



NATIONAL OPEN UNIVERSITY OF NIGERIA
PLOT 91, CADASTRAL ZONE, NNAMDI AZIKIWE EXPRESSWAY, JABI - ABUJA
FACULTY OF SCIENCES
DEPARTMENT OF PURE AND APPLIED SCIENCES
SEPTEMBER, 2020_1 EXAMINATION

COURSE CODE: PHY311
COURSE TITLE: KINETIC THEORY AND STATISTICAL MECHANICS
CREDIT UNIT: 2
TIME ALLOWED: (2 HRS)

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

QUESTION 1

- (a) i- What do you understand by statistical mechanics? **2 marks**
ii- Four coins are flipped in succession. Find the total number of possible outcomes. **2 marks**
- (b) i- Differentiate between permutation and combination. **2 marks**
ii- Seven physicists assembled for a meeting shake hands with one another. How many handshakes take place? **3 marks**
- (c) i- Define Entropy and state how it relates to probability. **2 marks**
ii- Using $w_f/w_i = \left(v_f/v_i\right)^N$ and $\Delta S = nR \ln\left(\frac{v_f}{v_i}\right)$ **5 marks**
- Show that; $S = K \ln(W)$
- (d) i-, Differentiate between macrostate and microstate. Give examples. **3 marks**
ii- Briefly explain each of the following:
1. Microcanonical ensemble **3 marks**

QUESTION 2

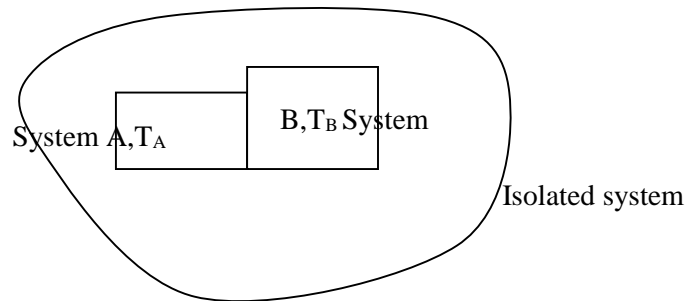
Derive the probability $W_N(n_1)$ for finding the particle at position $x=nl$ after N steps. **12 marks**

QUESTION 3

A particle of mass m is free to move in one dimension. Denote its position coordinate by x and its momentum by p . Suppose that this particle is confined with a box so as to be located between $x=0$ and $x=L$, and suppose that its energy is known to lie between E and $E+dE$. Draw the classical phase space of this particle, indicating the regions of this space which are accessible to the particle. **12 marks**

QUESTION 4

Consider two system A and system B with constant specific heat C'_A and C'_B and originally at respective temperature T_A and T_B , are brought into thermal contact with each other. After the system come to equilibrium, they reach a come final temperature T_f . What is the entropy change of the entire system in this process?



12 marks

QUESTION 5

5. With the help of the partition function, $z = \sum_R e^{-\beta(n_1 \epsilon_1 + n_2 \epsilon_2 + \dots)}$ compute the Maxwell-Boltzmann distribution.

12 marks

QUESTION 6

Using the Taylor expansion and derive the Gaussian distribution.

12 marks