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جامعة دمياط
Damietta University
كلية العلوم
قسم الرياضيات

الدرجة الكلية:70
زمن الامتحان: ساعتين

Answer the following questions:

Question One:

1) Compare between the different classes of thermodynamic systems.

2) Define the Helmholtz free energy and Enthalpy.

3) Calculate both the coefficient of thermal expansion and the coefficient of isothermal compressibility for the ideal gas.

Question Two:

1) Write short notes on the uncertainty and degeneracy principles.

2) Prove that the number of microstates of the state $(N_1, N_2, ..., N_m)$ is $w = \dfrac{N!}{N_1! N_2! ... N_m!}$ where $N = \sum_{i=1}^{m} N_i$.

Question Three:

1) Study the distribution of microstates of a system consists of three distinguishable particles and has four energy levels $E_i = i\epsilon J$, $i = 0,1,2,3$, such that the total energy $U = 3\epsilon J$.

2) A system consists of 4000 distinguishable particles and has three degenerate energy levels $E_i = i\epsilon j, i = 0,1,2$. The degree of degeneracy is g for all levels. Find the number of particles in each level for the most probable distribution, where the internal energy is $2300\epsilon j$.

Question Four:

1) Consider a system has a constant large number of identical and distinguishable particles N. The particles are distributed to the energy levels $E_1, E_2, ...$, where the number of particles in the ith energy level is N_i. Derive Maxwell-Boltzmann distribution and compute the average, variance, and standard deviation of energy.

2) Consider a system consisting of N distinguishable particles. Each particle can be in one of two microstates with single-particle energy 0 and ϵ. The system is in equilibrium at temperature T. Find the thermodynamic properties of the system.

With my best wishes

Examiner:	Head of Department
Dr. Heba Abd-ElRahman El-Rayes	Prof. Hassan Ahmed El-Morshdy