

**DEPARTMENT OF
SCIENCE & TECHNOLOGY****CHEMISTRY 1030 (Fall 1996)**

- INSTRUCTOR:** Dr. Som K. Pillay
(Office: E 309; Tel: 539-2985)
- PREREQUISITE:** CHEM 30 or equivalent and
MATH 30 & 31 or equivalent
(ENGINEERING STUDENTS ONLY)
- COREQUISITE:** MATH 1000 or equivalent
- TRANSFER CREDITS:** U. of Alberta: CHEM 103, 4.3 Credits
U. of Calgary: ENGG 201, 3 Credits
- LECTURES:** MONDAYS, WEDNESDAYS & FRIDAYS
10:00 - 10:50 A.M. (J 201)
- SEMINARS:** TUESDAYS
1:30 - 2:50 A.M. (J 201)
- LABORATORY:** TUESDAYS
3:00 - 5:50 P.M. (J 119)
- TEXT BOOKS AND LABORATORY ITEMS:**
- Chemical Principles, Second Edition, Steven S. Zumdahl, D. C. Heath and Company, 1995.*
- How to Solve General Chemistry Problems, 7th Ed., R. S. Boikess and C. H. Sorum, Prentice-Hall Inc., 1987 (Optional).*
- Chemistry 103, Laboratory Experiments, University of Alberta, 1996.*
- A Hard-Covered Laboratory Notebook, Lab Coats and Safety Glasses.

COURSE EVALUATION

| | |
|-----------------------|--------|
| Assignments/Quizzes | 12.5% |
| Lab Work/Quizzes | 12.5% |
| Mid-Term Examinations | 30.0% |
| Final Examination | 45.0% |
| | <hr/> |
| | 100.0% |

| <u>Grade</u> | <u>Marks(%)</u> | <u>Grade</u> | <u>Marks(%)</u> |
|--------------|-----------------|--------------|-----------------|
| 9 | 90-100 | 5 | 56-65 |
| 8 | 80-89 | 4 | 50-55 (Pass) |
| 7 | 74-79 | 3 | 45-49 |
| 6 | 66-73 | 2 | 36-44 |

Note: A pass Grade is essential for the Laboratory Component.

COURSE OUTLINE

EMPHASIS IS PLACED ON UNDERSTANDING OF PRINCIPLES AND THE ABILITY TO USE PRINCIPLES TO SOLVE PROBLEMS.

1. REVIEW

Approximately two weeks of lectures and two weeks of seminars. The following chapters are relevant, and the material should be known from Chem 30.

| | |
|-----------|---|
| Chapters: | 2. Atoms, Molecules, and Ions |
| | 3. Stoichiometry |
| | 4. Types of Chemical Reactions and Solution Stoichiometry |
| Appendix | 1. Mathematical Procedures |
| | 2. Units of Measurement |

Problem Sets: 1 & 2

2. PROPERTIES OF GASES

Equation of State for Ideal Gases, Dalton's Law of Partial Pressures, Kinetic Theory of Gases, Effusion and Diffusion, Molecular Speeds, Van der Waals Equation of State, Critical Phenomena

Chapter: 5; Problem Sets: 3 & 4

3. APPLICATIONS OF EQUILIBRIUM:

A. **General:** Gas Phase Equilibria, Heterogeneous Equilibria, Le Chatelier's Principle

Chapter: 6; Problem Set: 5

B. **ACID-BASE EQUILIBRIA:** Review of Fundamentals, Bronsted-Lowry Acid-Base Theory, The Lewis Theory, Dissociation Constant, Levelling Effect, pH of Simple and Complex Acids and Bases in Water, Indicators, Titration Curves, Buffer Solutions, Hydrolysis, Polyprotic Acids

Chapters: 7 & 8; Problem Sets: 6 & 7

- C. **IONIC EQUILIBRIA:** Solubility of Ionic Compounds, K_{sp} , Common-Ion Effect, The Effect of Complexing Ligands, The Effect of pH on Solubility Equilibria, Selective Precipitation of Ions, Extraction and Separation

Chapter: 8; Problem Set: 8

6. **THERMODYNAMIC PROCESSES AND THERMOCHEMISTRY:**

Reversible and Irreversible Processes, Internal Energy, PV Work, The First Law of Thermodynamics, Heat Capacity, Enthalpy, Processes Involving Ideal Gases, Thermochemistry, The Carnot Cycle, Heat Engines & Refrigerators.

