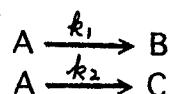


1. (20 %) The chemical reactions which may serve as the basis for titrimetric determinations are conveniently grouped into four types; (acid-base, oxidation-reduction, precipitation, complex). Please give examples and explain these reactions, respectively.
2. (20 %)  $\Delta G = \Delta H - T\Delta S$  is an equation of the second thermodynamics. Please (i) define the meaning of G, H, S, respectively.  
(ii) describe the relationship between this equation and chemical reaction.
3. (20 %) Derive the integrated rate equation for a parallel first reaction, and then have equations for [A], [B], [C] in exponential form. (assume; only A is present initially)



4. (20 %) (i) State the Arrhenius law. (ii) A second-order reaction in solution has a rate constant (k) of  $5.7 \times 10^{-5} \text{ dm}^3 \text{ mol}^{-1} \text{ s}^{-1}$  at  $25^\circ\text{C}$  and of  $16.4 \times 10^{-5} \text{ dm}^3 \text{ mol}^{-1} \text{ s}^{-1}$  at  $40^\circ\text{C}$ . Calculate the activation energy (E) and the preexponential factor (A), assuming the Arrhenius law to apply.  
(R is the gas constant, equal to  $8.314 \text{ J K}^{-1} \text{ mol}^{-1}$ )
5. (10 %) Describe the following problems:  
(i) what is the enzyme catalysis?  
(ii) what is the coenzyme reaction?
6. (10 %) Calculate  $E^\circ$  at  $25^\circ\text{C}$  for the cell  $\text{Cd} | \text{Cd}^{2+} || \text{Cu}^{2+} | \text{Cu}$  and determine the cell reaction and its equilibrium constant.  
Here  $\frac{1}{2} \text{Cd}^{2+} + e^- = \frac{1}{2} \text{Cd} \quad E^\circ = -0.4020 \text{ V}$   
 $\frac{1}{2} \text{Cu}^{2+} + e^- = \frac{1}{2} \text{Cu} \quad E^\circ = +0.3394 \text{ V}$