SYLLABUS

A. Course Description

Course Code	Course Num.	Course Name	Credit Hours	Lec.	Lab.	Tut.	Private study	Pre-requisites	Course Level	Language
CHM	222	Physical Chemistry	3	3	0	1	6	CHM 103 & CHM 223	3	English

Topics covered in the course include the properties of ideal gas and some laws related to them and the real gas properties. First, second and third laws of thermodynamics, the equilibrium states, Application of the Gibbs function and the Planck function to some phase changes. Thermodynamics of solution. Activities of ions in liquid solutions. Colligative properties: boiling-point elevation and freezing point depression. Chemical kinetics, chemical reaction equilibrium. Gibbs free energy and chemical equilibrium. Reaction kinetics.

At the end of this course the student will be able to
1. To state main gas laws and their applications
2. To define the concept of standard state and thermodynamic functions of pure substances due to change of temperature.
3. To describe the change of vapour pressure of pure liquids and solids due to change in temperature
4. To list the thermodynamic concept of phase equilibrium, chemical equilibrium, entropy, and Gibb's free energy.

B. References: Required Textbook & Internal Website

I shall use **Physical Chemistry**, K. J. Laidler, J. H. Meiser, B. C. Sanctuary, (4th Ed.), Houghton Mifflin Company, 2003, ISBN: 0618123415
Students are required to purchase the textbook/materials (it is an obligation). The book contains the lecture notes as well as activities for the students to take part in; the book serves as a workbook.
Other references:

- **Physical Chemistry**, P.W Atkins, and J. de Paula (8th Ed.), New York, NY: W.H. Freeman and Company, 2001. ISBN: 9780716735397
- **Physical Chemistry**, R. Silbey, R. Alberty, and M. Bawendi, (4th Ed.), New York, NY: John Wiley & Sons, 2004. ISBN: 9780471215042.

Google Classroom Webpage: http://www.imamm.org/

C. Topics Outline

Disclaimer: this is a very fast-paced course. There will be little time—if any—for review. What follows is an approximate outline of the pace of the course. We may go faster or slower, contingent on the class response. The tentative list of topics to cover:
1. Nature of physical chemistry, system, state and equilibrium.

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كلية العلوم
قسم الكيمياء

2. Classical mechanics and properties of gases. Kinetic theory of gases.

3. Gas Laws: Boyl's law, Charl's and Gay-Lussac's law, Graham's law, ideal gas law, General gas law.

4. Real gas behavior, Van der Waal's equation of state, compressibility factor. Thermophysical properties of pure substances: Cp, Cv, β, γ, κ, vapor pressure, boiling point.

5. Energy, heat, and work. Interaction of heat and work with the system boundaries. The first law of thermodynamics.

6. Thermochemistry : standard state, heat of formation, heat of solution, heat of dilution, heat of reaction, heat of combustion. Exothermic and endothermic reactions. Temperature dependence of the equilibrium constant.

7. The second law of thermodynamics. Carnot Cycle and entropy.

8. Changes of thermodynamic functions: Internal energy, enthalpy and Gibb's free energy. Equations of State.

9. Chemical Equilibrium involving ideal and non-ideal gaseous systems.

10. Chemical equilibrium in solution, heterogeneous equilibria. Factors affecting chemical equilibria.

11. Gibb's phase rule. Phase recognition, phase equilibria of 1-component system. Entropy and phase transition. Clausius-Clapeyron equation. Ideal gas mixtures and liquid solutions. Partial pressure and Dalton's law. Ideal gas mixtures and liquid solutions. Kay's rule and properties of Ideal mixtures and solutions.

12. Solution thermodynamics: Phase diagram, ideal solutions, Raoult's law and Henry's law. Mixing of ideal gases.

13. Thermodynamics of solution. Activities of ions in liquid solutions. Colligative properties: boiling-point elevation and freezing point depression.

14. Chemical kinetics, chemical reaction equilibrium. Gibbs free energy and chemical equilibrium.

15. Reaction kinetics, 1st and 2nd order reactions

Exams & Grading System

The semi-official dates of the exams for this course, with all the caveats, that the word "semi-official" entails, can be found here:

- **Midterm 1:** 6th or 7th week   &   **Midterm 2:** 11th or 12th week
- **Quizzes & Homeworks: During the semester**

Your course grade will be based on Final Exam, Midterms, Homework, Quizzes, Participation, Attendance and Project.

Midterm 1: 20 %	**Midterm 2:** 20 %	**Final Exam:** 40 %
Quizzes; Homework & Attendance & Participation: 20 %		

Grading distribution:

A⁺: [95, 100], A: [90, 95), B⁺: [85, 90) , B: [80, 85), C⁺: [75, 80), C: [70, 75), D⁺: [65, 70), D: [60, 65), F: [0, 60).

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D. Student Attendance/Absence

Only three situations will be considered as possible excused absences:

- Occurrence of a birth or death in the immediate family will be excused. ("Immediate family" is defined by the University as spouse, grandparents, parents, brother, or sister).
- Severe illness in which a student is under the care of a doctor and physically unable to attend class will be excused. Students are not excused for a doctor's appointment. Do not make appointments that conflict with rehearsals. Notes from the University Health Center will be accepted.

Executive Rules for Study Regulations and Exams
goo.gl/ykm7t3

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