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**NATIONAL OPEN UNIVERSITY OF NIGERIA**

**PLOT 91, CADASTRAL ZONE, NNAMDI AZIKIWE EXPRESSWAY, JABI - ABUJA**

**FACULTY OF SCIENCES**

**DEPARTMENT OF PURE AND APPLIED SCIENCES**

**JULY 2018 EXAMINATIONS**

**COURSE CODE: PHY 311**

**COURSE TITLE: ELECTRONICS IIKINETIC THEORY AND STATISTICAL MECHANICS**

**CREDIT UNIT: 2**

**TIME ALLOWED: (2 HRS)**

**INSTRUCTION: *Answer question one (1) and any other three (3) questions***

**QUESTION 1**

1. Show that entropy (S) of a system is related to the number of microstates (W) in the following equation:

where is the Boltzmann constant. [7 marks]

1. Consider a system of N particles and a phase space consisting of only two cells with energies 0 and respectively. Calculate the partition function and the internal energy. [10 marks]
2. Can the electronic heat capacity be explained using statistical mechanics? Explain your answer. [4 marks]
3. Define partition function [4 marks]

**QUESTION 2**

1. State the Equi-partition theorem (2 Marks)
2. Consider a system A0 consisting of interacting subsystems A1

and A2 for which Ω1 = 1020 and Ω2 = 2 × 1020.

What is the number of states available to the combined system A0? (4 Marks)

Also, what are the entropies S1, S2, and S0 in terms of the Boltzmann’s constant?

(9 Marks)

**QUESTION 3**

1. What is Statistical mechanics ?(5 Marks)
2. Consider systems of 100 molecules in otherwise empty rooms. What is the average number of molecules in the front third of the rooms, the standard deviation about this value, and the relative fluctuation? (10 Marks)

**QUESTION 4**

1. State the second law of thermodynamics? (2 Marks)
2. Find the number of ways in which two particles can be distributed in six states if :
3. the particles are distinguishable (4Marks)
4. the particles are indistinguishable and obey Bose-Einstein statistics (4Marks)
5. the particles are indistinguishable and only one particle can occupy any

one state. (5Marks)

**QUESTION 5**

1. What do you understand by Ensemble? (2 Marks)
2. Calculate:
3. The average kinetic energy per gas molecule. (4 Marks)
4. The speed of the molecules at room temperature. (4 Marks)

Take the Boltzmann’s constant and room temperature as 1.38 x 10 -23 JK-1

and 300 K in that order.

1. A coin is so tossed that the probability of getting 'head' in a toss is 0.7. Deduce the probability that in 5 tosses , we will get 2 heads 3 tails. (5 Marks)