?

(a) $e < a$ (b) $e > a$ (c) $e = a$ (d) none

Ans (c) $e = a$

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(ix) Bosons have symmetrical wave functions
They do not obey

(a) Aufbau principle

(b) Pauli's exclusion principle

(c) Hund's Rule

(d) Heisenberg's uncertainty principle

Ans → (b) Pauli's exclusion principle

(x) Helium shows Bose-Einstein condensation below what temperature?

(a) 100.5 K (b) 12.3 K (c) 5.125 (d) 2.13 K

Ans → (d) 2.13 K

Group B

write any four short answer type questions $5 \times 4 = 20$

2. what are ensemble. write down its types.
3. what is partition function. derive its expression.
4. explain Kirchhoff's law
5. Derive Rayleigh-Jeans law from Planck's law
6. write down some properties of liquid He
7. what is law of equipartition of energy
8. what is Black body radiation. write down its properties
9. what is phase space

Group c

Answer any two question of the following $15 \times 2 = 30$

10. Derive Maxwell - Boltzmann Distribution law
11. Derive Planck's Radiation formula. Derive (a) Wien's law and (b) Stefan - Boltzmann law from Planck's law
12. (a) What do you mean by macrostate and microstate?
(b) How entropy is related with thermodynamic probability? (8+7)
13. Explain the criteria for the applicability of Fermi - Dirac statistics. Derive Fermi - Dirac Distribution law.

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