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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 SCIENCE**

 **APRIL/MAY, 2019 EXAMINATIONS**

**COURSE CODE: PHY 311**

**COURSE TITLE: KINETIC THEORY AND STATISTICAL MECHANICS**

**CREDIT UNIT 2**

**TIME ALLOWED (2 HRS)**

**INSTRUCTION: *Answer question 1 and any other three questions***

**QUESTION 1**

1. Define the following terms:

(i) Statistical Mechanics **(3 marks)**

(ii) Events **(3 marks)**

(iii) Sample space **(3 marks)**

b) State the single particle partition function for an ideal monoatomic gas consisting of $N$ particles, each of mass $m$ and occupying a volume$ V$. **(4 marks)**

c) Give the mathematical equation generated by the following laws for energy density

 i) Rayleigh Jean law **(2 marks)**

 ii) Bose derivation of Planck’s law **(2 marks)**

 iii) Wien’s law **(2 marks)**

d) Define the distribution function for Bose-Einstein and Fermi-Dirac. Also in each case define the function for the continuous distribution. **(6 marks)**

**QUESTION 2**

1. Given a universal set $E=\left\{E\_{1}, E\_{2}\right\}$, draw the Venn diagram with a shaded portion indicating i) $E\_{1}∩E\_{2}$ **(3 marks)**

ii) $E\_{1}∪E\_{2}$ **(4 marks)**

1. An unbiased die is rolled write down the sample space for the experiment.

If two coins are tossed, what is the probability that:

1. two tail appears (4 marks)
2. ii) at least one head appears. (4 marks)

**QUESTION 3**

1. Define the terms: i) Permutation **(3 marks)**

 ii) Combination **(3 marks)**

 b) Give the mathematical expression for Permutation and Combination. **(4 marks)**

 c) Nine Physicists assembled for a meeting shake hands with one another. How many

 handshakes take place? **(5 marks)**

**QUESTION 4**

1. State the function of the following terms under Statistical Ensembles
2. Micro Canonica Ensemble **(3 marks)**
3. Canonical Community **(3 marks)**
4. Grand Canonical **(3 marks)**
5. Derive the qualitative theoretical explanation provided by Einstein to

determine the heat capacity of a solid. **(6 marks)**

**QUESTION 5**

a) State the equation that defined the partition function for all systems in

 thermal equilibrium with a heat bath.. **(3 marks)**

1. Derive the probability to show that when a system is placed in a heat

bath it will be in a particular state$ E\_{i}$. **(12 marks)**