UC 12298 135

CBM003 ADD/CHANGE FORM

☒ Undergraduate Council	or	☐ Graduate/Professional Studies Council
☐ New Course ☒ Course Change		☐ New Course ☐ Course Change
Core Category: Life/Phys Sci Effective Fall ~~2013~~ 2014		Effective Fall 2013

APPROVED SEP - 4 2013

RECEIVED APR - 4 2013

1. Department: CHEM College: NSM
2. Faculty Contact Person: Bott Telephone: 3-2771 Email: sbott@uh.edu
3. Course Information on New/Revised course:
   - Instructional Area / Course Number / Long Course Title: CHEM / 1332 / Fundamentals of Chemistry 2
   - Instructional Area / Course Number / Short Course Title (30 characters max.) CHEM / 1332 / FUNDAMENTALS OF CHEMISTRY
   - SCH: 3 Level: FR CIP Code: ~~1~~ → 40.0501.0002 Lect Hrs: 3 Lab Hrs: 0
4. Justification for adding/changing course: **To meet core curriculum requirements**
5. Was the proposed/revised course previously offered as a special topics course? ☐ Yes ☐ No
   If Yes, please complete:
   - Instructional Area / Course Number / Long Course Title: ____ / ____ / ____
   - Course ID: _____ Effective Date (currently active row): _____
6. Authorized Degree Program(s): _____
   - Does this course affect major/minor requirements in the College/Department? ☒ Yes ☐ No
   - Does this course affect major/minor requirements in other Colleges/Departments? ☒ Yes ☐ No
   - Can the course be repeated for credit? ☐ Yes ☒ No (if yes, include in course description)
7. Grade Option: Letter Instruction Type: Lect. (Note: Lect/Lab info. must match item 3, above.)
8. If this form involves a change to an existing course, please obtain the following information from the course inventory: Instructional Area / Course Number / Long Course Title
   ____ / ____ / ____
   - Course ID: _____ Effective Date (currently active row): _____
9. Proposed Catalog Description: (If there are no prerequisites, type in "none".)
10. Cr. 3. (3-0). Prerequisites: MATH 1330 or equivalent and CHEM 1331. For science and engineering majors. May not be applied toward a degree until CHEM 1112 is successfully completed. Credit may not be applied to a degree for both CHEM 1332 and CHEM 1301. General principles, fundamental laws, equilibrium, kinetics, electrochemistry, and elementary inorganic, nuclear, and organic chemistry.
    Print/Type Name: Ian Evans

REQUEST FOR COURSES IN THE CORE CURRICULUM

Originating Department or College: Chemistry
Person Making Request: Simon Bott Telephone: x3-2771
Email: sbott@uh.edu
Dean's Signature: _____ Date: 11/12/12

Course Number and Title: CHEM 1332, Fundamentals of Chemistry 2
Please attach in separate documents:

X Completed CBM003 Add/Change Form with Catalog Description

X Syllabus

List the student learning outcomes for the course (Statements of what students will know and be able to do as a result of taking this course. See appended hints for constructing these statements):
1. Relate the properties of solids, liquids and gases to the principles of intermolecular forces: 2. Characterization of the properties of various solutions. 3. Explain concepts of chemical kinetics and interpret chemical reactions from kinetic data. 4. Explain the concept of chemical equilibrium and the effect of Le Chatelier's Principle on equilibrium. 5. Apply chemical equilibrium concepts to acid-base equilibria. 6. Apply equilibrium concepts to solubility. 7. Apply the principles of chemical thermodynamics to processes of chemical or physical change. 8. Apply oxidation-reduction reactions in relation to electrochemistry. 9. Apply the general principles of coordination complexes to Transition Metals. 10. Describe processes of nuclear reactions and their applications. 11. Apply critical thinking skills to solve problems in chemistry.

Component Area for which the course is being proposed (check one):
***Note:** If you check the Component Area Option, you would need to also check a Foundational Component Area.

☐ Communication
☐ Mathematics
☐ Language, Philosophy, & Culture
☐ Creative Arts
X Life & Physical Sciences
☐ American History
☐ Government/Political Science
☐ Social & Behavioral Science
☐ Component Area Option

Competency areas addressed by the course (refer to appended chart for competencies that are required and optional in each component area):

X Critical Thinking	X Teamwork
X Communication Skills	☐ Social Responsibility
X Empirical & Quantitative Skills	☐ Personal Responsibility

Because we will be assessing student learning outcomes across multiple core courses, assessments assigned in your course must include assessments of the core competencies. For each competency checked above, indicated the specific course assignment(s) which, when completed by students, will provide evidence of the competency. Provide detailed information, such as copies of the paper or project assignment, copies of individual test items, etc. A single assignment may be used to provide data for multiple competencies.

