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**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:

 (9 marks)

1b) Calculate Δr*H*for the reaction,C (graphite) + H2O (g) →CO(g) + H2(g);CO(g) + H2(g) at 318K. If Δr*H* at 298 K is l31.2 Kj and the *C*pvalues 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 25oC, which depresses the vapour pressure of the water from 3.16 x 103to 3.10 x 103 Nm-2. (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.

1. Name the law. (1 mark)
2. 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, 2NO(g) + O2 (g) → 2NO2 (*g*)

Calculate *ΔG* at 7.00 × 102 K. The entropy and enthalpy changes at 7.00 × 102 K

are respectively, -1.45 × 102J mol-1K-1and -1.13 x 102kJ mol-1(4 marks)

6b) Discuss the derivation of thermodynamic quantities from emf values. (8 marks)