Course Syllabus
Faculty of Arts and Science

Academic Department Chemistry

Academic Year 2021/2022 Semester: Second

Course Title :	Physical Chemistry (1)
Course No. :	1722210
Prerequisite :	1722102
Concurrent :	-
Department :	Chemistry
Coordinator :	Dr. Dima Khater
Mode of Instruction	**On-Campus Learning** - 3 hours in-class (Synonym) learning

*** Instructor:**

Lecturer	Office Phone	Room No.	Office Hours	E-mail
Dr. Dima Khater	1283	224	11.00-12.00 S, M, T, W, Th	d_khater@asu.edu.jo

Course Description

The material in this course covers fundamental topics in physical chemistry (Nature of Physical Chemistry, system, state and equilibrium, and thermal equilibrium, Gases and the kinetic theory of gases, The First Law of thermodynamics, the second law of thermodynamics, chemical equilibrium, phases and solution, and phase equilibria. Attendance is expected and students are responsible for being denied from the final exam if the absence exceeds 15% of the lecture sessions.

Intended Learning Outcomes

Upon the completion of the course, this module should lead to the following learning outcomes:

A. Knowledge and Understanding (Student should):

A1 state some certain subjects that are academically and/or professionally related to physical chemistry.

B. Cognitive and Intellectual Skills (Student should):

B1 differentiate between the different laws of thermodynamics and the different phases of the matter.

B2 calculate mathematically the output of different chemical reactions.

B3 explain concepts, principles of chemical systems by applying mathematical expressions and explaining the physical meaning.

C. Subject Specific Skills (Student should):

C1 interpret data based on theory.

D. Transferable Skills (Student should):

D1 employ computational software and data-processing skills in handling chemical information and analysis of chemical data.

Program Learning Outcomes (PLOs):

1.1	Describe the fundamentals of chemistry including structure, reactivity, and properties of chemical substances, the different situations of reaction, and the states of matter.
1.2	Construct essential facts, principles, and theories across the four principal areas of chemistry, i.e. analytical, organic, inorganic, and physical.
1.5	Recognize certain subjects in biology, physics, and mathematics that serve the chemistry disciplines.
1.7	State certain subjects that are academically and/or professionally related to chemistry.
2.2	Explain concepts, principles and determine the efficiency of chemical systems by applying mathematical expressions.
2.3	Analyze chemical and spectral data to identify and confirm chemical structures as well as determine the chemical composition.
2.4	Establish and conclude mechanisms for physical and chemical processes.
2.5	Solve the scientific problems using different mechanisms and procedures.
2.6	Present scientific material and arguments clearly and correctly, in writing and orally, to a range of audiences.
3.1	Demonstrate adequate life-long learning skills.
3.3	Select appropriate techniques and procedures for chemical synthesis and analysis.
4.3	Interpret data derived from laboratory observations and measurements in terms of their significance and the theory underlying them.

Course Learning Outcomes Alignment Matrix						
PLO	**A1**	**B1**	**B2**	**B3**	**C1**	**D1**
1.1	√					
1.2	√					
1.5			√		√	
1.7		√				√
2.2				√		
2.3						√
2.4				√		
2.5						√
2.6					√	
3.1				√		
3.3		√				√
4.3		√				√

Course Contents and Schedule

Week	Day and Date	Topics to be covered	Method of instruction	CL Os	PLOs
1	Mon. 7th Mar.	**Chap1: The Nature of Physical Chemistry and the Kinetic Theory of Gases**:	In-class lecture	**A1 A2 B2 B3 C1**	**1.1 1.2 1.5 2.2 2.3 3.1**
	Wed. 9th Mar.	1. 1. 1.2 Some concepts from classical mechanics 1.9 The Kinetic Molecular Theory of Ideal Gas 1.5 Pressure and Boyle's law	In-class lecture		

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2	Mon. 14th Mar. Wed. 16th Mar.	1.10 The Barometric Distribution Law	In-class lecture In-class lecture	**A1 B3 C1**	**1.1 1.2 1.5 2.2**
3	Mon. 21th Mar. Wed. 23th Mar.	1.12 Real Gases 2.5 Thermochemistry	In-class lecture In-class lecture	**A1 B1 B2 B3**	**1.2 1.1 1.7 1.5 2.2 2.3 3.1**
4	Mon. 28th Mar. Wed. 30th Mar.	2.6 Ideal gas relationship 2.7 Real gases, heat, and work concepts	In-class lecture In-class lecture	**A1 B1 B2 B3**	**1.2 1.1 1.7 1.5 2.2 2.3 3.1**
5	Mon.4th April Wed. 6th April	**Chap3: Second and Third Law** 3.1The Carnot cycle, 3.2Irreversible processes,	In-class lecture In-class lecture	**A1 B1 B2 B3**	**1.2 1.1 1.7 1.5 2.2 2.3 3.1**
6	Mon. 11th April Wed. 13th April	3.4 entropy concept and entropy changes 3.5 third law of thermodynamics	In-class lecture In-class lecture	**A1 B1 B2 B3**	**1.2 1.1 1.7 1.5 2.2 2.3 3.1**
7	Mon. 18th April Wed. 20th April	3.6 equilibrium conditions, 3.7 Gibbs free energy, 3.9 Maxwell relations, Gibbs-Helmholtz equation	In-class lecture In-class lecture	**B1 B2**	**1.5 1.7 3.3 3.4**
8.	Mon. 25th April Wed. 27th April	**Chap4: Chemical Equilibrium:** 4.1, 4.2 Equilibria involving ideal and non-ideal gases, 4.3 solution equilibrium, 4.4 heterogeneous	In-class lecture In-class lecture	**A1 B2 B3 D1**	**1.1 1.2 3.3 4.3 2.2 3.5 4.3**

