

Questions / Statistical mechanics / Third stage / Physics

Q1/ Write an equation with illustration for standard deviation equation for a population and standard deviation equation for a sample of a population.

Q2/ In binomial probability distribution, the number of steps $n=20, 20, 40$ and the probability of the steps to the right $p = 0.5, 0.7, 0.5$ respectively. Find the mean and the standard deviation for each distribution, with diagram.

Q3/ In Fermi-Dirac distribution. Use Lagrange's multipliers method; find the distribution of F-D for large number of particles.

Q4/ A system consist of two energy levels with two cells in each level and the number of particles in the first level $=2$ and in the second level $=1$; find the number of ways in which the particles can be distributed, with diagram: For each level and for the two levels. Using M-B statistics distribution.

Q5/ Show by diagram with illustration;

Dependence of Maxwell-Boltzmann speed distribution on temperature.

Q6/ Write down the binomial probability distribution formula, and then identify each of the variables given in that formula.

Q7/ Given 4 things, find the number of ways to place them in groups of 3 at a time where order does not matter; a-By using formula. b-By arrangement.

Q8/ In Bose -Einstein distribution. Use Lagrange's multipliers method; find the distribution of B.E for photonic gas.

Q9/ Show by diagram with illustration; The Fermi-Dirac probability function versus ϵ at $T=0$ K.

Q10/ What is meant by statistical mechanics? List the important terms which are fundamental in our understanding of statistical mechanics.

Q11/ Write down the binomial probability distribution formula, and then identify each of the variables given in that formula.

Q12/ Using the momentum distribution function of M.B statistic: Show that the ratio of the root mean square to the mean value of P is $(3\pi/8)^{1/2}$

Q13/ Fill in the following blanks:

Statistics is the study of how to: 1- *collect*, 2- *.....*, 3- *....*, and 4-*.....* numerical information from data.

Q14/ Write an equation with illustration for: Stirling's approximation for large factorials as typically used in applications.

Q15/ Given 4 distinguishable particles, 2 energy levels, each with two cells. Find: a/ The total number of macrostates distribution. b/ The most probable microstate distribution in only one macrostate case.

Q16/ Show graphically with illustration: The frequency distribution showing the relative position of the mean, median and mode for curves which is positively skewed curve.

Q17/ In metals, knowing that at absolute zero temperature, the last levels which occupied by the electrons is Fermi level ϵ_{f_0} , and that depends on the number of electrons per unit volume. Calculate the value of ϵ_{f_0} at 0 K, and then find the number of electrons per unit volume.

Q18/ Calculate, with diagram, the most probable distribution of distributing 3 objects a, b and c into two cells of two energy levels with the occupation $\{1, 2\}$.