Department of Chemistry

College of Science

University of Salahaddin

Subject: Physical Chemistry

Course Book – (2nd Stage.Thermodynamic Chemistry)

Lecturer's name : Asst.Prof.D. Heman A.Smail

Academic Year: 2022/2023

Assistant: Aveen matte and rezan jalal. (for Practical)

1. Course name	**Physical Chemistry**
2. Lecturer in charge	**Heman A.Smail**
3. Department/ College	**Department of Chemistry/College of Science**
4. Contact	**e-mail:heman.smail@su.edu.krd**
5. Time (in hours) per week	**6**
6. Office hours	**Tuesday,Wednesdayand Thursday 9-1 every week**
7. Course code	
8. Teacher's academic profile	**I received my B.Sc of Science in Chemistry from Salahaddin University, Erbil -Iraq in 2005. I received Master of Science in physical chemistry from Salahaddin University, Erbil-Iraq in 2009, and PhD. 2017.**
9. Keywords	**Thermodynamic chemistry ,Thermo chemistry, Viscosity, Colligative properties of solution, Physical properties of liquid.**

10. Course overview:

The course is built around thermodynamic chemistry which are devoted to various aspects of chemical data collection and analysis. Guidelines for preparation of reports will be covered in the first lab meeting. Although students will work in pairs, laboratory reports should be written independently. Occasionally a take-home exam will be given that will require independent reading and research to complete. Although resources may be shared for these take home exams, the writing of the exam should be done by each student independently. You are responsible for attending all lecturs, and you are expected to start all laboratories at the designated times. Any delays or absences must be approved by the instructor. Only excused absences may be made up.

11. Course objective:

This course is composed of ten modules or experiments. All lectures will be performed simultaneously by rotating teams of two students each. Each team will rotate through the set of six experiments, with at least two weeks devoted to each of the labs.There will be occasional take home exams which will require independent study, web and literature searches for completion. These will be devoted to various topics important in experimental physical chemistry, such as temperature measurement, pressure measurement, voltage and current measurement, equipment design, computer interfacing and data logging, vacuum methods, high pressure methods, balances, pH meters, signal averaging, and timing.

12. Student's obligation

Your final grade will be derived as follows:

- *Quizzes:*About 10 quizzes will be given throughout the semester. They will be given at the beginning of the class period and last 10 minutes.
- *Exams*: There will be three closed book exams given throughout the semester. Each test will be scheduled for 3 hr.

- *Practical Exam*: This Exam is Comprehensive in all course outlines.

The grade of this semester distributed as follows?

Activity: 3

Quiz: 2

Absence: 1

Exam: 14.

13. Forms of teaching

Power point text, white board and lectures copied paper.

14. Assessment scheme

Although students will work in pairs, laboratory reports should be written independently. Occasionally a take-home exam will be given that will require independent reading and research to complete. Although resources may be shared for these take home exams, the writing of the exam should be done by each student independently.

15. Student learning outcome:

To convey the joys of experimental physical chemistry and the satisfaction obtained from doing quality work. You should obtain an appreciation and understanding of experimental methods and equipment used in chemical thermodynamics, kinetics, and spectroscopy, including data collection methods, instrumentation, data reduction, error analysis, and report writing.

16. Course Reading List and References:

Course Reading List and References :

1- books :

- Physical Chemistry by P.W. Atkins
- Fundamental Physical Chemistry by Maron & Lando
- Physical Chemistry by Robert A. Alberty
- Physical Chemistry by David & Ball
- Gordon M. Barrow (vi) Physical Chemistry:
- Physical Chemistry by Laidler, Meiser, and Sanctuary

2- Internet .

17. The Topics:	**Lecturer's name**
Course Topics: **- (properties of matter and physical/chemical**	**Hemn A.Smail** **ex: (3 hrs)**

equilibria) **-Chemical equilibrium** **-Determination of equilibrium constant** **-Thermodynamic equilibrium constant** **-KP and KC for gaseous reaction** **-Le Châtelier's Principle** **-Properties of equilibrium constant** **-The Phosgene equilibrium** **-Effect of inert gases on equilibrium** **-The equilibrium constant for hetrogenouse reaction** **-Effect of pressure on hetrogenouse equilibria** **-Variation of Ka & Kp with Temperature.** **-Physical equilibria involving pure substance** **-Clausius-Clapeyron equation** **-Trouton's Rule** **-Criteria of equilibria** **-Physical Properties of Matter** **-Evidence of Chemical Change** **-Gibbs free energy** **-Properties of Gibbs free energy**	
In this section The lecturer shall write titles of all practical topics he/she is going to give during the term. This also includeѕ a brief description of the objectives of each topic, date and time of the lecture	

Q// Explain the effect of inert gases on equilibrium by examples?
Answere:
The presence of these gases cannot affect in any way the thermodynamic equilibrium
constant . But , the presence of these inert gases modifies the ϒ's and there by also KϒΥ
as a result Kp is changed .
However ,even if we neglect this effect on Kp , the presence of the inert gases still
affects the partial pressures of the reactants and products at a given total equilibrium
pressure , and hence we may expect a shift in the extent of reaction to permit a
redistribution of the partial pressures in accord with the demands of the

equilibrium
constant .
To show quantitatively the effect of an inert gas on an equilibrium consider the
reaction:-

$COCl_2(g) = CO(g) + Cl_2(g)$

At 394.8:C & total pressure at equilibrium of 1.0 atm. The degree of dissociation of $COCl_2$ = 0.206 .Suppose the equilibrium is established in pressure of N_2 gas at partial pressure = 0.4 atm. In total pressure of 1.0 atm..

20. Extra notes:

I will try to do my best to cover the course very well.

