UNIVERSITI TEKNOLOGI MARA

CHM431: PHYSICAL CHEMISTRY

Course Name (English)	PHYSICAL CHEMISTRY APPROVED
Course Code	CHM431
MQF Credit	3
Course Description	The course is an introductory course to physical chemistry which covers the areas of thermochemistry, thermodynamic, electrochemistry, chemical kinetics, phase equilibrium, colloids and surface chemistry. The lecture session is used to discuss and relates the laws, principles and theories in physical chemistry. The outcomes will be assessed through paper examination, teats and quizzes, laboratory exercises and written laboratory reports.
Transferable Skills	Knowledge Critical Thinking Practical Written report
Teaching Methodologies	Lectures, Lab Work, Discussion
CLO	CLO1 Explain the concepts in Themochemistry, Thermodynamics, Electrochemistry, Chemical kinetics, Phase equilibrium and Colloids and surface chemistry CLO2 Apply the concepts, law and theories to solve the problem in Themochemistry, Thermodynamics, Electrochemistry, Chemical kinetics, Phase equilibrium and Colloids and surface chemistry CLO3 Conduct the scientific experiments in areas of thermochemistry, electrochemistry, chemical kinetic, phase equilibrium, colloid and surface chemistry CLO4 Report a written scientific experiment in thermochemistry, electrochemistry, chemical kinetic, phase equilibrium, colloid and surface chemistry areas.
Pre-Requisite Courses	No course recommendations

Topics
1. Thermochemistry 1.1) 1.1 Exothermic and endothermic reactions. Energy profile for the two types of reactions 1.2) 1.2 Explanation of activation energies for reversible and nonreversible reactions 1.3) 1.3 Enthalpy and enthalpy change 1.4) 1.4 Calorimetry, Heat capacity and spescific heat 1.5) 1.5 Defination of heat of reactions. Calculations of heat of reaction from standard heat of formation 1.6) 1.6 Hess's Law and Calculation
2. Thermodynamics 2.1) 2.1 relationship between temperature and equilibrium in reversible and non reversible processes 2.2) 2.2 explanation of 1st, 2nd and 3rd law of thermodynamics 2.3) 2.3 First law: work and heat, enthalpy (qp and qv) Cv and Cp, effect of temperature on enthalpy, ideal gas system, explanation of isothermal, adiabatic, reversible and irreversible processes 2.4) 2.4 Second law : Spontaneous reaction, entropy change (ideal gas, liquid, solid and changing phase), dependance of entropy on variables in a system (variables T and V, variables T and P) 2.5) 2.5 Third law : explanation of absolute entropy, spontaneity, basic equations for closed system, Gibbs absolute entropy on T and P

3. Electrochemistry
3.1) 3.1 Electrode potential and electrochemical cell
3.2) 3.1.1 Electrode potential and activity (Nerst equation)
3.3) 3.1.2 Electrochemical cell and cell reaction
3.4) 3.1.3 Standard hydrogen electrode
3.5) 3.1.4 Measurement of EMF and sign determination
3.6) 3.2 Uses of electrode potential and cell EMF; pH determination, selective ionic electrode, potentiometry an determination of equilibrium constant
3.7) 3.3 Electrode processes, electrolysis and corrosion
3.8) Lab 2 : Electrochemistry : Electrochemical cell

4. Chemical Kinetic
4.1) 4.1 Rates of reaction. Defination and units
4.2) 4.2 Factors affecting rates of reaction, reaction rate and stoichiometry
4.3) 4.3 Concentration and rate
4.4) 4.3.1 Rate law and overall reaction order
4.5) 4.3.2 Using initial rates to determine rate laws
4.6) 4.4 Change of concentration with time
4.7) 4.4.1 First Order and Second Order reactions
4.8) 4.4.2 Half-life
4.9) 4.5 Arrhenius equation
4.10) 4.6 Reaction mechanism
4.11) 4.6.1Elementary reactions and their Rate laws uni, bi and termolecular
4.12) 4.6.2 Rate-determining step for a multi-step mechanism
4.13) 4.7 Catalytic kinetics: homogeneous, enzyme and heterogeneous catalysis
4.14) Lab 3: Chemical kinetic : Factor affecting rates of reaction
4.15) Lab 4: Chemical kinetic : Order of reaction

5. Phase Equilibrium
5.1) 5.1 One component system: ice-water vapor system and CO2system
5.2) 5.2 Use of Roult's law in explaining the effect of nonvolatile solute on vapor pressure of solvent and its melting and boiling points
5.3) 5.3 Boiling point-composition phase diagram for two component system
5.4) 5.3.1 Two completely miscible solids - eutectic mixture
5.5) 5.3.2 Two completely miscible liquids - ideal,positive and negative deviations from Raoult's law
5.6) 5.3.3 Azeotropic system and fractional distillation
5.7) Lab 5: Phase equilibrium : Solid-liquid phase diagram-Eutectic system

6. Colloid and Surface Chemistry
6.1) 6.1 Colloid
6.2) 6.1.1 Definition. Differences between colloid, true solution and heterogeneous system. Characteristics of each system
6.3) 6.1.2 types of colloid based on the dispersion medium and dispersed phase and examples. Gel, paste and emulsion
6.4) 6.1.3 Methods and preparation
6.5) 6.1.4 Lyophilic and lyophobic colloid. Stability of lyophobic colloid
6.6) 6.2 Adsorption
6.7) 6.2.1 Adsorption phenomenon
6.8) 6.2.2 Single layer and multilayer adsorptions
6.9) Lab 6: Colloid : Property of colloidal dispersion
6.10) Lab 7: Surface chemistry : Adsorption at a solid surface

Assessment Breakdown	%
Continuous Assessment	60.00%
Final Assessment	40.00%

Details of Continuous Assessment

Assessment Type	Assessment Description	% of Total Mark	CLO
Practical	labs skill	5%	CLO3
Test	Test 1 covered chapter 1 (Thermochemistry) and chapter 2 (Thermodynamics)	20%	CLO1
Test	Test 2 covered chapter 3 (electrochemistry) and chapter 4 (chemical kinetics)	20%	CLO2
Written Report	laboratory reports	15%	CLO4

Reading List

Recommended Text	• **Keith James Laidler,John H. Meiser,Bryan C. Sanctuary 2003, *Physical Chemistry*, 4th Ed., 1,3,5,6, 9,18,, Brooks/Cole Publishing Company USA [ISBN: 0-618-12341-5]**
Reference Book Resources	• **Martin Stuart Silberberg 2009, *Chemistry*, 8th Ed., 1, McGraw Hill USA [ISBN: 9780071283540]**
Article/Paper List	This Course does not have any article/paper resources
Other References	This Course does not have any other resources