

Assignment 7

Indian Institute of Science Education and Research

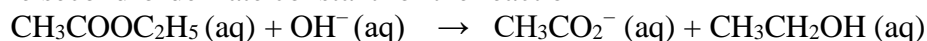
CHM202: Energetics and dynamics of chemical reactions

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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°C . If the activation energy is 154 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}Sr and its subsequent incorporation in place of calcium in bones. This nuclide emits β rays of energy 0.37 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?