Physical Chemistry 2

Course Outcome for Physical Chemistry 2 with focus on Chemical Thermodynamics II, Quantum Mechanics II, and Electrochemistry I:

Knowledge:
1. Define the Second Law of Thermodynamics and explain the concept of reversibility and spontaneity in chemical processes.
2. Explain Caratheodory's principle and the Principle of increase in entropy of the universe in natural processes.
3. Discuss the Carnot cycle, efficiency, and the Kelvin-Plank and Clausius Statements of the second law.
4. Understand the principles of Quantum Mechanics, including operators, Hermitian operators, and the Schrödinger equation.
5. Explain the flow of charge through conductors, the classification of electrolytes, and the dynamics of ions in an ideal solution.

Comprehension:
1. Differentiate between reversible and irreversible processes in terms of entropy change and work done.
2. Interpret the Clausius inequality and its implications for heat engines and refrigerators.
3. Analyze the efficiency of Carnot cycles and the impossibility of attaining absolute zero temperature.
4. Evaluate the solutions of the Schrödinger equation for various systems and understand energy quantization.
5. Compare the forces on ions in electrolytic solutions and the validity of Ohm's Law in such systems.

Application:
1. Apply the Carnot theorem to determine the maximum efficiency of a heat engine.
2. Calculate the change in entropy and Gibbs free energy for different types of processes using thermodynamic equations of states.
3. Solve problems related to quantum systems, including 1-D, 2-D, and 3-D boxes and the Simple Harmonic Oscillator.
4. Predict the behavior of ions in electrolytic solutions under applied potential differences.

Analysis:
1. Analyze the implications of commutators in quantum mechanics with respect to position and momentum operators.
2. Evaluate the temperature dependence of Gibbs free energy and its relation to the Gibbs-Helmholtz equations.
3. Compare the behavior of real gases with ideal gases in terms of Gibbs free energy and fugacity.
4. Analyze the forces acting on ions in electrolytic solutions and their impact on conductivity.

Evaluation:
1. Compare and contrast the efficiency of different types of heat engines based on the Carnot cycle.
2. Evaluate the validity of predictions made by the Schrödinger equation for simple quantum systems.
3. Assess the behavior of ions in electrolytic solutions under different conditions and potential differences.

Synthesis:
1. Design experiments to measure the change in entropy and Gibbs free energy in various chemical processes.
2. Develop mathematical models to predict the behavior of quantum systems based on the Schrödinger equation.
3. Create strategies to improve the conductivity of electrolytic solutions based on the forces acting on ions.

Overall, upon completion of this course, students will be able to analyze and apply the principles of Chemical

Thermodynamics II, Quantum Mechanics II, and Electrochemistry I to understand and predict the behavior of chemical systems at a molecular level.