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:

$$If \begin{cases} p_{ext} = p \\ p_{ext} = p + dp \\ P_{ext} = p - dp \end{cases}$$

(9 marks)

1b) Calculate $\Delta_r H$ for the reaction, C (graphite) + H_2O (g) → CO(g) + H_2(g); CO(g) + H_2(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
H_20 (g) 30.04
CO (g) 26.51
H_2 (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^{o}C, which depresses the vapour pressure of the water from 3.16 x $10^{3}$to 3.10 x 10^{3} 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.

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 H_2 with 2.00 mol of Q_2 assuming that no chemical reaction occurs. (4 marks)

6a) For the reaction, $2NO(g) + O_2(g) \rightarrow 2NO_2(g)$
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 $mol^{-1}K^{-1}$and -1.13 x 10^{2}kJ mol^{-1}(4 marks)

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