

NATIONAL OPEN UNIVERSITY OF NIGERIA Plot 91, Cadastral Zone, NnamdiAzikiwe Expressway, Jabi - Abuja Faculty of Science

June 2017 Examination

COURSE TITLE: Physical Chemistry III

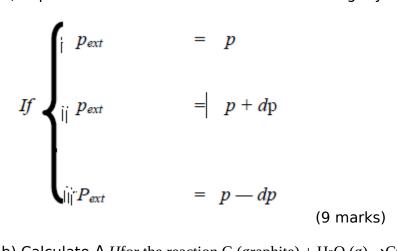
COURSE CODE: CHM 301

COURSE UNIT: 3 Units

INSTRUCTION: Answer question one and any other four questions

TIME: 2 ½ Hours

1a) Explain what each of the conditions below signify:



1b) Calculate $\Delta_r H$ for the reaction,C (graphite) + H₂O (g) →CO(g) + H₂(g);CO(g) + H₂(g) at 318K. If $\Delta_r H$ at 298 K is l31.2 Kj and the C_P values are given below in the temperature range, 298 to 348 K.

Substance C_p/J mor₋₁ K₋₁

Graphite 15.93 H₂0 (g) 30.04 CO (g) 26.51

H₂ (g) 29.04 (6 marks)

- 1c) Calculate the molecular mass of 9.21g non-volatile organic compound, dissolved in 50g of pure water at 25° C, which depresses the vapour pressure of the water from $3.16 \times 10^{\circ}$ to 3.10×10^{3} Nm². (7 marks)
- 2a) Highlight the different ways work can be done. (4 ½ marks)
- 2b) Give the characteristic of Kirchhoff's equation and derive the equation. (3 marks)
- 2c) State three of the special cases of Kirchhoff's equation. (4 ½ marks)
- 3a) State the Carnot Theorem. (2 marks)
- 3b) List the steps by which the Carnot cycle can be described. (4 marks)
- 3c) Discuss three of the steps mentioned in (3b) above. (6 marks)
- 4a) Give the classification of a system. (9 marks)
- 4b) A law of thermodynamic is based on the concept of thermal equilibrium.
 - i. Name the law. (1 mark)
 - ii. State the Law. (2 marks)
- 5a) Distinguish among isothermal, adiabatic, cyclic and reversible processes. (8 marks)
- 5b) Calculate the entropy of mixing of 1.00 mol of H₂ with 2.00 mol of Q₂ assuming that no chemical reaction occurs. (4 marks)
- 6a) For the reaction, $2\text{NO}(g) + O_2(g) \rightarrow 2\text{NO}_2(g)$ Calculate ΔG at 7.00×10^2 K. The entropy and enthalpy changes at 7.00×10^2 K are respectively, -1.45×10^2 J mol 4 K 4 and -1.13×10^2 kJ mol 4 (4 marks)
- 6b) Discuss the derivation of thermodynamic quantities from emf values. (8 marks)