		equilibrium, tests of equilibrium			
9	Mon.2rdMay Wed.4thMay	Official holiday			
10	Mon. 9th May Wed. 11th May	4.5 tests of equilibrium, coupled reactions 4.8 temperature dependence of equilibrium constants	In-class lecture In-class lecture	**B2 B3**	**1.5 2.2 2.3 3.1**
11	Mon. 16th May Wed. 18th May	**Chap 5: Phases and Solutions:** 5.1 Phase recognition, vapor pressure relations, 5.3 classification of phase transitions,	In-class lecture In-class lecture	**B1 B2**	**1.7 1.5 3.3 4.3**
12	Mon. 23nd May Wed. 25th May	5.4 Raoul's and Henry's laws, Official holiday	In-class lecture	**C1 D1**	**1.5 1.7 2.3 2.5 2.6 3.3 4.3**
13	Mon. 30th May Wed. 1st Jun	5.5 partial molar quantities, solution thermodynamics 5.7 Thermodynamics, colligative properties 5.8 Colligative properties	In-class lecture In-class lecture	**A1 C1 D1**	**1.5 1.1 1.2 1.7 2.3 2.5 2.6 3.3 4.3**
14	Mon. 6th Jun Wed. 8th Jun	**Chap6: Phase Equilibria** 6.1 Equilibria between phases, 6.2 One-component systems, 6.3 Binary systems involving vapor	In-class lecture In-class lecture	**A1 C1 D1**	**1.5 1.1 1.2 1.7 2.3 2.5 2.6 3.3 4.3**
15	Mon. 13th Jun	6.4 Condensed binary	In-class lecture	**A1**	**1.5**

	Wed.15th Jun	systems, 6.5 Ternary Systems	In-class lecture	C1 D1	1.1 1.2 1.7 2.3 2.5 2.6 3.3 4.3
16.	**Final Exam**				

Grading Plan and Assessment Tools

Assessment Tools	Weights	Due date
Mid-term	30	TBA
Assignments	10	TBA
Quizzes	10	TBA
Interactive lectures	……	
Group Work	……	
Presentation	……	
Reports	……	
Project	……	
Case-Study	……	
Final Exam	50	TBA

Supplementary Reading

Textbook:
Physical Chemistry by: K.J. Laidler, J. H. Meiser, and B. C. Sanctuary, 4th Ed., Houghton Mifflin (2003).

References:

- Analytical Chemistry: An Introduction, 8th ed. by D.A. Skoog, D. M. West, F. J. Holler and S.R. Crouch (2007). ISBN 0-03-020293-0.
- Physical Chemistry," 3rd Edition by R. J. Silby and R. A. Alberty, John Wiley Sons, New York, New York (2000).
- "Physical Chemistry: a modern introduction," by C. E. Dykstra, Prentice-Hall Publishers, Upper Saddle River (1997).
- "Physical Chemistry," 6th Edition by G. M. Barrow, Mcgraw-Hill, Boston, Massachusetts (1996).

- "The Elements of Physical Chemistry," 2nd Edition by P. W. Atkins, Oxford University Press, London, United Kingdom (1996).
- "Physical Chemistry," 4th Edition by I. N. Levine, McGraw-Hill, New York, New York (1995).
- "Physical Chemistry," 5th Edition by P. W. Atkins, Oxford University Press, London, United Kingdom (1994).
- "Physical Chemistry," by G. K. Vemulapalli, Prentice-Hall Publishers, Englewood Cliffs, New Jersey (1993).
- "A Textbook of Physical Chemistry," by K. K. Sharma and L. K. Sharma, Vani Educational Books, New Delhi, India (1986).
- "Principles of Physical Chemistry with Applications to the Biological Sciences," by D. Freifelder, Jones and Bartlett Publishers, Boston, Massachusetts (1985).
- "Physical Chemistry," 2nd Edition by J. P. Bromberg, Allyn and Bacon, Boston, Massachusetts (1984).
- "Physical Chemistry," by W. J. Moore, Prentice-Hall Publishers, Englewood Cliffs, New Jersey (1972).

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Subject Coordinator	**Dr. Dima Khater**	**Signature:**	----------
Head of Curriculum Committee	**Dr. Hussam Miqdad**	**Signature:**	----------
Department Head	**Dr. Hussam Miqdad**	**Signature:**	----------
Faculty Dean	**Dr. Hadeel Ali Saed**	**Signature:**	----------

Copy to:

- Department Head.
- Head of Curriculum Committee.
- Course File.