Critical Thinking:
Questions on midterm exams will assess critical thinking. Particular non-quantitative examples will include questions from (see attached syllabus for detailed learning outcomes) 1A, 1B, 2H, 3H, 3I, 3K, 4I, 5J, 6D, 7C, 7G, 8G, 8I, 9E.

Communication Skills:
While there are many short-answer questions associated with Blackboard homeworks in this specific course that can be used to assess communication skills, a better range of assessments can be found in the associated (and required) lab class, CHEM 1112. In particular, post-lab assessments can be used for this assessment.

Empirical & Quantitative Skills:
There are obviously numerous opportunities to assess these in a chemistry class. Again, we will use questions on midterm exams that are associated with Learning Outcomes 2 through 8 and 10.

Teamwork:
The entire lab class (CHEM 1112) is one in which students work in pairs or groups. Ideally, a university-developed instrument will be used to assess this competency,

Social Responsibility:
n/a

Personal Responsibility:
n/a

Will the syllabus vary across multiple section of the course? ☐ Yes X No

If yes, list the assignments that will be constant across sections:

Click here to enter text.

Inclusion in the core is contingent upon the course being offered and taught at least once every other academic year. Courses will be reviewed for renewal every 5 years.

The department understands that instructors will be expected to provide student work and to participate in university-wide assessments of student work. This could include, but may not be limited to, designing instruments such as rubrics, and scoring work by students in this or other courses. In addition, instructors of core courses may be asked to include brief assessment activities in their course.

Dept. Signature: _____

The following courses have been reviewed and approved by the NSM Curriculum Committee to meet the new core requirements. Given the length of the individual submissions I have elected to submit these requests by electronic means only.

Natural Sciences: Core Courses

BIOL 1309 – Human Genetics and Society

BIOL 1310 – General Biology

BIOL 1320 – General Biology

BIOL 1361 - Introduction to Biological Science I

BIOL 1362 - Introduction to Biological Science II

CHEM 1301 – Foundations of Chemistry

CHEM 1331 – Fundamentals of Chemistry I

CHEM 1332 – Fundamentals of Chemistry II

GEOL 1302 - Introduction to Global Climate Change

GEOL 1330 - Physical Geology

GEOL 1340 - Introduction to Earth Systems

GEOL 1350 - Introduction to Meteorology

GEOL 1360 - Introduction to Oceanography

GEOL 1376 - Historical Geology

PHYS 1301 - Introductory General Physics I

PHYS 1302 - Introductory General Physics II

PHYS 1321 - University Physics I

PHYS 1322 - University Physics II

Mathematics: Core Courses

MATH 1310 – College Algebra

MATH 1311 – Elementary Mathematical Modeling

Math/Reasoning: Core Courses

COSC 1306 – Computer Science and Programming

MATH 1330 - Precalculus

MATH 1431 - Calculus I

MATH 1432 – Calculus II

MATH 2311 – Introduction to Probability and Statistics

Writing in the Disciplines: Core Courses

BCHS Biochemistry Lab II

BIOL 3311 – Genetics Lab

PHYS 3313 – Advanced Lab I

Ian Evans

Associate Dean

4/4/13

CHEM 1332
Summer 4 2012

INSTRUCTOR: Simon Bott, Room 138-A, Fleming Building (713-743-2771), sbott@uh.edu
Office Hours: By appointment.

TEXT: Silberberg, "Chemistry: The Molecular Nature of Matter and Change." 6th or 7th Edition. Study Guide and Solutions Manual for this text are optional.

REQUIREMENTS: You must have passed CHEM 1331 or an equivalent before taking this class.

GRADING: There will be 3 exams of 20 questions each given during the semester and a final exam of 40 questions. Every chapter has at least one Blackboard homework associated with it. There will also be a number of "pop" quizzes given in class, which will combine with the Blackboard to account for 20 points. Your final letter grade will be calculated out of 100 points; the sum of the final exam, the Blackboard/quizzes and your best TWO exam scores.

CALCULATORS: Much of this class involves calculations. We will do these both with and without calculators. When we need to use them, you MUST have a NON-PROGRAMMABLE scientific (with scientific notation and logs) calculator that you can use.

