UNIVERSITI TEKNOLOGI MARA

CHM476: PHYSICAL CHEMISTRY

Course Name (English)	PHYSICAL CHEMISTRY APPROVED
Course Code	CHM476
MQF Credit	3
Course Description	This course is an introductory course to physical chemistry. It will interactively engage students in areas of thermochemistry, chemical kinetics, phase equilibrium, colloid and surface chemistry. Lecture sessions employ a mixture of lectures and problem based learning. Students will define concepts and perform investigations via laboratory exercises. Results of laboratory investigations leading to its relation to existing laws, principles or theories will also be discussed in the lecture session.
Transferable Skills	Knowledge, critical thinking and practical skills.
Teaching Methodologies	Lectures, Lab Work, Discussion
CLO	CLO1 Explain the basic concepts and theories in thermochemistry, chemical kinetics, phase equilibrium, colloid and surface chemistry. (PLO1, C2) CLO2 Apply the concepts, law and theories to solve the problems in thermochemistry, chemical kinetics, phase equilibrium, colloid and surface chemistry. (PLO3, C3) CLO3 Conduct scientific experiments related to thermochemistry, chemical kinetics, phase equilibrium, colloid and surface chemistry. (PLO2, P3)
Pre-Requisite Courses	No course recommendations

Topics
1. 1.0 Thermochemistry 1.1) 1.1 Exothermic and endothermic reaction. 1.2) 1.1.1 Energy profile. 1.3) 1.1.2 Activation energy for reversible and non-reversible reactions. 1.4) 1.2 Enthalpy and enthalpy change. 1.5) 1.2.1 Definitions of heats of reaction, enthalpy of combustion and enthalpy of 1.6) formation. 1.7) 1.2.2 Calculation of heats of reaction using standard enthalpy of formation. 1.8) 1.3 Calorimetry. 1.9) 1.3.1 Heat capacity and specific heat. 1.10) 1.3.2 Simple calorimeter and bomb calorimeter. 1.11) 1.3.3 Calculation of enthalpy of combustion. 1.12) 1.4 Hess's law. 1.13) 1.4.1 Definition and calculation.
2. 2.0 Chemical Kinetics 2.1) 2.1 Rates of reaction. 2.2) 2.1.1 Definition and units. 2.3) 2.1.2 Determination of rates of reaction. 2.4) 2.2 Factors affecting rate of reaction. 2.5) 2.2.1 Collision Theory. 2.6) 2.2.2 Transition state. 2.7) 2.3 Rate law and order of reaction. 2.8) 2.3.1 Rate law for zero, first, second order. 2.9) 2.3.2 Rate law for reactions higher than second order. 2.10) 2.3.3 Rate law for fractional order. 2.11) 2.4 Methods to determine order of reactions. 2.12) 2.4.1 Initial rate. 2.13) 2.4.2 Integration. 2.14) 2.4.3 Half-life.

2.15) 2.5 Relation between rate and temperature.
2.16) 2.5.1 Arrhenius equation.
2.17) 2.5.2 Determination of activation energy by graphical method or calculation using Arrhenius equation.
2.18) 2.6 Reaction mechanism.
2.19) 2.6.1 Basic processes – molecularity.
2.20) 2.6.2 Reversible, series and parallel reactions.
2.21) 2.6.3 Relationship between rate law and reaction mechanism.
2.22) 2.7 Catalytic kinetics.
2.23) 2.7.1 Homogeneous and heterogeneous catalysis.
2.24) 2.7.2 Acid-base catalysis.
2.25) 2.7.3 Enzyme catalysis.

3. 3.0 Phase Equilibrium
3.1) 3.1 Definition.
3.2) 3.1.1 Phases.
3.3) 3.1.2 Components.
3.4) 3.1.3 Phase rule: Degree of Freedom.
3.5) 3.2 One component system.
3.6) 3.2.1 Phase diagram of ice-water-vapour system.
3.7) 3.2.2 Phase diagram of CO2 system.
3.8) 3.3 Two components system.
3.9) 3.3.1 Raoult's law – effect of volatile and non-volatile solute on vapour
3.10) pressure (colligative properties).
3.11) 3.3.2 Two completely miscible liquids – ideal, positive and negative deviation from Raoult's law.
3.12) 3.3.3 Vapour-pressure composition diagram vs boiling point-composition diagram.
3.13) 3.3.4 Fractional distillation and azeotropic system.
3.14) 3.3.5 Two completely miscible solids – eutectic system and cooling curves.

4. 4.0 Colloid and Surface Chemistry
4.1) 4.1 Colloids.
4.2) 4.1.1 Definition: Colloid, true solution and heterogeneous systems.
4.3) 4.1.2 Classification of colloids: Based on physical state of dispersed phase and dispersion medium; nature of interaction between dispersed phase and dispersion medium (Lyophilic and Lyophobic); and type of particle of dispersed phase (Multimolecular, macromolecular and associated (micelles) colloids).
4.4) 4.1.3 Lyophilic and lyophobic colloids.
4.5) 4.1.4 Stability of lyophobic colloid.
4.6) 4.1.5 Preparation of lyophilic and lyophobic colloid (dispersion and condensation methods).
4.7) 4.1.6 Property of lyophobic colloid – Brownian, dialysis, Tyndal effect, electric double layer and coagulation.
4.8)
4.9) 4.2 Adsorption
4.10) 4.2.1 Definition.
4.11) 4.2.2 Types of adsorption: Single and multilayers.
4.12) 4.2.3 Chemical and physical adsorptions.
4.13) 4.2.4 Gibbs equation.
4.14) 4.2.5 Isotherms: Freundlich, Langmuir and BET adsorption isotherms.

Assessment Breakdown	%
Continuous Assessment	60.00%
Final Assessment	40.00%

Details of Continuous Assessment

Assessment Type	Assessment Description	% of Total Mark	CLO
Practical	Written lab report and lab skills	20%	CLO3
Test	Test 1	20%	CLO1
Test	Test 2	20%	CLO2

Reading List

Recommended Text

- **Peter Atkins,Julio de Paula 2014, *Atkins' Physical Chemistry*, 10 Ed., Oxford University Press Oxford, United Kingdom [ISBN: 9780199697403]**
- **James E. Brady,Neil D. Jespersen,Alison Hyslop 2015, *Chemistry*, 7 Ed., John Wiley & Sons Singapore [ISBN: 9781118717271]**

Reference Book Resources

- **Keith James Laidler,John H. Meiser,Bryan C. Sanctuary 2003, *Physical Chemistry*, 4 Ed., Brooks/Cole Publishing Company United States of America [ISBN: 9780618123414]**
- **Kenneth Goldsby,Raymond Chang 2012, *Chemistry*, 11 Ed., McGraw-Hill Education United States of America [ISBN: 0073402680]**

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

Other References: This Course does not have any other resources