Course Book(Practical)

1. Course name	**Practical Physical Chemistry**
2. Lecturer in charge	**Aveen Matti Hanna**
3. Department/ College	**Department of Chemistry/College of Science**
4. Contact	**e-mail:aveen.hanna@su.edu.krd**
5. Time (in hours) per week	**Practical: 2:00**
6. Office hours	**Tuesday,Wednesdayand Thursday 9-1 every week**
7. Course code	
8. Teacher's academic profile	**I received my B.Sc of Science in Chemistry from Mosul University, Mosul -Iraq in 2004. I received Master of Science in physical chemistry from Salahaddin University, Erbil-Iraq in 2014**
9. Keywords	**Thermo chemistry, viscosity, Colligative properties of solution, Physical properties of liquid.**

10. Course overview:

The course is built around ten sets of experiments which are devoted to various aspects of chemical data collection and analysis. Laboratory reports will be required for all experiments.Reports are due no later than one week after completion of each module. Guidelines for preparation of reports will be covered in the first lab meeting. Students will work in the laboratory in pairs, but each student will be required to keep their own

laboratory notebook, which will be graded periodically in class by the instructor. Although students will work in pairs, laboratory reports should be written independently. Occasionally a take-home exam will be given that will require independent reading and research to complete. Although resources may be shared for these take home exams, the writing of the exam should be done by each student independently. You are responsible for attending all laboratories, and you are expected to start all laboratories at the designated times. Any delays or absences must be approved by the instructor. Only excused absences may be made up.

11. Course objective:

This course is composed of ten modules or experiments. The six experiments will be performed simultaneously by rotating teams of two students each. Each team will rotate through the set of six experiments, with at least two weeks devoted to each of the labs.There will be occasional take home exams which will require independent study, web and literature searches for completion. These will be devoted to various topics important in experimental physical chemistry, such as temperature measurement, pressure measurement, voltage and current measurement, equipment design, computer interfacing and data logging, vacuum methods, high pressure methods, balances, pH meters, signal averaging, and timing.

12. Student's obligation

Your final grade will be derived as follows:

- *Quizzes:*About 10 quizzes will be given throughout the semester. They will be given at the beginning of the class period and last 10 minutes.
- *Exams*: There will be three closed book exams given throughout the semester. Each test will be scheduled for 1.5 hr.
- *Practical Exam*: This Exam is Comprehensive in all course outlines.

The Practical grade of this semester distributed as follows?

Report: 3

Quiz: 3

Absence: 1

Practical Exam: 3 for practical.

13. Forms of teaching

Power point text, white board and lectures copied paper.

14. Assessment scheme

Although students will work in pairs, laboratory reports should be written independently. Occasionally a take-home exam will be given that will require independent reading and research to complete. Although resources may be shared for these take home exams, the writing of the exam should be done by each student

independently.

15. Student learning outcome:

To convey the joys of experimental physical chemistry and the satisfaction obtained from doing quality work. You should obtain an appreciation and understanding of experimental methods and equipment used in chemical thermodynamics, kinetics, and spectroscopy, including data collection methods, instrumentation, data reduction, error analysis, and report writing.

16. Course Reading List and References:

- "Mathematics for Physical Chemistry, 3rd Edition" by Robert Mortimer, Elsevier, Academic Press, Boston, 2005.
- "Data Reduction and Error Analysis for the Physical Sciences, 3rd Edition" by Philip Bevington, McGraw Hill, 2002.
- F. Daniels, J. W. Williams, P. Bender, R. A. Alberty, C. D. Cornwell and J. E. Harriman, Experimental Physical Chemistry, 7th ed., McGraw-Hill, 1970. QD457.D21.
- (http://pubs.acs.org/journals/jpcafh/index.html)

17. The Topics:	Lecturer's name
18. Practical Topics (If there is any)only for first course **1-Determination of liquid mixture composition by Refractive Index.** **2- Determination of M.wt by depression of freezing point.** **3-M.wt Determination by Victore Meyer method.** **4- Determination of M.wt by elevation of boiling point.** **5- Determination of surface tention of a liquid.** **6- Determination of heat of ionization** **7- Determination of heat of neutralization.** **8-Temperature dependence of viscosity** **9-The density of a liquid as a function of temperature** **10- Determination heat of solution from solubility** **11-Thermochemistry Heat of Transition by Caloremetry.** **12-Determination of equilibrium constant by distribution method.** **13-Homogeneous equilibrium in liquid system.** **14-Determination of molecular weight by steam**	**Aveen Matti Hanna** (15hrs)

distillation method. **15-Determination of the ''Boiling point-composition curve'' for azotropic solution (liquid- vapour equilibrium in a mixture of two miscible liquids).** **16-Liquid and solid phase diagram for two compositions.** **17-Determination of phase diagram for water-phenol binary system (Mutual solubility).** **18-Determination of phase diagram for three component system.** **19-Particle size measurement by viscosity method.** **20-Fractional distillation.**	
In this section The lecturer shall write titles of all practical topics he/she is going to give during the term. This also includes a brief description of the objectives of each topic, date and time of the lecture	

19. Examinations:

1. Compositional:

What are the factors affect viscosity?

2.True or false type of exams:

Is Velocity of light is less in dielectric material than it is in vacuum?

answer: True

3. Multiple choices:

Is angle $ø_v$ increase, the angle $ø_m$ increase, and reach its maximum value $ø_m$ when the angle $ø_v$ becomes equal toa/45 b/90 c/180 angle.

20. Extra notes:

I will try to do my best to cover the course very well.

21. Peer review

I carefully revised the final form prepared by ‘ Aveen Matti Hannna’ with some minor changes.

Dr. Mazin