ATTENDANCE: You are encouraged to attend class as an aid to understanding the material as well as to take the quizzes (which are an important part of your final grade!). In addition, I am not prepared to help a student who has multiple unexcused absences from class. ALL EXAMS are compulsory. **Absolutely no make up exams or quizzes will be given.**

NOTES:

1. All drops are the responsibility of the student.
2. ALL GRADED WORK SHOULD BE DONE INDIVIDUALLY. The UH Academic Honesty Policy is in effect.
3. Any students who need special accommodations are responsible for communicating these to me.
4. In exams, only non-programmable calculators without alphanumeric capability are allowed. CASA also has rules about bags, etc.
5. This is a TOUGH class to be taking during the summer. You will need to devote at least 4 efficient hours of study a day OUTSIDE class in order to achieve the best grade of which you are capable. I strongly discourage you from taking other classes or trying to maintain a time-demanding job during the summer while you are taking this class.

PROVISIONAL SYLLABUS (You are responsible for ALL material in chapters 1 to 21 and 24, regardless of class coverage. I also expect you to know the names that correspond to the symbols for the first 36 elements):

Mon 9th July	Introduction, Chapter 12, *Intermolecular Forces*
Tues. 10th July	Chapters 12 and 13, *Intermolecular Forces and Properties of Solutions*
Weds. 11th July	Chapter 13, *Properties of Solutions*
Thurs 12th July	Chapter 13, *Properties of Solutions*
Fri. 13th July	Chapter 16, *Kinetics*
Mon. 16th July	Chapter 16, *Kinetics*
Tues. 17th July	Chapter 16, *Kinetics*
Weds. 18th July	Chapter 17, *Equilibrium*
Thurs. 19th July	Chapter 17, *Equilibrium*
Fri. 20th July	Chapter 18, *Acid-base*
Mon. 23rd July	Chapter 18, *Acid-base*
Tues. 24th July	Chapter 18, *Acid-base*
Weds. 25th July*	Chapter 19, *Aqueous Equilibria*
Thurs. 26th July	Chapter 19, *Aqueous Equilibria*
Fri. 27th July	Chapter 19, *Aqueous Equilibria*
Mon. 30th July	Chapter 20, *Thermodynamics*
Tues. 31st July	Chapter 20, *Thermodynamics*
Weds. 1st August	Chapter 21, *Electrochemistry*
Thurs. 2nd August	Chapter 21, *Electrochemistry*
Fri. 3rd August	Chapter 22, *Transition Metal Chemistry*
Mon. 6th August	Chapter 24, *Nuclear Chemistry*
Weds. 8th August	**COMPREHENSIVE FINAL EXAM IN CASA**

*LAST DAY TO DROP CLASS.

Exams (to be taken at the CASA Testing Center in the Susanna Garrison Gym, #532 on map)

Exam 1	Friday 20th July (Chapters 12, 13, 16)
Exam 2	Friday 27th July (Chapters 17, 18, 19)
Exam 3	Friday 3rd August (Chapters 19, 20, 21)
Final	Wednesday 8th August (All material)

You are responsible for scheduling your own test (NOT DURING CLASS TIME) through Blackboard.

I reserve the right to change the above syllabus depending upon our rate of progress. I will NEVER change the test dates, however.

Blackboard homework will be available from the start of the coverage of the material to the day of the test covering the material. NO EXCEPTIONS OR EXTENSIONS. You can take each assignment as often as you want within that time, with at least an hour between attempts. I suggest you familiarize yourself with the Blackboard protocols as quickly as possible! Go to www.uh.edu/Blackboard to get started. It is YOUR responsibility to ensure that you can access this material.

Learning Outcomes

By the end of this class, the student (you) will be able to:

1. Relate the properties of solids, liquids and gases to the principles of intermolecular forces:

2. Characterization of the properties of various solutions.

3. Explain concepts of chemical kinetics and interpret chemical reactions from kinetic data.

4. Explain the concept of chemical equilibrium and the effect of Le Chatelier's Principle on equilibrium.

5. Apply chemical equilibrium concepts to acid-base equilibria.

6. Apply equilibrium concepts to solubility.

7. Apply the principles of chemical thermodynamics to processes of chemical or physical change.

8. Apply oxidation-reduction reactions in relation to electrochemistry.

9. Apply the general principles of coordination complexes to Transition Metals.

10. Describe processes of nuclear reactions and their applications.

11. Apply critical thinking skills to solve problems in chemistry.

Course Competencies:

1. Relate the properties of solids, liquids and gases to the principles of intermolecular forces:

A. Employ the kinetic molecular model to explain the differences between the gas, liquid, & solid phases.

B. Explain the origins and relative strengths of dipole-dipole forces, hydrogen bonding and London dispersion forces and use these to explain the trends in phase change and other properties of solids, liquids and gases.

