NATIONAL OPEN UNIVERSITY OF NIGERIA
14-16 AHMADU BELLO WAY, VICTORIA ISLAND LAGOS
MARCH/APRIL 2016 EXAMINATION

SCHOOL OF SCIENCE AND TECHNOLOGY

COURSE CODE: **CHM301**
COURSE TITLE: **PHYSICAL CHEMISTRY III**

TIME ALLOWED: **2 ½ HOURS**
INSTRUTIONS: Answer question 1 and any other four

$R = 8.314\ \text{J}\ mol^{-1}k^{-1}$;

Question 1 (compulsory) (22marks)
1a.) An ideal gas initially at 3.00×10^2K and 4.00×10^5 Pa pressure occupies 0.831 m^3 space. What is the minimum amount of work required to compress the gas isothermally and reversibly so that the final pressure is $7.00 \times l0^6$ Pa? (11mks)

b) Outline Carnot analyses for functioning of an engine. (5mks)

C.) State the first law of thermodynamics in its three major ways. (6mks)

Question 2 (12MARKS)
a. Mention and discuss the three ways work can be done. (6mks)
bi. Define the term Heat capacity and in relation with the following terms : constant volume, constant pressure, one mole of a substance at constant conditions. (4mks)
ii. What do you understand by this statement "The heat capacities change with temperature." (2mks)

Question 3 (12marks)
Write short notes on the following:

a. Bond enthalpy
b. Enthalpy of atomization
c. Joule-Thomson effect.
d. Spontaneous process
e. Decrease in Gibbs free energy (-d*G*)
f. Fugacity

(2 mks each)

Question 4 (12 marks)

Calculate the heat necessary to raise the temperature of 5.00 mol of butane from 298 K to 593 at constant pressure. where C_P (19.41 + 0.233T)$Jmol^{-1}$ K^{-1}. (12mks)

Question 5(12 marks)

a. Mention the three statements of the second law of thermodynamics.(7mks)
b. Explain the terms i. System (1 ½mks) ii. Surrounding (1 ½ mks) iii. State of a system(1mk) iv The zeroth law of thermodynamics (1mk)

Question 6 (12marks)

a. 1.00 mol of a monoatomic gas initially at 3.00×10^2 K and occupying 2.00×10^{-3} m^3 is heated to 3.25×10^2 K and the final volume is 4.00×10^{-3} m^3. Assuming ideal behaviour, calculate the entropy change for the process. (10mks)

b.Define an idea solution in terms of a solid. (2mks)

Question 7 (12 marks)

a. 1.00 mol of an ideal gas is compressed isothermally and reversibly from $1.00 \times 10^{-2} m^3$to $1.00 \times 10^{-3} m^3$. Calculate the entropy change. (6 marks)
b. State the applications of Clausius-Clapeyron equation.(6marks)