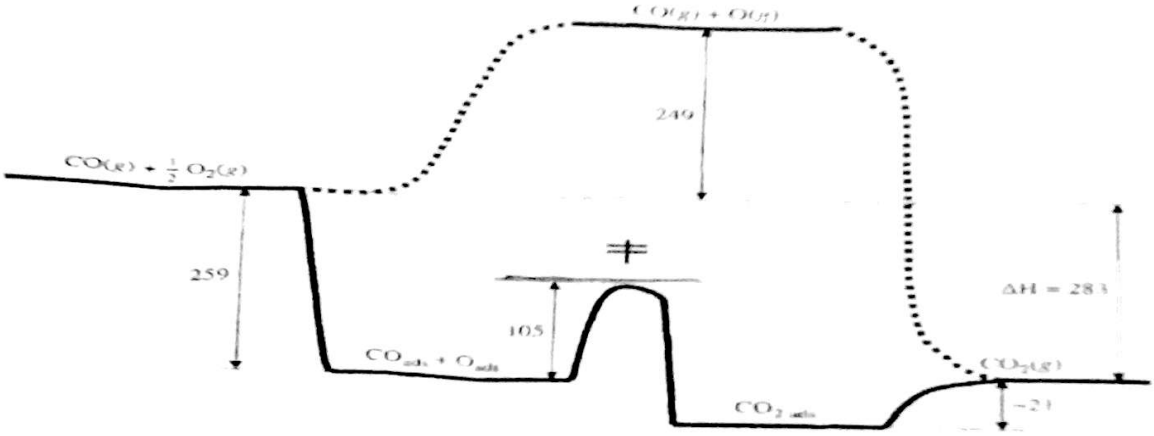
Department of Chemical Engineering

Minor I – CLL 222 CRE -II

Time: 1-2 Date: 27th Sept., 2016 (Saturday)

M.M 20 Venue: LH- 121

1. Anderson and Boudart, proposed the thermochemical kinetic profile for the platinum-catalyzed oxidation of carbon monoxide according to the overall reaction, ($CO + ½ O_2 \rightarrow CO_2$). The Schematic energy diagram for the oxidation of CO and a Pt catalyst is given below. In this Figure All energies are given in kJ mol^{-1}. For comparison, the heavy dashed lines show a noncatalytic route. Explain the role of catalyst in the steps given in the energy diagram and also give values for activation energy and heat of reaction for catalytic and noncatalytic reaction. (5)



2. (a) Derive the Langmuir adsorption isotherm in terms of fraction of active sites covered (Θ) (5)

(b) The BET isotherm used for the determination of surface area of the catalyst is given by

$$\frac{p}{v(p_0 - p)} = \frac{1}{v_m c} + \frac{(c-1)p}{c v_m p_0}$$

Using this linear form of equation slope and intercept were calculated from the BET plot and these values were $13 * 10^{-3}$ cm^{-3} and $0.1 * 10^{-4}$ cm^{-3} for respectively one gram of the catalyst sample. The area per molecule for the nitrogen is $16.2 * 10^{-16}$ cm^2. From these data calculate the BET surface area of the catalyst (5)

3. $A + S \rightleftharpoons AS$ is a reversible reaction with S as active site of catalyst (Ru/Al_2O_3) and A as reactant. The rate of reaction is $1*10^{-6}$ mol/s*g-catalyst. The dispersion of the catalyst is 50% at these conditions. The reaction used 0.5% wt of Ru catalyst on Al_2O_3. Calculate the turn over frequency for the reaction (M.W of Ru = 101) (5)