C. Draw a phase diagram of a substance given proper data and use a phase diagram to predict the phases present at a given temperature and pressure.

D. Given heating/cooling curves, calculate the heat associated when a given substance changes from one condition to another.

E. Compare and contrast crystalline and amorphous solids.

F. Categorize crystalline solids as ionic, molecular, covalent network and metallic solids.

2. Characterization of the properties of various solutions:

A. Describe the processes by which solutes and solvents interact in forming solutions. Include terms about the nature of particles, the various forces and energy involved.

B. Solve concentration problems with molarity, mass percent, mole fraction, molality and ppm.

C. Solve problems with Henry's law.

D. Describe temperature effects on solubility.

E. Explain qualitatively the colligative properties, vapor pressure lowering, boiling point elevation and freezing point depression, and work quantitative problems.

F. Describe the process of osmosis and some applications and solve quantitative problems.

G. Describe how the colligative properties of solutions of electrolytes differ from those of solutions of non-electrolytes.

H. Use colligative properties to determine molar mass and predict atomic scale solution behavior.

I. Describe the characteristics of colloids.

3. Explain concepts of chemical kinetics & interpret chemical reactions from kinetic data:

A. Discuss the effect of concentration, temperature, catalysis and physical state upon rate of reaction.

B. Distinguish between average rate and instantaneous rate.

C. Determine the rate law and overall order of a reaction using initial rate data.

D. Calculate the rate constant from rate data.

E. Describe and use quantitatively the two types of rate laws (differential and integrated).

F. Distinguish between zero, first and second order reactions using integrated rate laws.

G. Determine the relationship between half-life equations and reaction order.

H. Draw a reaction profile to explain the progress of a reaction.

I. Describe the collision model and discuss the temperature dependence of reaction rates.

J. Define and calculate activation energy.

K. Discuss reaction mechanisms and identify the rate-determining step using reaction rate data.

L. Explain the effect of a catalyst on a chemical reaction.

4. Explain the concept of chemical equilibrium and the effect of Le Chatelier's Principle on equilibrium

A. Explain how the terms reversible reaction and dynamic equilibrium are related.

B. Write the general equilibrium constant expression and explain its significance.

C. Explain why the concentrations of pure liquids and solids are never used in equilibrium constant expressions.

D. Show how the numerical value of the equilibrium constant changes when the stoichiometric coefficients are changed or the reaction is reversed.

E. Explain the differences between the terms K_c and K_p and calculate one given the other.

F. Calculate the value of a reaction quotient and use it to predict the direction of a reaction.

G. Given K_{eq} and initial concentrations/pressures of reactants and/or products, calculate the final concentrations/pressures of reactants and/or products or calculate K_{eq} when given initial and one final concentrations/pressures.

H. List the external factors that can affect equilibria.

I. Explain how changes in temperature, pressure, volume or concentration affect the equilibrium position for a chemical reaction.

J. Describe the effect of a catalyst on a system as it approaches equilibrium.

5. Apply chemical equilibrium concepts to acid-base equilibria.

A. Explain the similarities and differences between terms such as: K_a and K_b, pH and pOH, and pK_a and pK_b.

B. Apply Brønsted-Lowry acid-base concepts to determine the relative strength of acids and their conjugate bases.

C. Name and list the common strong acids and strong bases.

D. Relate $[H^+]$ and $[OH^-]$, pH and pOH. Calculate the pH for solutions of strong acids and bases.

E. Identify a weak acid or base and write a chemical equation to represent its ionization. Set up an equation for determining its ionization constant expression (K_a and K_b).

F. Calculate from appropriate data, ionization constants (K_a or K_b), concentration of the non-ionized acid or base, the concentration of ions in aqueous solution, the pH and the percent dissociation.

G. Relate acid strength to K_a and base strength to K_b.

H. Explain why certain salts give acidic, basic or neutral solutions and show how to calculate the pH of these solutions.

