

Yashwantrao Chavan College of Science Karad
B.Sc II : Semester IV : Paper VII
Subject: Thermal Physics and Statistical Mechanics
Question Bank

Q.1) Select the most correct alternative

- 1) Internal energy U and Helmholtz free energy F are related by the equation
 - (a) $U = F + TS$
 - (b) $U = T + FS$
 - (c) $F = U + TS$
 - (d) $U = S + FT$
- 2) Gibb's function $G =$
 - (a) $H + TS$
 - (b) $H - TS$
 - (c) $HT + S$
 - (d) $S - HT$
- 3) The Joule-Thomson effect shows a heating effect at ordinary temperatures.
 - (a) only hydrogen
 - (b) only helium
 - (c) Both hydrogen and helium
 - (d) oxygen
- 4) For an ideal gas, the Joule-Thomson effect is
 - (a) zero
 - (b) positive
 - (c) infinite
 - (d) negative
- 5) For a real gas, $C_p - C_v = \dots$
 - (a) $R(1 - \frac{2a}{RTV})$
 - (b) $R(1 + \frac{2a}{RTV})$
 - (c) $R(1 - \frac{RTV}{2a})$
 - (d) $R(1 + \frac{RTV}{2a})$
- 6) The radiation consisting of all possible wavelengths corresponding to the temperature of an enclosure is
 - (a) full radiation
 - (b) ultraviolet radiation
 - (c) visible region radiation
 - (d) microwave radiation
- 7) For a perfectly black body, the coefficient of reflection and coefficient of transmission is.....
 - (a) one and zero
 - (b) both one
 - (c) zero and one
 - (d) both zero
- 8) In the black body radiation spectrum, as the temperature is increased. the wavelength corresponding to maximum energy shifts towards.....

- (a) shorter wavelength side
 (b) longer wavelength side
 (c) infinite wavelength side
 (d) zero wavelength side
- 9) In the black body radiation spectrum, the maximum energy radiated....
- (a) increases with a decrease in temperature
 (b) increases with an increase in temperature
 (c) remains constant with an increase in temperature
 (d) first increases and then decreases with an increase in temperature
- 10) The black body radiation spectrum in shorter wavelength region can be verified by
- (a) Wien's displacement law
 (b) Stefan's law
 (c) Wien's distribution law
 (d) Rayleigh-Jeans law
- 11) Phase space is combined . space
- (a) position and moment
 (b) position and momentum
 (c) moment and momentum
 (d) velocity and momentum
- 12) The relation between entropy (S) and probability (W) is .
- (a) $S = kW$
 (b) $S = W \ln k$
 (c) $S = k \ln W$
 (d) $S = \frac{W}{k}$
- 13) The volume of a cell in phase space is.
- (a) \hbar
 (b) \hbar^2
 (c) \hbar^3
 (d) \hbar^4
- 14) If W, M and G are total probability, thermodynamic probability, and priori probability of any distribution then
- (a) $W = M + G$
 (b) $W = M \times G$
 (c) $W = \frac{M}{G}$
 (d) $W = \frac{G}{M}$
- 15) The r.m.s. speed of the gas molecules at temperature $T^\circ K$ is.
- (a) $\sqrt{\frac{2KT}{\pi m}}$
 (b) $\sqrt{\frac{3KT}{m}}$
 (c) $\sqrt{\frac{8KT}{\pi m}}$
 (d) $\sqrt{\frac{3KT}{\pi m}}$

Q.2) Answer the following questions in brief

- 1) Using Maxwells thermodynamical relations, obtain an expression for C_p/C_v .
- 2) Give the experimental study of black body radiation spectrum.
- 3) Derive Maxwell- Boltzmann distribution law.
- 4) Derive Fermi Dirac distribution law.
- 5) Calculate the depression in the melting point of ice produced by a 2 atoms increase in pressure. Given the Latent heat of ice=80 cal/gm and the specific volume of a gm of ice and water at 0C are 1.091cm^3 and 1 cm^3 respectively.

Q.3) Answer the following questions in short

- 1) Derive Clausius-Clapeyrons equation from Maxwells thermodynamical relations.
- 2) Derive first and second TdS equations.
- 3) Derive Wiens displacement law from Planks law.
- 4) A spherical black body with a radius of 12 cm radiates 440W power at 500K. If the radius were halved and temperature doubled the power radiated would be?
- 5) Write a short note on microstates and macrostates.
- 6) Define thermodynamic probability. Obtain an expression for thermodynamic probability.
- 7) Obtain an expression for Bose-Einstein distribution law.
- 8) Give comparison between Maxwell-Boltzmann, Bose-Einstein and Fermi Dirac statistics.
- 9) State and explain any two thermodynamics potentials.
- 10) What is black body? How it can be realized in practice?