BOWEN UNIVERSITY, IWO. OSUN STATE. NIGERIA

COLLEGE OF AGRICULTURE, ENGINEERING, AND SCIENCES

PHYSICS PROGRAMME

FIRST SEMESTER EXAMINATION 2022/2023 SESSION

PHY 432: STATISTICAL PHYSICS (2 CREDITS)

DATE: June, 2023 **TIME: 8.30am – 10.30am**

INSTRUCTION: ATTEMPT THREE QUESTIONS. QUESTION 1 IS COMPULSORY

QUESTION 1

(a) Write short notes on the following
   (i) Maxwell-Boltzmann statistics **(5 marks)**
   (ii) Fermi-Dirac Statistics **(5 marks)**
   (iii) Bose-Einstein Statistics. **(4 marks)**

(b) Are Maxwell-Boltzmann statistics valid for conduction electron in silver at 300 K? (Silver has a density of 10.5 g/cm3 and a molar weight of 107.9g) **(12 marks)**

QUESTION 2

(a) Derive the Fermi energy for electrical conduction whose allowable energies for electron is given as

$$E = \frac{h^2}{8mL^2}(n_1^2 + n_2^2 + n_3^2)$$ **(7 marks)**

(b) Derive the intensity of the emitted radiation in black body radiation. **(7 marks)**

(c) Using a well-labelled diagram, explain the a transition from the normal phase to the superfluid phase in liquid helium **(6 marks)**

QUESTION 3

(a) (i)What do you understand by the term 'sample' or outcome space as applied in modern probability theory. **(1 mark)**

(ii) Find the chance of throwing a 6 at least once in two throws of a single dice. **(7 marks)**

(b) (i) An experiment succeeds twice as often as it fails. Find the chance that in the next six trials these will be at least 4 successes. **(5 marks)**

(ii) Four persons are chosen at random from a group of 3 men, 2 women and 4 children. Show that the chance that exactly two of them will be children is $\frac{10}{21}$ **(7marks)**

QUESTION 4

(a) (i) What do you understand by the term phase space as applied to the state of a monoatomic gas from the molecular viewpoint? Hence, **(3 marks)**

(ii) Distinguish between the terms microstate and macro state. **(2 marks)**

(b) With reference to an ideal gas, explain how the set of occupation numbers completely specify the microstate of the system. **(5 marks)**

(c) By considering a system of N non-interacting spins, find the dependence of its temperature T on the total energy E. What is the probability that a given spin is up? **(10 marks)**

Moderated
04/06/2023