Department: Chemistry

College: Education

University: Salahaddin

Subject: Chemical Kinetics

Course Book: *Stage* 3; First semester

Lecturer's name: Khozan A. Haji

Academic Year: 2023-2024

Course Book

1. Course name	Chemical Kinetics
2. Lecturer in charge	Dr.Khozan A. Haji
3. Department/ College	Chemistry/ Education
4. Contact	e-mail:khozan.haji@su.edu.krd
5. Time (in hours) per week	Theory: 4
6. Office hours	Thursday 10.5am – 12.5 pm or by appointment
7. Course code	
8. Teacher's academic profile	I graduated from the College of Education, Department of Chemistry in 1997 and got a bachelor's degree BSc in chemistry. After that. I then started to study MSc/Analytical Chemistry in 1998 at Salahaddin University. After finishing my MSc study in 2000, I worked in Collage of Education / Chemistry department, as an assistant lecturer. The teaching experience is practical in the analytical Physical, Industrial &Organic Chemistry. Finally, I received my PhD-Physical Chemistry in the same University in 2015. My academic and research program interest focus on Kinetic study; I have more than 4 published articles and going to publish some other articles.
9. Keywords	**Kinetic study, chalcones, spectrophotometry, bromination, rate of reaction.**

10. Course overview:

The study of kinetics is important because it aims to collect adequate information about the reaction's behavior and the rate of reaction throughout the process.

This may necessitate a detailed study of how reactant or product concentrations change over time, as well as the effect of temperature on the rate of reaction. Accordingly, kinetic measurements play an important part in identifying the reaction's course, as well as the energy required for it and the mechanism in which it takes place.

11. Course objective:

The study of kinetics has aided in the knowledge and advancement of a variety of fields. In the field of industry, for example, it helped to understand how to manage the reaction rate to achieve a high-quality industry, develop special output, or raise the quantity. In the biological fields, it contributed to the understanding of the behavior of the reactions that occur inside the body of the organism. In the field of the pharmaceutical industries, the study of kinetics was of great importance in determining the time required to consume a particular medicine.

12. Student's obligation

The student attendance in class two hours a week, preparation of the home works examinations and participate in the discussion in the classroom.

13. Forms of teaching

Different forms of teaching will be used to reach the objectives of the course: Direct questions, Quizzes, Discussion and conclusions. Power point presentations

14. Assessment scheme

Exams: There will be two closed book exams given throughout the semester.
Each test will be to take 90 minutes. Each exam carry out 7.5 degrees, they considered = 15%.

Final Exam: The Final Exam is Comprehensive in all course outlines. Carry out 50% degrees of the grade.

Theoretical grade = 65%

Practical grade = 35%

15. Student learning outcome:

The student will learn the phase rules, chemical equilibrium, finding the equilibrium constant for different reactions, in addition to learning the colligative properties of a mixtures

16. Course Reading List and References:

1- P.Atkins, and J.DE Paula. " ATKINS Physical Chemistry "6th edition.
2- IRA N. Levine. "Physical Chemistry" 6th edition.
3- A. Bahl, B.S. Bahl, and G.D. Tuli " Essential of physical Chemistry" .
4- R.A. Alberty, and R.J. Silbey."Physical Chemistry" 2nd edition.

17. The Topics:	Lecturer's name
. 1st week Kinetic of simple reaction 2nd week Order of reactions Zero order and 1st order 3rd week Order of reaction 2nd order and third order 4th week Complex reaction Reversible reaction Consecutive reaction 5th week	Dr.Khozan A. Haji 2 hours

Complex reaction Parallel reaction Chain reaction 6th week Mechanism of reaction Steady state approximation 7th week Mechanism of reaction Rate determining step approximation 8th week Arrhenius law 9th week Theories of Reaction Rates Collision theory 10th week Theories of Reaction Rates Activated complex theory 11th week Kinetic of catalysed reaction 12th week Enzyme kinetic 13th week Photochemistry Laws of photochemistry	

14th week Photochemistry Photochemical reactions 15th week Adsorption	

19. Examinations:

A second order reaction, in which the initial concentration of both the reactants is the same, is pleted in 600 sec. How long will it take for the reaction to go to 75% completion?

