UNIVERSITI TEKNOLOGI MARA

CHM520: PHYSICAL CHEMISTRY II

Course Name (English)	PHYSICAL CHEMISTRY II APPROVED
Course Code	CHM520
MQF Credit	4
Course Description	This course will interactively engage students cognitively and scientifically in areas of thermodynamics, electrochemistry and radiochemistry. 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.
Transferable Skills	Course Learning Outcomes: Upon completion of this course, students should be able to: 1. Apply concepts for thermodynamics, solutions of electrolytes, electrochemical cells and radiochemistry. (LO1,LO3,C3) 2. Solve qualitative & quantitative problems algebraically and numerically. (LO1,LO3,C3) 3. Conduct and communicate in writing scientific investigation on thermodynamics, solutions of electrolytes, electrochemical cells and radiochemistry. (LO2,LO4,C4)
Teaching Methodologies	Lectures, Blended Learning, Lab Work, Practical Classes
CLO	CLO1 Apply concepts for thermodynamics, solutions of electrolytes, electrochemical cells and radiochemistry CLO2 Apply concepts for thermodynamics, solutions of electrolytes, electrochemical cells and radiochemistry CLO3 Solve qualitative & quantitative problems algebraically and numerically CLO4 Solve qualitative & quantitative problems algebraically and numerically CLO5 Conduct and communicate in writing scientific investigation on thermodynamics, solutions of electrolytes, electrochemical cells and radiochemistry CLO6 Conduct and communicate in writing scientific investigation on thermodynamics, solutions of electrolytes, electrochemical cells and radiochemistry CLO7 Conduct and communicate in writing scientific investigation on thermodynamics, solutions of electrolytes, electrochemical cells and radiochemistry CLO8 Conduct and communicate in writing scientific investigation on thermodynamics, solutions of electrolytes, electrochemical cells and radiochemistry
Pre-Requisite Courses	No course recommendations

Topics
1. Thermodynamics 1.1) 1.1 Define heat, work and energy; and distinguish between exothermic and endothermic reactions; opened, 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.

1.8) 1.3.5 Variation of temperature with enthalpy.
1.9) 1.3.6 Ideal gas relationships.
1.10) 1.3.7 Isothermal, adiabatic, reversible and irreversible processes.
1.11) 1.4 Second law of thermodynamics.
1.12) 1.4.1 Natural processes.
1.13) 1.4.2 Entropy.
1.14) 1.4.3 Changes of entropy in variation of changes of volume, pressure and temperature; and during phase transition.
1.15) 1.5 Third law of thermodynamics.
1.16) 1.5.1 Absolute zero of temperature and absolute entropy.
1.17) 1.5.2 Gibbs free energy state functions and the satisfactory criteria for spontaneity and equilibrium in a system.
1.18) 1.5.3 Dependence of Gibbs free energy on pressure and temperature.

2. Solutions of electrolytes
2.1) 2.1 Properties of electrolytes.
2.2) 2.2 Electrolytic Deposition.
2.3) 2.2.1 Faraday's first and second laws of electrolysis.
2.4) 2.3 The Process of conduction.
2.5) 2.3.1 Ohm's law.
2.6) 2.3.2 Molar conductivity at infinite dilution and Kohlrausch's law.
2.7) 2.3.3 Weak electrolytes: the Arrhenius theory and Ostwald's dilution law.
2.8) 2.3.4 Strong electrolytes: Debye-Hückel theory.
2.9) 2.3.5 Independent migration of ions.
2.10) 2.3.6 Transport numbers.
2.11) 2.3.7 Ion conductivities.
2.12) 2.3.8 Activity Coefficients: Debye-Hückel limiting law.
2.13) 2.3.9 Ionic equilibria: equilibrium constant and solubility products.

3. Electrochemical cells
3.1) 3.1 Components of a cell.
3.2) 3.2 Conventional representation of a cell.
3.3) 3.3 Potentials of cells and electrodes.
3.4) 3.4 Thermodynamics of cells.
3.5) 3.4.1 Work and free energy.
3.6) 3.4.2 Standard electrode potentials.
3.7) 3.4.3 Equilibrium constants.
3.8) 3.4.4 Nernst equation.
3.9) 3.5 Types of electrodes and general form of Nernst equation for an electrode.
3.10) 3.6 Types of galvanic cells and general form of Nernst equation for a galvanic cell.
3.11) 3.7 Applications of Galvanic cell potentials.
3.12) 3.7.1 Activity coefficients.
3.13) 3.7.2 Equilibrium constants.
3.14) 3.7.3 Solubility constants
3.15) 3.7.4 pH.

4. Radiochemistry
4.1) 4.1 Types of radioactive decay.
4.2) 4.2 Balancing nuclear equations.
4.3) 4.3 Radioactive decay rates.
4.4) 4.4 Nuclear stablility.
4.5) 4.5 Nuclear reactions.
4.6) 4.5.1 Nuclear fission.
4.7) 4.5.2 Nuclear fusion.
4.8) 4.6 Radiation detection.
4.9) 4.6.1 Gas filled detection.
4.10) 4.6.2 Scintillation detection.
4.11) 4.6.3 Semi conduction detection.
4.12) 4.7 Applications of radioactive nuclides

Assessment Breakdown	%
Continuous Assessment	50.00%
Final Assessment	50.00%

Details of Continuous Assessment

Assessment Type	Assessment Description	% of Total Mark	CLO
Assignment	Assignment 1	4%	CLO1 , CLO2 , CLO3 , CLO4
Lab Exercise	7 Labs	20%	CLO5 , CLO6 , CLO7 , CLO8
Online Quiz	Online Quiz 1	2%	CLO1 , CLO2
Online Quiz	Online Quiz 3	2%	CLO3 , CLO4
Quiz	Quiz 2	2%	CLO2 , CLO3
Test	Test 2	10%	CLO3 , CLO4 , CLO8
Writing Test	Test 1	10%	CLO1 , CLO2 , CLO8

Reading List

Recommended Text

- **Peter Atkins,Julio de Paula 2009, *Physical Chemistry*, 9 Ed., Oxford University Press UK [ISBN: 1429218126]**
- **Chin Han Chan,Yit Meng Chin,Lai Har Sim 2013, *Laboratory Manual: Physical Chemistry II*, Penerbit Press, UiTM [ISBN: 9789673053179]**

Reference Book Resources

- **Keith James Laidler,John H. Meiser,Bryan C. Sanctuary 2003, *Physical Chemistry*, 4 Ed., Brooks/Cole Publishing Company USA [ISBN: 9780618123414]**
- **Ira N. Levine 2008, *Physical chemistry*, 6 Ed., McGraw-Hill Science/Engineering/Math [ISBN: 0072538627]**
- **Robert J. Silbey,Robert A. Alberty 2000, *Physical Chemistry*, 3 Ed., Wiley [ISBN: 9780471383116]**
- **Ralph H. Petrucci,F. Geoffrey Herring,Jeffry D. Madura,Carey Bissonnette 2010, *General Chemistry*, 10 Ed., Prentice Hall [ISBN: 0136121497]**
- **Raymond Chang,Kenneth Goldsby 2012, *Chemistry*, 11 Ed., McGraw-Hill Science/Engineering/Math [ISBN: 0073402680]**

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

Other References: This Course does not have any other resources