I. Describe the ionization of a polyprotic acid in aqueous solution.

J. Explain how bond strength and polarity affect acid-base properties.

K. Identify the Lewis acid and base in a chemical reaction.

L. Describe the effect of common ions on the ionization of weak acids or bases and calculate the concentration of species present in solutions of weak acids or bases with their common ion.

M. Explain the principles of a buffered solution.

N. Calculate the pH of a buffer solution from concentrations of the buffer components and a value of K_a and K_b, and describe how to prepare a buffer having a specific pH.

O. Determine the changes in pH of a buffer solution that result from addition of acids or bases.

P. Determine the volume of a solution of known concentration required to titrate another solution of known volume and concentration.

Q. Determine the concentration of a solute in a solution by titrating it against a known amount of another substance.

R. Sketch a titration curve for and carry out calculations associated with the titration of:

1. Strong acid with a strong base

2. Weak acid with a strong base

3. Weak base with a strong acid

4. Polyprotic acid or base

6. Apply equilibrium concepts to solubility.

A. Write an equation to express the relationship between a solid solute and its constituent ions in a saturated solution.

B. Calculate the K_{sp} from molar solubility and molar solubility from K_{sp}.

C. Calculate the effect of a common ion on the molar solubility of a salt.

D. Predict whether precipitation will occur when salt solutions are mixed and determine the concentration of ions remaining in solution after precipitation.

E. Solve chemical equilibrium problems involving complex ions.

7. Apply the principles of chemical thermodynamics to processes of chemical or physical change.

A. Explain the similarities and differences between such terms as enthalpy, entropy and free energy.

B. Explain entropy changes in terms of changes in the number of accessible microstates.

C. Predict whether the entropy change in a given process is positive, negative or near zero.

D. Use standard molar entropies to calculate ΔS for a reaction.

E. Distinguish between spontaneous and non-spontaneous processes using the second law of thermodynamics.

F. Use Gibbs free energies of formation to calculate ΔG for a reaction.

G. Explain how ΔH, ΔS and ΔG are related to reaction spontaneity and allow one to predict the conditions under which a reaction will occur.

H. Describe the relationship between the standard free energy of reaction and the equilibrium constant. Calculate K_{eq} for a chemical reaction from $\Delta H°$ and $S°$ or $\Delta G°$.

I. Calculate ΔG for a chemical reaction that occurs under non-standard conditions.

8. Apply oxidation-reduction reactions in relation to electrochemistry.

A. Describe oxidation-reduction reactions as electron loss and electron gain.

B. Balance oxidation-reduction equations.

C. Describe the components and operation of voltaic/galvanic and electrolytic cells.

D. Using standard half-cell potential, calculate cell potentials for both voltaic and electrolytic cells and make predictions about reaction spontaneity.

E. Using a table of standard reduction potentials, predict whether a selected reaction will occur.

F. Explain the similarities and differences between terms such as anode and cathode, voltaic cell and electrolytic cell, electromotive force and voltage.

G. Understand the relationship between cell potential, free energy change and equilibrium constant and carry out appropriate calculations.

H. Use the Nernst equation to calculate the cell potential for reactions occurring under nonstandard conditions.

I. Predict products and solve stoichiometry problems involving electrolytic cells.

J. Describe practical applications for voltaic and electrolytic cells (batteries, corrosion and commercial electrolytic cells).

9. Apply the general principles of coordination complexes to Transition Metals.

A. Understand the trends of Transition Metals as it relates to general properties, electron configuration, oxidation states, and reduction potentials.

B. Determine the coordination numbers, ligands, and nomenclature of Transition Metals.

C. Structural isomerism and Stereoisomers of transition metal complexes.

D. Explain bonding theory in complex ion formation.

E. Predict coordination complex geometry based on Crystal Field Theory.

F. Explain the biological significance of coordination complexes.

10. Describe processes of nuclear reactions and their applications.

A. Explain the similarities and differences between such terms as alpha, beta and gamma radiation; binding energy and mass defect; fission and fusion.

B. Review and describe the composition of the nucleus.

C. Name the different types of radioactive decay (e.g., alpha decay) and describe the characteristics of each.

D. Write balanced equations for radioactive decay processes.

E. Calculate the rate of radioactive decay, the half-life or the number of atoms or moles in a sample of a radioactive nuclide if two of the three terms are known.

F. Write equations for nuclear transformation reactions.

G. Describe some of the practical and beneficial uses of radioisotopes.

H. Describe the processes of nuclear fission and fusion and discuss the problems with using either process as a source of energy.

I. Calculate binding energies and energies associated with nuclear reactions.