

PALOMAR COLLEGE
COURSE OUTLINE OF RECORD FOR
DEGREE CREDIT COURSE

Transfer course A.A. degree applicable course
(check all that apply)

COURSE NUMBER AND TITLE: CHEM 115 General Chemistry

UNIT VALUE: 3

MINIMUM NUMBER OF SEMESTER HOURS: 48

BASIC SKILLS REQUIREMENTS: Appropriate language and computational skills.

ENTRANCE REQUIREMENTS

PREREQUISITE: CHEM 110 and CHEM 110L

COREQUISITE: None

RECOMMENDED PREPARATION: Concurrent enrollment in CHEM 115L

SCOPE OF COURSE:

Principles of, and calculations in, areas such as reaction spontaneity, energy changes accompanying chemical reactions, rates of reactions, chemical equilibrium, acids and bases, precipitation reactions, complex ions, oxidation and reduction, nuclear reactions, and descriptive chemistry.

SPECIFIC COURSE OBJECTIVES:

The successful student will be able to:

1. Analyze problems by applying appropriate principles and associated formulas.
2. Explain how principles can predict results of specific chemical reactions.

CONTENT IN TERMS OF SPECIFIC BODY OF KNOWLEDGE:

1. Thermodynamics
 - a. Familiarity with enthalpy, entropy, and free energy as well as their associated laws and formulas.
 - b. Use of Hess' Law, First Law of Thermodynamics, and the Second Law of Thermodynamics.
 - c. Calculations involving work, internal energy ΔH , ΔS , and ΔG .
 - d. Interpretation of reaction spontaneity based on values of ΔH , ΔS , and ΔG and temperature dependence of spontaneity based on signs of ΔH , ΔS , and ΔG .
2. Chemical Kinetics
 - a. Familiarity with zero, first and second order rate laws, half-lives, rate constants, and the Arrhenius equation.
 - b. Determination of the order of a reaction from rate data.
 - c. Determination of the order of a reaction from graphs of concentration versus time.
 - d. Use of formulas relating concentration to rate and use of formulas relating concentration to time.
 - e. Calculations relating rate constants at different temperatures.

3. Chemical Equilibrium
 - a. Familiarity with K , size of K related to concentrations of reactants versus products, alteration of K to adjust to changes in the way the reaction is written, K_c versus K_p , position of equilibrium, Le Chatelier's principle.
 - b. Determination of K from two or more reactions with associated K 's.
 - c. Writing mass action expressions for homogeneous and heterogeneous equilibria.
 - d. Calculations of equilibrium concentrations from starting concentrations and value of K .
 - e. Evaluation of net movement of a reaction towards equilibrium based on stress and Le Chatelier's principle.
4. Acid-Base Equilibria
 - a. Familiarity with Arrhenius, Bronsted-Lowry (including determination of conjugate acids and bases), and Lewis definitions of acids and bases.
 - b. Familiarity with pH , pOH , K_a , K_b , $\text{p}K_a$, $\text{p}K_b$, polyprotic acids, strong acids versus weak acids, strong bases versus weak bases, acidic salts, basic salts, neutral salts, acid strength dependent on chemical formula and periodic properties, buffers, acid-base indicators, acid-base titrations including strong acid-strong base, strong acid-weak base and weak acid-strong base titrations.
 - c. Capability of relating correct K and reaction with given acid, base, salt or acid-base combination.
 - d. Capability of calculating pH for any chemical formula that is one of the following: strong acid, strong base, weak acid, weak base, polyprotic acid or conjugate base or a polyprotic acid, buffer combination, acidic salt, basic salt, neutral salt, acid-base combination.
5. Ions and Ionic Equilibria
 - a. Familiarity with hydrolysis (if not already covered under acid-base equilibria).
 - b. Familiarity with solubility and solubility product, prediction of precipitation based on value of Q under given conditions, and complex ion equilibria.
 - c. Capability of writing correct mass action expression for a specific K and relating given conditions in a problem to the expression and K .
 - d. Capability of concentration of one ion when a solution is added to a combination of the ion with another similar ion to precipitate one preferentially.
 - e. Calculation of concentration of the ion when a solution is added to a combination of the ion with another similar ion to precipitate one preferentially.
6. Oxidation-Reduction Reactions
 - a. Familiarity with oxidation and reduction processes in a reaction, capability of identifying oxidizing and reducing agent in a reaction, capability of recognizing spontaneous redox reaction from activity series (electrochemical series), and capability of determining oxidation numbers of elements in a reaction.
 - b. Balancing redox reactions.
7. Electrochemistry
 - a. Associating E° on electrochemical series table with a given redox reaction in a problem and changing it to adjust to the problem.
 - b. Calculating E° from E°_{ox} and E°_{red} .
 - c. Associating the sign of E° with reaction spontaneity.
 - d. Familiarity with electrolytic, galvanic or voltaic electrochemicals cells, emf, standard oxidation potential, standard reduction potential, and the terms volt, coulomb, ampere, and faraday.
 - e. Relating ΔG and K to E° .
 - f. Use of the Nernst equation.
 - g. Calculating amperes, time or coulombs for stoichiometric quantities (or vice versa) in the redox reaction.

