UNIVERSITI TEKNOLOGI MARA

CHM524: ADVANCED PHYSICAL CHEMISTRY

Course Name (English)	ADVANCED PHYSICAL CHEMISTRY APPROVED
Course Code	CHM524
MQF Credit	4
Course Description	This course is an advanced course to physical chemistry. It will interactively engage students cognitively and scientifically in areas of thermodynamics, electrochemistry and quantum mechanics. Students will define concepts, make predictions as to the possible outcome of an event and perform investigations via laboratory exercises. The designated lecture session is used to discuss results of investigations leading to its relation to the existing laws, principles or theories. Lecture sessions employ a mixture of lectures and problem based learning. The outcomes shall be assessed through a variety of tools which include the traditional paper examination, informal interviews and classroom engagement. Results of laboratory investigations leading to its relation to existing laws, principles or theories will also be discussed in the lecture session.
Transferable Skills	Calculation and lab skills
Teaching Methodologies	Lectures, Blended Learning, Lab Work, Practical Classes
CLO	CLO1 Discuss algebraically and numerically in quantitative and qualitative related to thermodynamics, solutions of electrolytes, quantum mechanics and radiochemistry. CLO2 Display practical skills in experimental labs related to thermodynamics, solutions of electrolytes, quantum mechanics and radiochemistry CLO3 Conduct scientific experiments related to thermodynamics, solutions of electrolytes, quantum mechanics and radiochemistry
Pre-Requisite Courses	No course recommendations

Topics
1. 1.0 Thermodynamics 1.1) 1.1 Define heat, work and energy; and distinguish between exothermic and endothermic reactions; open, closed and isolated systems 1.2) 1.2 Temperature and the zeroth law of thermodynamics 1.3) 1.3 First law of thermodynamics 1.4) 1.3.1 Internal energy, work, heat 1.5) 1.3.2 State functions 1.6) 1.3.3 Enthalpy 1.7) 1.3.4 Heat capacities
2. 1.0 Thermodynamics 2.1) 1.3.5 Variation of temperature with enthalpy 2.2) 1.3.6 Ideal gas relationships 2.3) 1.3.7 Isothermal, adiabatic, reversible and irreversible processes 2.4) 1.4 Second law of thermodynamics 2.5) 1.4.1 Natural processes 2.6) 1.4.2 Entropy 2.7) 1.4.3 Changes in entropy in variation of changes in volume, pressure and temperature; and during phase transition 2.8) 1.5 Third law of thermodynamics 2.9) 1.5.1 Absolute zero of temperature and absolute entropy 2.10) 1.5.2 Gibbs free energy state functions and the satisfactory criteria for spontaneity and equilibrium in a system 2.11) 1.5.3 Dependence of Gibbs free energy on pressure and temperature

3. 2.0 Solutions of electrolytes
3.1) 2.1 Molecular motion in liquids
3.2) 2.2 The conductivities of electrolyte solutions
3.3) 2.2.1 Ohm's law
3.4) 2.2.2 Molar conductivity at infinite dilution

4. 2.0 Solutions of electrolytes
4.1) 2.2.3 Strong electrolytes: Kohlrausch's law and Debye-Hückel theory
4.2) 2.2.4 Weak electrolytes: the Arrhenius theory and Ostwald's dilution law
4.3) 2.2.5 Independent migration of ions
4.4) 2.2.6 The mobilities of ions
4.5) 2.2.7 Transport numbers
4.6) 2.2.8 Ion conductivities
4.7) 2.3 The solute activity
4.8) 2.3.1 The activities of ions in solution
4.9) 2.3.2 Activity Coefficients: Debye-Hückel limiting law and deviations from Debye-Hückel limiting law
4.10) 2.3.3 Ionic equilibria: equilibrium constant and solubility products
4.11) 2.3.4 Ionization of water

5. 3.0 Quantum Mechanics
5.1) 3.1 The origins of quantum mechanics
5.2) 3.1.1 The failure of classical physics
5.3) 3.1.2 Wave-particle
5.4) 3.2 Bohr's atomic theory
5.5) 3.3 Quantum mechanical principles
5.6) 3.4 Schrödinger's wave mechanics
5.7) 3.5 Quantum-mechanical postulates
5.8) 3.6 Quantum-mechanics of some simple systems

6. 4.0 Radiochemistry
6.1) 4.1 Types of radioactive decay
6.2) 4.2 Balancing nuclear equations
6.3) 4.3 Nuclear stablility
6.4) 4.4 Nuclear binding energy
6.5) 4.5 Radioactive decay rates

Assessment Breakdown	%
Continuous Assessment	50.00%
Final Assessment	50.00%

Details of Continuous Assessment

Assessment Type	Assessment Description	% of Total Mark	CLO
Practical	Demonstration / understanding of practical skill may be evaluated by practical experiment, simulation, interview and presentation.	5%	CLO2
Quiz	Quiz can be in the form of assignment	10%	CLO1
Test	Online test will be conducted	20%	CLO1
Written Report	Written report of practical	15%	CLO3

Reading List

Recommended Text

- **Peter Atkins,Julio de Paula,James Keeler 2018, *Atkins' Physical Chemistry*, 10 Ed., 1, 2, 3, 7, 16, Oxford University Press UK [ISBN: 9780198769866]**
- **Keith James Laidler,John H. Meiser,Bryan C. Sanctuary 2003, *Physical Chemistry*, 4 Ed., Brooks/Cole Publishing Company 1, 2, 3, 7, 11 [ISBN: 0-618-12341-5]**

Reference Book Resources

- **Ira N. Levine 2019, *Physical chemistry*, 6 Ed., 1, 2, 3, 9, 10, 17, McGraw-Hill Science/Engineering/Math [ISBN: 9780072538625]**
- **Robert J. Silbey,Robert A. Alberty,Moungi Gabriel Bawendi 2005, *Physical Chemistry*, 4 Ed., 1, 2, 3, 7, 9, John Wiley & Sons Incorporated [ISBN: 0-471-65897-9]**
- **Raymond Chang,Jason Overby, *Chemistry*, 13 Ed., 19, Mc Graw Hill [ISBN: 9781260085310]**

Article/Paper List: This Course does not have any article/paper resources

Other References: This Course does not have any other resources