ELIZADE UNIVERSITY ILARA-MOKIN ONDO STATE

FACULTY: BASIC AND APPLIED SCIENCES
DEPARTMENT: PHYSICAL AND CHEMICAL SCIENCES
FIRST SEMESTER EXAMINATIONS
2016/2017 ACADEMIC SESSION

COURSE CODE: CHM 305
COURSE TITLE: PHYSICAL CHEMISTRY 11
DURATION: 2 HOURS
TOTAL MARKS: 60

HOD'S SIGNATURE

Matriculation Number: _____

INSTRUCTION: Answer three questions only

(Take R = 8.321J/mol/K or 0.0821 Lit-atm deg^{-1} mol^{-1})

1a. Define these terms: (i) Isolated system (ii) Adiabatic wall (iii) intensive properties (iv) Thermal equilibrium (v) internal energy **[5 marks]**

b Given that C = dq / dT; show that Cp = Cv + R **[5 marks]**

c. One mole of an ideal gas at 20°C is compressed adiabatically to 0.125 of it initial volume. What is the temperature of the gas after compression (Cp= 20.8 J/mol/k) **[10 marks]**

2a. Show that PV^{γ} is a constant for the reversible adiabatic expansion of a mole of an ideal gas of constant heat capacity where $\gamma = C_p/C_v$ **[8 marks]**

b. 16 g of oxygen at 10°C and 5 atm are subjected to reversible adiabatic expansion to a pressure of 38cmHg. Calculate the work done. **[6 marks]**

c. 64 g of oxygen expands reversibly under isothermal conditions from a volume of $0.0015m^3$ to 45 litres at 250°C. Evaluate: (i) q, (ii) ΔE and (iii) W. **[6 marks]**

3a. Show that the heat absorbed at constant pressure is equal to the enthalpy change. **[4 marks]**

b. 5 moles of an ideal gas at 10°C is compressed adiabatically to $1/4^{th}$ of the original volume. Calculate the temperature differential after compression. **[6 marks]**

c. 3 moles of Argon at 2 atm is compressed adiabatically and reversibly from 100 L to 5 x 10^4 cm^3 at 10°C. The molar heat capacity, Cv at constant volume of Argon is 12.5 j/mol/k. Calculate the final pressure of Argon. **[10 marks]**

4a. Distinguish between Gibbs free energy and Helmholts free energy **[4 marks]**

b. Given that A = E-TS, show that the maximum work obtainable at a constant temperature is at the expense of the decrease in the Helmholtz free energy of the system. **[4 marks]**

c. Calculate the final pressure when two moles of helium at 30°C and 76 cmHg is expanded reversibly and isothermally to a final volume of $1.5m^3$. **[12 marks]**