



KIBABII UNIVERSITY

**UNIVERSITY EXAMINATIONS
2019/2020 ACADEMIC YEAR**

**FOURTH YEAR SECOND SEMESTER
MAIN EXAMINATIONS**

FOR THE DEGREE OF B.ED (SCIENCE)

COURSE CODE: SPH 425

**COURSE TITLE: THERMODYNAMICS AND SELECTION OF
MATERIALS**

DATE: 6TH NOVEMBER, 2020

TIME: 9:00AM-12:00PM

INSTRUCTIONS TO CANDIDATES

TIME: 3Hours

Answer question ONE and any TWO of the remaining

KIBU observes ZERO tolerance to examination cheating

QUESTION ONE (30 marks) compulsory

- (a) Define the following terms:
- (i) Heat (1mk)
 - (ii) Entropy (1mk)
 - (iii) Free energy (1mk)
- (b) Discuss situations involving entropy changes (4mks)
- (c) Methane gas reacts with water vapor to produce a mixture of carbon monoxide (co) and hydrogen. The ΔH for the reaction is +206.1KJ/mol, while the ΔS is +215J/k.mol.
- (i) Determine the ΔG at 25⁰C (3mks)
 - (ii) Determine if the reaction is spontaneous at that temperature (2mks)
- (d) State and explain whether the entropy change is positive or negative for an exothermic phase transition (2mks)
- (e) Define the following terms: (3mks)
- (i) Sintering
 - (ii) Single-phase alloys
 - (iii) Multi-phase alloys
- (f) The formation of Nitrogen monoxide from nitrogen and oxygen gases is a reaction that strongly favors the reactants at 25⁰C. given that ΔG is +173.4kJ/mol and ideal gas constant, $R = 8.314J/k.mol$, determine the equilibrium constant (4mks)
- (g) Briefly discuss the following terms:
- (i) Dissociation temperature (2mks)
 - (ii) Dissociation pressure (2mks)
- (h) Briefly describe Pitting corrosion (4mks)
- (i) Define the term Atomic diffusion (1mk)

QUESTION TWO (20 marks)

- (a) Discuss the following properties of metals:
- (i) Ductility/Formability (2mks)
 - (ii) Weldability (2mks)
 - (iii) Machinability (2mks)
 - (iv) Tensile strength (2mks)
- (b) Discuss the factors to be considered when selecting various materials for various purposes (12mks)

QUESTION THREE (20 marks)

- (a) The solubility product constant of Lead (II) oxide is 1.4×10^{-8} at 25⁰C. Determine the ΔG for the dissociation of Lead (II) oxide in water ($R = 8.314J/k.mol$), hence or otherwise. comment on the dissociation of Lead (II) oxide at equilibrium. (5mks)
- (b) (i) What do you understand by the term Ellingham diagram (1mk)

(ii) Discuss the features of Ellingham diagrams

(14mks)

QUESTION FOUR (20 marks)

(a) What do you understand by the following terms:

(i) Corrosion

(1mk)

(ii) Passivation

(1mk)

(b) Discuss various types of passivity types of corrosion

(18mks)