8. Coordination Compounds
 - a. Familiarity with coordination compounds, complex ions, coordination number and geometries, ligands, common polydentate chelating agents.
 - b. Nomenclature of coordination compounds.
 - c. Capability of giving possible geometry of complex ion in a coordination compound and drawing stereoisomers based on geometry and naming geometric isomers as cis- or trans isomers.
 - d. Capability of drawing orbital diagram for central metal atom with specific hybridization of bonding orbitals and determining number of unpaired electrons.
 - e. Applying Crystal Field Theory to octahedral complexes (and other geometries if time allows).
9. Nuclear Chemistry (optional)
10. Descriptive Chemistry (optional)

REQUIRED READING:

Ebbing, Darrel D. and Steven D. Gammon. General Chemistry. 6th edition. Boston: Houghton Mifflin Company, 1999.

SUGGESTED READING: None

REQUIRED WRITING:

Problem-solving exercises are more appropriate.

Solve specific types of problems and exercises, illustrating each principle on quizzes and exams. Type of problems include redox balancing, stoichiometry involved in reactions, thermodynamic variable calculations, prediction of precipitation and calculating concentrations for producing precipitation, calculation of reaction rates and orders, calculating reaction electrical potential, etc.

OUTSIDE ASSIGNMENTS:

Students are expected to spend a minimum of three hours per unit per week in class and on outside assignments, prorated for short-term classes.

Reading of chapters followed by solving end-of-chapter exercises and problems, studying lecture notes in preparation for quizzes and exams.

INSTRUCTIONAL METHODOLOGY:

Check all that apply:

- lecture
 laboratory
 lecture-laboratory combination
 directed study

This course may be offered as a distance learning course and meets Title 5 regulations 55370, 55372, 55374, 55376, 55378, and 55380.

Yes No

If yes, check all that apply.

- Television Course (Video one-way, e.g. ITV, video cassette, etc.)
 Online Course (Text one-way, e.g. newspaper, correspondence, electronic file, etc.)
 Two-Way Video Conferencing (Two-way interactive video and audio)
 One-Way Video Conferencing (One-way interactive video and two-way interactive audio)
 Computer Assisted Instruction (A specialized form of mediated instruction relying primarily on student access to information and prepared lessons or teaching materials through a computer terminal, but not under immediate supervision of a qualified instructor.)

GRADING POLICY AND STANDARDS (include methods of determining whether the stated objectives have been met by students):

Percentage of points in each area to be determined by individual instructor. One example of distribution is as follows:

4 Exams @ 13.5% each	= 54%
12 Quizzes @ 1% each	= 12%
Final Exam	= 34%
Total	= 100%

IS COURSE REPEATABLE FOR REASON(S) OTHER THAN DEFICIENT GRADE?

Yes ___ No X Number of times course may be taken for credit: 1

If yes, identify specific provision of Title 5 Division 2 section(s), 55761-55763 and 58161 which qualifies course as repeatable:

CONTACT PERSON: Edwin Groschwitz

SIGNATURES:

SIGNATURES ON FILE
