

## Assignment 7

Indian Institute of Science Education and Research

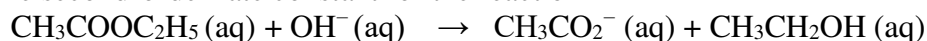
CHM202: Energetics and dynamics of chemical reactions

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**Ques. 1** Initial rate of a first order gaseous reaction becomes three times when the temperature increases from 400K to 420K. If the half-life time of the reaction at 400K is 10 minutes, find out the time (in seconds) needed for 25% conversion of the reactant into product at 420K. [  $R=1.987\text{cal K}^{-1}\text{mol}^{-1}$  ]

**Ques.2** Derive an integrated expression for a second-order rate law  $v = k[A][B]$  for a reaction of stoichiometry  $2 A + 3 B \rightarrow P$ .

**Ques.3** The second-order rate constant for the reaction



is  $0.21\text{ dm}^3\text{ mol}^{-1}\text{ s}^{-1}$ . What is the concentration of ester after (a) 10 s, (b) 10 min when ethyl acetate is added to sodium hydroxide so that the initial concentrations are  $[\text{NaOH}] = 0.030\text{ mol dm}^{-3}$  and  $[\text{CH}_3\text{COOC}_2\text{H}_5] = 0.200\text{ mol dm}^{-3}$ ?

**Ques.4** Find an expression for the time it takes for the concentration of a substance to fall to one-third its initial value in an  $n$ th-order reaction.

**Ques.5** The rate constant of a first order reaction is  $2.50 \times 10^{-4}\text{ sec}^{-1}$  at  $290^\circ\text{C}$ . If the activation energy is  $154\text{ kJ/mol}$ , what is the temperature at which the rate constant is  $3.20 \times 10^4\text{ sec}^{-1}$ .

**Ques.6** One of the hazards of nuclear explosions is the generation of  $^{90}\text{Sr}$  and its subsequent incorporation in place of calcium in bones. This nuclide emits  $\beta$  rays of energy  $0.37\text{ MeV}$ , and has a half-life of 22.1 year. Suppose  $2.00\text{ }\mu\text{g}$  was absorbed by a newly born child. How much will remain after (a) 15 year, (b) 60 year if none is lost metabolically?