نموذج توصيف مقرر
Course Description Form

Name of College\Faculty : Science — **اسم الكلية:**

Name of Department: Chemistry — **اسم القسم العلمي:**

Course Name	Physical Chemistry I	**اسم المقرر**
Course No.	0420214	**رقم المقرر**
No. of Credits	4	**عدد الوحدات**
Theoretical Hours	3	**عدد الساعات النظرية**
Practical Hours	1	**عدد الساعات المحلية**

Course topics — **مواضيع المقرر**

1. Properties of ideal and real gases.
2. The first law of thermodynamics
3. The second law of thermodynamics
4. Physical transformation of pure substances and mixtures
5. Simple phase diagrams and phase equilibria (phase rule)
6. Chemical equilibria

Text book: (Name, Author , Year , Publisher) — **عنوان الكتاب : (الاسم ، المؤلف ، سنة الطبع ، دار النشر)**

Peter Atkins, Physical Chemistry, Oxford University Press, Oxford, Latest Edition.

References: (Name , Author , Year . Publisher) — **عنوان المرجع : (الاسم ، المؤلف ، سنة الطبع ، دار النشر)**

1. P.A. Rock, Chemical Thermodynamics, Oxford University Press, Latest Edition.
2. David W. Ball: “Physical Chemistry”, Latest Edition.
3. I.N. Levine, Physical Chemistry, McGraw-Hill, New York, Latest Edition.
4. D.P. Shoemaker, C.W. Garland and J.W. Nibler, Experiments in Physical Chemistry, McGraw-Hill, London, Latest Edition.
5. Laboratory Manual for Chem. 214, prepared by the Department

Prerequisites					متطلبات المقرر	
Grading	Exams	30	%		الاختبارات	آلية رصد المقرر
	Quizzes	5	%		امتحانات قصيرة	
	Lab	25	%		واجبات	
	Final	40	%		الاختبار النهائي	
	100%					

Chapters included:

Chapter	Topic	pages
CH.1	Properties of gases	3-9, 19-26
CH.2	The first law of thermodynamics	33-56, 59-68
CH.3	The second law of thermodynamics	77-85, 92-95
CH.4	The Physical transformation of pure substances and mixtures	119-126, 128-134
CH.5	Simple mixtures	141-152, 155-162
CH.6	Phase diagram of binary systems	166-175
CH.7	Chemical equilibria	1-14, 212-216

Course objectives					
No.	Course Objectives (Learning Outcomes)	Example(s) of relevant (Topics and activities)	Recommended Level to satisfy the objectives		
			High	Medium	Low
1	Students will develop an understanding of gas laws, thermodynamic equation of state.	• Understand and solve problems of perfect gases such as those involving Boyle's Law, Charles's Law, perfect gas equation of state, Dalton's law. • Understand the effect of molecular interactions on gas compression factor. • Understand and solve problems of real gases using empirical (Virial) and	x		

		Theoretical (van Der Waals) equation of state. • Understand the concept of Critical constants and the principle of corresponding.			
2	Provide a fundamental basis for thermodynamics and introduce the concepts of entropy, free energy changes and their role in specifying the direction of a chemical reaction.	• Understand molecular nature of internal energy. • Discuss the different types of systems and boundaries. • Understand and solve problems involving free-constant pressure- reversible, isothermal reversible-expansion, adiabatic and reversible-adiabatic works. • Define the heat transfer and constant-volume, constant-pressure and specific heat capacities • Determine the change in internal energy and entropy • Justify and solve problems involve the relationship between the constant-volume and constant-pressure heat capacities and the heat capacities ratio. • Know the difference between state and path functions and the difference between exact and inexact differentials. • Identify the properties of thermodynamics functions using partial derivatives with the help of Euler's chain rule, the inverter and Maxwell's relations. • Define the internal pressure and understand the effect of interaction on such function. • Interpret the Joule-Thomson effect. • Define system and surrounding entropy changes	**x**		

		for general cases, isothermal and adiabatic reversible processes. • Understand the effect of phase transition and physical change on entropy. • Identify the direction of spontaneous change using total entropy, Clausius inequality, Gibbs and Helmholtz energies. • Show that maximum expansion work is equal to Helmholtz energy and maximum non-expansion works equal to Gibbs free energy. • Define the chemical potential of pure substance and fugacity			
3	Students will understand the basics of phase diagrams and phase equilibria of one- and multi-component systems.	• Understand basics of the phase diagram, phase stability and transition and to relate those to the chemical potential pure substance. • Determine the effect of pressure and temperature on the chemical potentials of pure substances. • Determine the effect of applied pressure on the vapor pressure of pure substances. • Determine the slope and location of the phase boundaries of pure substances using Clapeyron's and Clausius-Clapeyron's equations. • Define the partial molar quantities of mixtures and the significance of Gibbs-Duhem equation. • Determine the thermodynamics functions of	**x**		

		mixtures of perfect gases and a mixture of liquids. • Understand ideal solutions laws (Raoul's and Henry's Laws). • Justify the Gibbs phase rule. • Understand one- and two-components phase diagrams • Use of lever rule to determine the compositions of the phases			
4	Students will understand the equilibrium in chemical reactions.	• Perform equilibrium calculations. • Describe factors that affect equilibrium.	**x**		
5	Obtain a vision of the matter-energy relationship in physical and chemical systems.	• Explain Le Chatelier's principle in terms of thermodynamics quantities. • Discuss the physical basis of the van't Hoff equation for temperature dependence of K. • Explain the colligative properties in terms of thermodynamics quantities.	**x**		
6	To demonstrate experimentally the topics covered in this course	• Evaluate van't Hoff factor from the measurement of depression of freezing point. • Determine heat capacity ratio, C_p/C_v, of N_2, He and polyatomic from measurements of temperature drop caused by adiabatic expansion. • Determine the enthalpy of vaporization from vapor pressure measurements. • Determine the heat of neutralization for a reaction using calorimetry at constant pressure • Construct a phase diagram for a two-component system (solid-liquid equilibria; liquid-	**x**		

		vapor equilibria) or three-component systems. • Determine thermodynamic parameters ΔG, ΔH and ΔS from electrochemical measurements at different temperatures. • Study the chemical equilibrium in the solution between Iodine and potassium iodide solution. • Measure critical points for Sulfur Hexafluoride (SF6). • Use differential scanning calorimetry. • Study the partial molar volume by Pycnometry			
Fields	Physical Chemistry				
Skills					
Coordinator (Name and Rank) :		Physical Chemistry Coordinator			
Signature and stamp :					
Date:		**10/11/2025**			