Chapter: 9; Problem Sets: 9 & 10

LECTURE SESSION

Regular attendance of lectures/seminars is essential to achieve a good understanding of the course material. You are encouraged to ask questions and to participate in class discussions. Help is also available outside the class room. **NO APPOINTMENTS ARE NEEDED.**

TENTATIVE LECTURE SCHEDULE

FALL SEMESTER

| WEEK OF | MONDAY | WEDNESDAY | FRIDAY | TUESDAY (Tutorial) |
|---------|-------------------|---------------------------|------------------|-----------------------|
| Sept. 2 | - | - | Introduction | - |
| 9 | Stoichiometry | Stoichiometry | Stoichiometry | Stoichiometry |
| 16 | .. | .. | .. | .. |
| 23 | Gases | Gases | Gases | Gases |
| 30 | .. | .. | .. | .. |
| Oct. 7 | Equilibria | Equilibria | Equilibria | EXAM I |
| 14 | NO LECTURE | Equilibria | Acids & Bases | Equilibria |
| 21 | Acids & Bases | Acids & Bases | .. | Acids & Bases |
| 28 | .. | .. | .. | .. |
| Nov. 4 | .. | Ionic Equilibria | Ionic Equilibria | Ionic Equilibria |
| 11 | NO LECTURE | .. | Thermodynamics | EXAM II |
| 18 | Thermodynamics | Thermodynamics | .. | Thermodynamics |
| 25 | .. | .. | .. | .. |
| Dec. 2 | .. | END OF CLASSES | - | REVIEW |
| Dec. 9 | • | FINAL | EXAM | • |

READING AND PROBLEM ASSIGNMENTS

Problem solving is an essential part of this course. It will guide your study in the right direction and also will help you to monitor your performance in the course.

Approximately ten questions will be assigned as homework every week. However, you are encouraged to solve as many additional problems as you can. It is important that you work out these problems independently. Seek help with the ones you cannot solve yourself. Unless instructed otherwise, assignments are due on Fridays at 10:00 A.M. **NO LATE ASSIGNMENTS ARE ACCEPTED. DON'T ASK!**

FALL SEMESTER

| PROBLEM SET # | CHAPTER* | PROBLEMS |
|---------------|----------|--|
| 1 | 3 | 24 & Questions 1-13, Pages 8-9 |
| 2 | 3 | 76, 77, 79 & Questions 14-25, Pages 9-10 |
| 3 | 5 | 3, 24, 37, 63, 109 & Questions 1-8, Pages 11-12 |
| 4 | 5 | 74, 88, 91, 96, 106, 107 & Questions 9-17, Pages 12-13 |
| 5 | 6 | 21a, 26, 28, 33, 35, 39, 45, 47, 49, 55 & Questions 1-3, Page 14 |
| 6 | 7 | 30, 62, 66, 67, 80, 84 & Questions 1-12, Page 15 |
| 7 | 8 | 60, 80, 86 & Questions 13-26, Pages 15-16 |
| 8 | 8 | 45, 65, 67, 68, 94, 95, 96, 102 & Questions 1-5, Page 17 |
| 9 | 9 | Questions 1-10, Pages 18-19 |
| 10 | 9 | 19, 23, 48, 68 & Questions 11-21, Pages 19-21 |

*TEXT: *Chemical Principles, Second Edition, Steven S. Zumdahl, D. C. Heath and Company, 1995.*

LABORATORY SESSION

Laboratory sessions start at 3:00 P.M. sharp. All students are expected to come to the laboratory well prepared for the experiment that is to be performed and on time. At the start of each lab period you will be given a 15 minute quiz.

Students are expected to attend all laboratory periods. Absences due to illness must be substantiated by presenting suitable evidence to the Instructor/Lab Technician. An opportunity to make up a lab will be given only for excused absences.

The laboratory experiments are designed to allow a well-prepared student to finish all the work within the allotted time. **IT IS YOUR RESPONSIBILITY TO COMPLETE THE LAB ON TIME.**

LABORATORY REPORT:

You must record everything you do and observe as you carry out your experiment. Use a hard-cover laboratory notebook for this purpose. Do not copy the procedure from the laboratory manual. Keep your notebook neat. Your notebook will be checked periodically.

Formal lab reports should be written using the format given in your laboratory manual. The lab reports are due on Fridays at 4:30 P.M. **NO LATE LAB REPORTS ARE ACCEPTED.**

TENTATIVE LABORATORY SCHEDULE

| WEEK OF | EXPERIMENT* |
|----------|---------------------------|
| Sept. 9 | * Check-In * |
| Sept. 23 | A. Hydrates |
| Oct. 7 | D. Ideal Gas Constant |
| Oct. 21 | G. Interactive equilibria |
| Nov. 4 | I. Titration Curves |
| Nov. 18 | E. Enthalpy of a Reaction |

*TEXT: *Chemistry 103, Laboratory Experiments, University of Alberta, 1996.*