****

**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 J $mol^{-1}k^{-1}$;

 **Question 1 (compulsory) (22marks)**

1a.) An ideal gas initially at 3.00 × 102K and 4.00 ×105 Pa pressure occupies 0.831

m3 space. What is the minimum amount of work required to compress the gas

isothermally and reversibly so that the final pressure is 7.00 × l06 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:

1. Bond enthalpy
2. Enthalpy of atomization
3. Joule-Thomson effect.
4. Spontaneous process
5. Decrease in Gibbs free energy (-d*G*)
6. 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 CP (19.41 + 0.233T)Jmol-1 K-1. (12mks)

**Question 5(12 marks)**

1. Mention the three statements of the second law of thermodynamics.(7mks)
2. 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

$1.00×10^{-2}m^{3} $to $1.00×10^{-3}m^{3}$. Calculate the entropy change. (6 marks)

b. State the applications of Clausius-Clapeyron equation.(6marks)