

Syllabus for  
**CHE 303--Physical Chemistry Lecture I**  
3.0 Credit Hours  
Fall 2017

I. COURSE DESCRIPTION

The mathematical modeling of chemical systems, including derivations and limitations of equations. Systems studied include gases, kinetics, and thermodynamics of chemical reactions and equilibrium.

Prerequisites: CHE 212 Lecture and Lab and MAT 201

II. COURSE GOALS

The purpose of this course is to enable the student to derive the fundamental physical property equations, determine various important parameters used in chemistry, appreciate the order, symmetry and logic that God has incorporated into the basic makeup of physical processes.

This course is a calculus based Physical Chemistry I type course arranged to cover ideal gases, first law, second law, free energy and equilibria, thermodynamics of phases and solutions, non-ideality, and kinetics of simple and complex systems. The material is arranged so that a student may take this class prior to or after taking Physical Chemistry Quantum Mechanics (Physical Chemistry II type class) if necessary for scheduling or other requirements. Select Calculus of Multivariable topics are introduced so that a student with two semesters of Calculus can readily work with the material at its full rigor.

Only in rare circumstances should a student take Physical Chemistry I while simultaneously taking Calculus II, it is best to have Calculus II before, though it is not required. MAT 321 – Calculus of Functions of Several Variables – would be the most helpful additional math class to take, though the student is not expected to have taken it and select topics from this course are covered in class.

III. STUDENT LEARNING OUTCOMES FOR THIS COURSE

As a result of successfully completing this course, the student will be able to do the following:

- A. Define, understand, and solve problems relating to the ideal gas laws, critical phenomena, and the law of corresponding states.
- B. Discuss and use the concepts of exactness, work, heat, the first law, enthalpy, heat capacity, and adiabatic processes.
- C. Solve problems in thermochemistry.
- D. Define and use the second and third laws of thermodynamics, and the concept of entropy.
- E. Define, use, and explain the types of free energies, how to use them, and their various differentials.
- G. Explain liquid and solid phase equilibrium.

- H. Use the Clausius-Clapyron equation and its applications.
- I. Work problems involving ideal solutions.
- J. Describe and use Raoult's law, work solubility problems, and understand Henry's law and its relationship to Raoult's law.
- K. Explain and use the colligative properties of solutions.
- L. Use the concept of activity to work with non-ideal solutions.
- M. Use the fundamental postulates of chemical kinetics, to evaluate various simple order reaction types.
- N. Use the integrated rate laws, determine reaction orders, and apply these equations to complex chemical systems.

#### IV. TEXTBOOKS AND OTHER LEARNING RESOURCES

##### Required Textbooks

Silbey, R. J., and Alberty, R. A., Physical Chemistry. 3rd ed. New Jersey: Prentice-Hall, Inc., 2001.

#### V. POLICIES AND PROCEDURES

- A. University Policies and Procedures
  - 1. Attendance at each class or laboratory is mandatory at Oral Roberts University. Excessive absences can reduce a student's grade or deny credit for the course.
  - 2. Students taking a late exam because of an unauthorized absence are charged a late exam fee.
  - 3. Students and faculty at Oral Roberts University must adhere to all laws addressing the ethical use of others' materials, whether it is in the form of print, video, multimedia, or computer software. By submitting an assignment in any form, the student gives permission for the assignment to be checked for plagiarism, either by submitting the work for electronic verification or by other means.
  - 4. Final exams cannot be given before their scheduled times. Students need to check the final exam schedule before planning return flights or other events at the end of the semester.
  - 5. Students are to be in compliance with University, school, and departmental policies regarding ePortfolio requirements. Students should consult the ePortfolio handbooks for requirements regarding general education and the students' majors.
    - a. The penalty for not submitting electronically or for incorrectly submitting an ePortfolio artifact is a zero for that assignment.
    - b. By submitting an assignment, the student gives permission for the assignment to be assessed electronically.

- B. School and/or Department Policies and Procedures
1. The Department of Chemistry adheres to the Assessment policy concerning plagiarism as described in the University Catalog, "Written assignments using sources must demonstrate ethical and accurate use of source material. Plagiarism and any unethical or inappropriate use of sources will not be tolerated."
  2. The following assessment actions will be taken in the event of documented instances of plagiarism on written assignments, copying of homework assignments, or cheating during examinations:
    - a. An automatic zero will be given for the assignment or exam.
    - b. The original assignment or exam will be kept in the student file and a copy will be given to the student. This could have a negative impact on letters of reference and admission to graduate schools and other postgraduate programs.
    - c. The Department will take repeated offences as grounds for further action.
  3. Any ePortfolio activity required in this course must be completed and assessed prior to the end of the semester to receive course credit, otherwise a grade of incomplete will be assigned.
- C. Course Policies and Procedures
1. Evaluation Procedures
 

