جامعة الكويت
KUWAIT UNIVERSITY

نموذج توصيف مقرر
Course Description Form

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

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

Course Name	Physical Chemistry	**اسم المقرر**
Course No.	0420217	**رقم المقرر**
No. of Credits	3	**عدد الوحدات**
Theoretical Hours	3	**عدد الساعات النظرية**
Practical Hours	3	**عدد الساعات المحلية**

Course topics **مواضيع المقرر**

1. Properties of perfect and real gases.
2. Basic concepts of the first law of thermodynamics
3. Second and third laws of thermodynamics
4. Physical transformation of pure substances and mixtures
5. Chemical change
6. Chemical Kinetics and process at the solid surface (Adsorption and desorption the rates of reactions

Text book: (Name, Author , Year , Publisher)	**عنوان الكتاب : (الاسم ، المؤلف ، سنة الطبع ، دار النشر)**
Peter Atkins, Elements of 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. 217, 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	page
CH.1	The properties of gases	4-31
CH.2	The first law of thermodynamics	39-78
CH.3	The second law of thermodynamics	86-109
CH.4	The Physical transformation	115-140
CH.5	Chemical change	177-194
CH.6	Chemical Kinetics	248-276, 281-287, 300-305

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 Boyl'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 Theoretical (van Der Waals) equation of state.	x		

		• Understand the kinetic model of gases.			
2	Provide the 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 the 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.	**x**		
3	Students will understand the basics of phase diagrams and phase equilibria of one- and multi-component systems.	• Define system and surrounding entropy changes 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. • Define the chemical potential of pure substance and fugacity.	**x**		
4	Students will understand the equilibrium in chemical reactions and the effect of temperature and pressure on equilibrium.	• Understand the 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 substance.	**x**		

		• 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 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.			
5	Understanding the rate of reactions (effect of temperature and pressure and complex reactions) and surface dynamics (adsorption isotherms, surface reaction, heterogeneous catalysis and adsorption in liquids).	• Perform equilibrium calculations • Describe factors that affect equilibrium • 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. • Students will understand the chemical equilibrium, effect of temperature and pressure on equilibrium.	**x**		
6	To demonstrate experimentally the topics covered in this course.	• Understanding the rate of reactions: effect of temperature and pressure and complex reactions. • Understanding Surface dynamics, adsorption isotherms, surface reaction, heterogeneous catalysis and adsorption in liquids. • Discuss the connection between activation energy and the energy	**x**		

		distribution of molecules and relate the forward and reverse activation energies using thermodynamics. • Outline the theoretical calculation of rate constants using collision theory. • Describe transition state theory and its thermodynamic formulation. • Perform equilibrium calculations.			
Fields	Physical Chemistry				
Skills					
Coordinator (Name and Rank) :		Physical Chemistry Coordinator			
Signature and stamp :					
Date:		**10/11/2025**			