

**NATIONAL OPEN UNVERSITY OF NIGERIA**

**PLOT 91, CADASTRAL ZONE, NNAMDI AZIKIWE EXPRESSWAY, JABI - ABUJA**

**FACULTY OF SCIENCES**

**DEPARTMENT OF PURE & APPLIED SCIENCES**

**EXAMINATION QUESTIONS, 2018\_2**

**COURSE CODE: CHM 405**

**COURSE TITLE: CHEMICAL THERMODYNAMICS**

**COURSE UNIT: 2**

**INSTRUCTION: Answer question 1 and any other three questions**

**TIME ALLOWED: 2 hours**

**Q1**

1. State the third law of thermodynamics. **(3 marks)**
2. Highlight the most essential application of the third law of thermodynamics and its

limitations**. (4 marks)**

1. Derive an expression for Maxwell equations. **(6 marks)**
2. Differentiate between inter molecular and intramolecular forces **(4 marks)**
3. Highlight the effect of inter and intra molecular forces on the various physical states of water. **(4 marks)**
4. Define the heat capacity of a close system. **(4 marks)**

**Q2**

1. Given that in a Joule-Thompson apparatus, the total work done is the sum of the work done in the first and second chamber, that is,  ,show that the process is isoenthalpy **(4 marks)**
2. (ii) Given the following thermochemical equations,



Calculate the standard enthalpy change for the reaction below: **(5 marks)**



1. Write an equation for total work done in first and second chamber of Joule-Thompson apparatus

**(3 marks)**

1. Calculate the enthalpy change for the combustion of propane, which occurs according to the following equation, **(3 marks)**



**Q3**

**(a)** State Zeroth Law of thermodynamics and to what extend is it important? **(3 marks)**

**(b)** A tire with a volume of 11.41 litre reads 44PSI on the tire gauge. What is the new tire pressure when you compress the tire and its new volume is 10.6? **(4 marks)**

**(c)** a syringe has a volume of 10 cubic centimeter, the pressure is 1 atm, if you plug the end so no gas can escape and push the plunger down, what must the final volume be to change the pressure to 3.5 atm. **(2 marks)**

(d) Calculate the ratio, for an ideal gas if the volume changes from 0.2 to 0.4 m3 with a corresponding change in pressure from 101325 to 50663 Pa**.(6 marks)**

**Q4**

1. What is entropy? Hence state the second law of thermodynamics with respect to entropy change of natural processes. **(1 mark)**
2. If the volume of an ideal gas changes from 0.2 to 0.4 m3 at stp, calculate the entropy change associated with the process**. (3 mark)**
3. If the pressure of an ideal gas under adiabatic process changes from 50662.50 to 101325 Pa and corresponding entropy change is 8.0J/mol/K, calculate the heat capacity at constant volume. **(5 marks)**
4. If the same gas in b(i) above undergoes isochoric change at initial temperature of 298 K, what will be its final temperature? **(6 marks)**

**Q5**

1. State Boyle’s Law. Show graphically that the pressure of an ideal gas varies inversely with its volume and the variation of pressure with volume according to Boyle’s law**.(6 marks)**
2. Show that for n moles of a gas, the CP is always greater than CV by multiple of R (where R is the gas constant). **(9 marks)**