3 °C, the half-life for the decomposition of a sample of gaseous ethanal (acetaldehyde) initially at pressure of 363 Torr was 410 s. When the partial pressure was 169 Torr, the half-life was 880 s. he order of the reaction. **(5M)**

mple of gaseous acetone is irradiated with monochromatic light having a wave length of 313nm. his wavelength decomposes the acetone the acetone according to the equation:

$O \rightarrow C_2H_6 + CO$

ion cell used has a volume of 59cm^3. The acetone vapor absorbs 91.5% of the incident energy. e experiment the following data are obtained: -

ure of reaction = 56.7 °C. Initial pressure =102.16 kPa. Final pressure =104.42 kPa. Time of = 7 hour. Incident energy = 48.1×10^{-4} J.s^{-1}. What is the quantum yield?

tm = 101.325kPa, PV=nRT) **(10M)**

The Arrhenius parameters for the gas-phase decomposition of cyclobutane, [$C_4H_{8(g)}\rightarrow2C_2H_{4(g)}$], .00 × 10^{15} s^{-1} and Ea = 261 kJ mol^{-1}. What is the half-life of cyclobutane at (i) 20 °C, (ii) 500 °C? **(5M)**

ate the energy associated with: a) One photon, b) one Einstein, of wave length 400nm.

(5M)

mechanism for the thermal decomposition of acetaldehyde is:

$$CH_3CHO \longrightarrow \dot{C}H_3 + \dot{C}HO$$

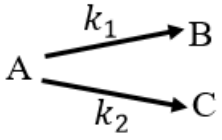
$$\dot{C}H_3 + CH_3CHO \longrightarrow CH_4 + \dot{C}H_2CHO$$

$$\dot{C}H_2CHO \longrightarrow CO + \dot{C}H_3$$

$$\dot{C}H_3 + \dot{C}H_3 \longrightarrow C_2H_6$$

(10M)

steady-state approximation, to obtain the rate of formation of CH_4.

his parallel reaction 

if $\frac{[A]}{[A]_o} = e^{-(k_1+k_2)t}$

Prove that $[B] = \frac{k_1[A]_o}{k_1+k_2}(1 - e^{-(k_1+k_2)t})$ **(10M)**

constant= $6.626 \times 10^{-34}\ J.s$, speed of light=$3 \times 10^8 \frac{m}{s}$

When the concentration of A in the reaction [**A** → **B**] was changed from 1.20 M to 0.60 M, the ncreased from 2.0 min to 4.0 min at 25°C. Calculate the order of the reaction and the rate

tain reaction is first order; after 540 s, 32.5 % of the reactant remains.

ate the rate constant for the reaction. **(5M)**

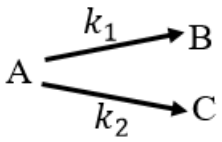
ength of time would be required for 25 % of the reactant to be decomposed?

00-cm^3 vessel containing hydrogen and chlorine was irradiated with light of 400nm.
nents with a thermopile showed that 11×10^{-7} J of light energy was absorbed by the chlorine per
During an irradiation of 1min the partial pressure of chlorine as determined by the absorption of
the application of Beer's law, decreased from 0.012 to 9.16×10^{-3} mol/L. (corrected to 0°C).
he quantum yield? **(10M)**

Calculate the rate constant at 500 K for the second-order gas-phase reaction between Cl_2 and H_2
frequency factor, $A = 8.1 \times 10^{-10}$ dm^3 mol^{-1} s^{-1} and activation energy E_a=23 kJ mol^{-1}.

ate the energy associated with: a) One photon, b) one Einstein, of wave length 800nm. **(5M)**

(5M)

Q4// For this parallel reaction 

(10M)

Prove that: $\frac{[A]}{[A]_o} = e^{-(k_1+k_2)t}$

Q5// For this reaction **(10M)**

$$H_2O_2 + 2H^+ + 2I^- \rightarrow I_2 + 2H_2O$$

Find the rate law, suppose one mechanism

$$H^+ + I^- \underset{K_{-1}}{\overset{K_1}{\rightleftharpoons}} HI \qquad \text{rapid equilibrium}$$

K_2

$HI + H_2O_2 \longrightarrow H_2O + HOI$ slow

$HOI + I^- \xrightarrow{K_3} I_2 + OH^-$ fast

$OH^- + H^+ \xrightarrow{K_4} H_2O$ fast

constant= $6.626 \times 10^{-34}\ J.s$, speed of light=$3 \times 10^8 \frac{m}{s}$

20. Extra notes:

21. Peer review