(6 pages) **Reg. No. :**.....

Code No. : 20557 E **Sub. Code : SMPH 21**

B.Sc. (CBCS) DEGREE EXAMINATION, APRIL 2021.

Second Semester

Physics — Core

THERMAL PHYSICS AND STATISTICAL MECHANICS

(For those who joined in July 2017 onwards)

Time : Three hours Maximum : 75 marks

PART A — (10 × 1 = 10 marks)

Answer ALL questions.

Choose the correct answer.

1. The minimum temperature produced using adiabatic demagnetization is

   (a) 1 K (b) 10^{-3} K

   (c) 10^{-4} K (d) 10^{-5} K

2. The temperature of inversion (T_i) of a gas is (a, b are Vander Waals constants and R is Gas constant)

   (a) a/Rb (b) $2a/Rb$

   (c) $3a/Rb$ (d) $Rb/2$a

3. Viscosity of a gas is due to transport of _____.

(a) momentum (b) energy

(c) force (d) none

4. Van der Waals equation of state for a gas is

(a) $\left(P+\frac{a}{V^2}\right)(V-b)=RT$

(b) $\left(P-\frac{a}{V^2}\right)(V-b)=RT$

(c) $\left(P+\frac{a}{V^2}\right)(V+b)=RT$

(d) $\left(P-\frac{a}{V^2}\right)(V+b)=RT$

5. According to first law of thermodynamics

(a) $\delta Q = dV + \delta w$ (b) $\delta Q = dV - dw$

(c) $\delta Q = 2dV + \delta w$ (d) none

6. In an adiabatic process

(a) PV^r = Constant (b) PV^{1-r} = Constant

(c) PV^{r-1} = Constant (d) PV = Constant

7. From Maxwell's thermodynamic relations, E_S / E_T =

(a) 2 (b) $1/\lambda$

(c) λ (d) none

8. The heat energy is measured in

(a) Joule (b) Watt

(c) Newton (d) Kelvin

9. The spin of photon is

(a) zero (b) $\frac{1}{2}\hbar$

(c) $\hbar$ (d) $\frac{3}{2}\hbar$

10. Photons obey the _____ Statistics.

(a) M – B (b) F – D

(c) B – E (d) None

PART B — (5 × 5 = 25 marks)

Answer ALL questions, by choosing either (a) or (b).

Answer should not exceed 250 words.

11. (a) What are the results of Joule-Kelvin Effect?

Or

(b) What are the practical applications of low temperature?

12. (a) Derive Van der Waals equation for gases.

Or

(b) Obtain the relation between temperature of inversion, Boyle's temperature and Critical temperature.

13. (a) Explain about isothermal and adiabatic changes.

Or

(b) Briefly explain about Carnot's Cycle.

14. (a) Derive the Clausius latent heat equation.

Or

(b) Obtain Maxwell's third thermodynamic relation.

15. (a) What are besons? What are their properties?

Or

(b) What are the postulates of Bose-Einstein distribution law?

PART C — (5 × 8 = 40 marks)

Answer ALL questions, by choosing either (a) or (b).

Answer should not exceed 600 words.

16. (a) Discuss the Onne's method for the liquefaction of Helium.

Or

(b) Define adiabatic demagnetization. Explain in detail the production of low temperature using it.

17. (a) Derive the expression for the pressure of a gas.

Or

(b) Derive Maxwell's distribution law of velocities for gas molecules.

18. (a) Using first law of thermodynamics show that $C_P - C_V = R$.

Or

(b) Discuss with necessary theory, the construction and working of Diesel engine.

19. (a) Derive the Clausius-Clapeyron's equation.

Or

(b) Deduce the Maxwell's Thermodynamical relations.

20. (a) Derive Maxwell Boltzmann Distribution Law.

Or

(b) Derive Fermi Dirac Distribution Law.

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