KIBABII UNIVERSITY

UNIVERSITY EXAMINATIONS

2021/2022 ACADEMIC YEAR

FOURTH YEAR FIRST SEMESTER

MAIN EXAM

FOR THE DEGREE OF BACHELOR OF SCIENCE

COURSE CODE: SCH 415

COURSE TITLE: STATISTICAL THERMODYNAMICS

DATE: 23/05/2022 **TIME:** 9:00AM-11:00AM

---

1. a) Define the following terms as used in statistical thermodynamics (5 marks)

   (i) Ensemble

   (ii) Thermodynamics

   (iii) Microstate

   (iv) Partition function

   (v) Phase space

b). What is the enthalpy of 1 mole of an ideal monatomic gas? (3 marks)

c). Differentiate between classical and statistical thermodynamics (6 marks)

d). Give four application of statistical thermodynamics (4 marks)

e). State three types of partition function as used in statistical thermodynamics (3 marks)

f). Calculate the number of ways of distributing 20 identical objects with the arrangement 1,0,3,5,10,1 (4 marks)

g). What is principle of equal a priori probability (2marks)

(20

h). A part from using factorial in the calculation of the number of weight of identical objects derive the starlings approximation, expression for the weights (3 marks)

2.a) Explain the differences among the three types of distribution as used in statistical thermodynamics. (9 marks)

b). You have six distinguishable particles and two energy levels one with a degeneracy of two and the other with degeneracy of five. Calculate the number of microstates in this system (11 marks)

3.a) Derive all the four Maxwell Thermodynamical relations using the differential form of the equations of U, H, A and G (10 marks)

b). State and explain the three types of ensembles as used in statistical thermodynamics (10 marks)

4 a). What is meant by molecular partition function (2 marks)

b). Derive relationships between the following partition function and thermodynamic functions. (12 marks)

i. Partition function and heat capacity at constant volume
ii. Partition function and heat capacity at constant pressure
iii. Partition function and internal energy

c). Explain three important properties of macroscopic system that distinguishing the from microscopic systems (6 marks)

5. a). Calculate the molar Gibbs energy of Ar at 298.18 K and 10^5 pa, assuming that the gas demonstrates ideal behavior (8 marks)

b). For an ensemble consisting of 1.00 moles of particles having two energy levels separated by hv = 1.00 * 10^{-20} J, at what temperature will the internal energy of this system equal 1.00 kJ? (8 marks)

c). What thermodynamic properties can be obtained from the partition function? (4marks)