Grading

A = 85% or higher; B = 70%-84%; C = 60%-69%; D = 50%-59%
  2. It may be necessary to curve the scores or change the scale due to extreme circumstances to protect academic standards. But the above scale represents typical student performance in previous classes.
  3. Three one-hour examinations, one final, and approximately four problem sets will be given to evaluate student performance. The grade is determined as follows:
 

|                         |                   |
|-------------------------|-------------------|
| a. Three hourly exams   | 300 points        |
| b. Four problem quizzes | 100 points        |
| c. Final exam           | <u>130</u> points |
| TOTAL                   | 530 points        |
  4. Letter grades are assigned on percentage of points earned.
  5. Eportfolio Requirements
    - a. Department of Chemistry ePortfolio [CHE, BMC majors only].  
The Analytical Problem Solving Assignment is the ePortfolio assignment for this course.
    - b. Depending on student enrollment in ePortfolio, the assignment should be submitted directly to ePortfolio or given directly to the instructor for assessment. Students failing to submit the assignment correctly will receive a grade of zero for the assignment.

VI. COURSE CALENDAR

|    |  |                    |
|----|--|--------------------|
| A. | Gas Laws   |                    |
| B. | The First Law of Thermodynamics                    |                    |
| C. | Thermochemistry                                    | <b>First Exam</b>  |
| D. | The Second and Third Laws of Thermodynamics        |                    |
| E. | Free Energy and Equilibria                         | <b>Second Exam</b> |
| F. | Thermodynamics of Solutions                        |                    |
| G. | Thermodynamics of Non-Ideal Solutions              | <b>Third Exam</b>  |
| H. | Crystallography and Solid State Physical Chemistry | <b>Final Exam</b>  |

## Course Inventory for ORU's Student Learning Outcomes

### Physical Chemistry I Lecture – CHE 303 Fall 2017

This course contributes to the ORU student learning outcomes as indicated below:

**Significant Contribution** – Addresses the outcome directly and includes targeted assessment.

**Moderate Contribution** – Addresses the outcome directly or indirectly and includes some assessment.

**Minimal Contribution** – Addresses the outcome indirectly and includes little or no assessment.

**No Contribution** – Does not address the outcome.

The Student Learning Glossary at <http://ir.oru.edu/doc/glossary.pdf> defines each outcome and each of the proficiencies/capacities.

| OUTCOMES & Proficiencies/Capacities |  | Significant Contribution | Moderate Contribution | Minimal Contribution | No Contribution |
|-------------------------------------|--|--------------------------|-----------------------|----------------------|-----------------|
| <b>1</b>                            | <b>Outcome #1 – Spiritually Alive</b><br>Proficiencies/Capacities      |                          |                       |                      |                 |
| 1A                                  | Biblical knowledge   |                          |                       |                      | X               |
| 1B                                  | Sensitivity to the Holy Spirit   |                          |                       | X                    |                 |
| 1C                                  | Evangelistic capability  |                          |                       | X                    |                 |
| 1D                                  | Ethical behavior   |                          |                       | X                    |                 |
| <b>2</b>                            | <b>Outcome #2 – Intellectually Alert</b><br>Proficiencies/Capacities   |                          |                       |                      |                 |
| 2A                                  | Critical thinking  | X                        |                       |                      |                 |
| 2B                                  | Information literacy   | X                        |                       |                      |                 |
| 2C                                  | Global & historical perspectives                                       |                          |                       |                      | X               |
| 2D                                  | Aesthetic appreciation   |                          |                       | X                    |                 |
| 2E                                  | Intellectual creativity  |                          | X                     |                      |                 |
| <b>3</b>                            | <b>Outcome #3 – Physically Disciplined</b><br>Proficiencies/Capacities |                          |                       |                      |                 |
| 3A                                  | Healthy lifestyle  |                          |                       |                      | X               |
| 3B                                  | Physically disciplined lifestyle                                       |                          |                       |                      | X               |
| <b>4</b>                            | <b>Outcome #4 – Socially Adept</b><br>Proficiencies/Capacities         |                          |                       |                      |                 |
| 4A                                  | Communication skills   |                          |                       | X                    |                 |
| 4B                                  | Interpersonal skills   |                          |                       | X                    |                 |
| 4C                                  | Appreciation of cultural & linguistic differences                      |                          |                       |                      | X               |
| 4D                                  | Responsible citizenship  |                          |                       | X                    |                 |
| 4E                                  | Leadership capacity  |                          |                       | X                    |                 |