UNIVERSITI TEKNOLOGI MARA

CHM432: FUNDAMENTAL PHYSICAL CHEMISTRY

Course Name (English)	FUNDAMENTAL PHYSICAL CHEMISTRY APPROVED
Course Code	CHM432
MQF Credit	4
Course Description	This is a fundamental course in physical chemistry. The topics covered included thermochemistry, thermodynamics, electrochemistry, chemical kinetics, phase equilibrium and colloid & surface chemistry.
Transferable Skills	Knowledge Critical thinking Practical written report
Teaching Methodologies	Lectures, Lab Work, Discussion
CLO	CLO1 Explain the basic concepts and theories in thermochemistry, thermodynamic, electrochemistry, chemical kinetic, phase equilibrium, colloid and surface chemistry. CLO2 Apply the concepts, law and theories to solve the problems in thermochemistry, thermodynamic, electrochemistry, chemical kinetic, phase equilibrium, colloid and surface chemistry. CLO3 Perform scientific experiments related to thermochemistry, thermodynamic, electrochemistry, chemical kinetic, phase equilibrium, colloid and surface chemistry. CLO4 Written report the scientific experiments in scientific manner of experiment related to thermochemistry, thermodynamic, electrochemistry, chemical kinetic, phase equilibrium, colloid and surface chemistry.
Pre-Requisite Courses	No course recommendations

Topics
1. 1.0 Thermochemistry 1.1) 1.1 Exothermic and endothermic reactions. Energy profile for the two types of reactions. 1.2) 1.2 Activation energies for reversible and non-reversible reactions. 1.3) 1.3 Enthalpy change of reaction (combustion/formation/neutralization/solution) 1.4) 1.4 Calorimetry. Heat capacity and specific heat capacity. 1.5) 1.5 Calculations of heat of reaction from standard 1.6) heat of formation. 1.7) 1.6 Hess's law and calculation
2. 2.0 Thermodynamics 2.1) 2.1 Definition of system/surrounding/boundary. 2.2) 2.2 Types of system in themodynamic. 2.3) 2.3 First law of Thermodynamics: internal energy changes .Work and heat, enthalpy (qp and qv) Cv and Cp, effect of temperature on enthalpy, ideal gas system, explanation of isothermal, adiabatic, reversible and nonreversible processes. 2.4) 2.4 Second law of Thermodynamics: Spontaneous reaction, entropy change (ideal gas, liquid, solid and changing phase), dependence 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 systems, Gibbs absolute entropy on T and P 2.6) 2.6 Free Energy and Equilibrium

3. 3.0 Electrochemistry
3.1) 3.1 Redox reaction
3.2) 3.2 Electrode potential and electrochemical cell
3.3) 3.3 Standard hydrogen electrode (SHE)
3.4) 3.4 Electrode potential and sign determination.
3.5) 3.5 Application of Nernst equation (determine pH/concentration of ion/electrode potential)
3.6) 3.6 Concentration cell
3.7) 3.7 Corrosion Process
3.8) 3.8 Electrolysis (selection of ion discharge in molten salt and aqueous salt)
3.9) 3.9 Calculation in electrolysis (C = ampere x time(s))

4. 4.0 Chemical Kinetics
4.1) 4.1 Rates of reaction. Definition 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 Relationship between rate and temperature. Arrhenius equation.
4.10) 4.6 Reaction mechanism.
4.11) 4.6.1 Elementary 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.

5. 5.0 Phase Equilibrium
5.1) 5.2 One component system : ice-water-vapour system and CO2 system; phase diagram ; Degree of freedom (F)
5.2) 5.3 Two component system : Liquid- Liquid system & solid-liquid system; ideal & non ideal solution (positive & negative deviation) ; eutectic mixture (eutectic diagram)
5.3) 5.4 Roults Law and calculation.
5.4) 5.5 Phase Diagram :Boiling point-composition diagram & Vapor pressure-composition diagram
5.5) 5.5 Azeotropic system and fractional distillation (distillate and residue)
5.6) 5.6 Colligative Properties (vapor pressure lowering/ elevation of boiling point/ Depression of freezing point/Osmotic pressure)

6. 6.0 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 of preparation.
6.5) 6.1.4 Lyophilic and lyophobic colloid. Stability of lyophobic colloid.
6.6) 6.1.5 Coagulation and Application
6.7)
6.8) 6.2 Adsorption
6.9) 6.2.1 Adsorption phenomenon. Single layer and multi layer adsorptions; Porosity; Physisorption & Chemisorption
6.10) 6.2.2 Lagmuir Adsorption isotherm
6.11) 6.2.3 BET Adsorption isotherm
6.12) 6.2.4 Freundlich Adsorption isotherm
6.13) 6.2.5 Determination of surface area from Vm
6.14) 6.2.6 Calculation on area occupied by one molecule

Assessment Breakdown	%
Continuous Assessment	60.00%
Final Assessment	40.00%

Details of Continuous Assessment

Assessment Type	Assessment Description	% of Total Mark	CLO
Practical	Lab skill	5%	CLO3
Practical	Written lab report	15%	CLO4
Test	Test 1 covered chapter 1 (Thermochemistry) and chapter 2 (Thermodynamics)	20%	CLO1
Test	Test 2 covered chapter 3(elctrochemistry) and chapter 4 (chemical kinetics)	20%	CLO2

Reading List

Reference Book Resources

- **Martin Stuart Silberberg, *Chemistry*, 6 Ed. [ISBN: 9781259072833]**
- **Peter Atkins,Julio de Paula 2014, *Atkins' Physical Chemistry*, 10 Ed., Oxford University Press [ISBN: 9780199697403]**

Article/Paper List

This Course does not have any article/paper resources

Other References

- **Book Raymond Chang 2016, *Chemistry*, Mc Graw Hill, New York**
- **Book James Brady 2015, *Chemistry*, John Wiley, Singapore**
- **Book Laidler 2003, *Physical Chemistry*, Houghton Mifflin Company, U.S.A**
- **Book Adrew Burrows *Chemistry (introducing inorganic, organic and physical chemistry)* , Oxford University Press, United Kingdom**