Fall 2016: Concepts in Chemistry, CHE*K111

Three Rivers Community College, Norwich, CT

Sec 30087	**Lecture**	**T, R 9:30 – 10:45**	**Room D128**
Sec 30081	**Lab**	**T 12:30 – 3:15**	**Room B216**

Vandana Basu

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Office Hours: **M**-11:30 – 12:30, **T**-10:45 – 11:45, **R**- 10:45-11:45
or by appointment M-F

Course Description:
This course offers a brief and comprehensive survey of important chemical theories and some of the applications of chemistry. Topics covered will include measurements in chemistry, atomic structure and chemical bonding, chemical reactions, states of matter, stoichiometry, theories of solution, and basic organic and biochemical concepts. Course Design: CHE* K111 is meant for students with little or no background in chemistry who need the course in preparation for General Chemistry, or for students who need to meet a pre-admission requirement for nursing or other allied health programs, or those who need a lab science course. **4 CREDIT HOURS**
Prerequisites: *ENG* K101* or *ENG* K101S* placement∞ or completion of *ENG* K096* with a "C#" grade or better; *MAT* K137* or *MAT* K137S* with a "C" grade or better (or permission of the instructor on math requirement).

Required Material:
1. TEXT: Introductory Chemistry: Concepts and Critical Thinking, 7th edition, C. H. Corwin
2. LAB MANUAL: Concepts of Chemistry Laboratory Exercises, 2nd edition Copeland Academx
3. Chemical safe goggles
4. Scientific Calculator (a cell phone can not be substituted for a calculator)

General Course Objectives:
1. To aid the student in developing an understanding of the basic concepts of chemistry
2. To develop critical thinking and problem solving skills
3. To increase appreciation for the role that chemistry plays in our daily lives.
4. To provide a useful body of knowledge for students studying chemistry, biology, fire science, environmental science, nursing, and other allied health science areas.

Tips for how to succeed in this course: The material in this course is cumulative, therefore it is important to dedicate time every week to review new material. Homework problems will be assigned every week. It is in your best interest to do them and check the answers in the back of the book. If you have problems, come to office hours. If you don't understand something during class, ask a question. Probably, the whole class will benefit.

Class Attendance Policy: Attendance of all class activities in lecture and lab is required. Absences are counted from the first meeting of class. More than four consecutive or more than six cumulative absences could result in a student receiving an "F" grade in this course. An explanation of the cause of each absence should be given to your instructor.

TENTATIVE COURSE SCHEDULE* (subject to change)

Week, Date	Chapter and Topics	Lab
1, 8/30 – 9/1	Ch.1 Intro to Chemistry/PSS	#1 Safety and Equipment
2, 9/6 – 9/8	Ch.2 Metric System	#2 Measurements
3, 9/13 – 9/15	**QUIZ 1 – metric system, sig figs** Ch.3 Matter and Energy/Sec 5.3	#3 % Water in a Hydrate
4, 9/20 – 9/22	Ch.4 Models of the Atom	#4 Phys & Chem Changes
5, 9/27 – 9/29	**QUIZ 2- elements, isotopes, compounds, mixtures** Ch.5 Periodic Table Ch.6 Language of Chemistry	#5& #6 Chemical Formulas
6, 10/4 – 10/6	**UNIT TEST I (Ch.1-6)** Ch. 12 Chemical Bonding	**Lab Practical Exp #1-#6**
7, 10/11 – 10/13	Ch.7/Reactions/ Sec 17.1, 17.2 REDOX	#7 & #8 Qual/Quant Analysis
8, 10/18 – 10/20	**QUIZ 3 – chemical nomenclature** Ch.8 The Mole	Problem Session I
9, 10/25 – 10/27	Ch.9 Chemical Equation Calculation	#9 Stoichiometry
10, 11/1 – 11/3	**QUIZ 4 – Chemical Reactions, REDOX** Ch.10 Gases/Ch.11 Liquids & Solids	Problem Session II
11, 11/8 – 11/10	**UNIT TEST 2 (Ch. 7-10, 12, 17)** Ch. 13 Solutions	#10 Solutions
12, 11/15 – 11/17	Ch. 14 Acids & Bases	#11, #12, #13, Acids/Bases
13, 11/22 – 11/24	**QUIZ 5 – Acids and Bases, Solutions** Ch.16 Equilibrium & Kinetics	
14, 11/29 – 12/1	Ch.19 ORGO, Ch.20 Biochem	#14 Orgo and Biochem
15, 12/6 – 12/8	**UNIT TEST 3 (CH.11, 13, 14, 16, 19, 20)** Ch.18 Nuclear Chemistry	**Lab Practical Exp #7-14**
16, 12/13	Semester Review	**12/13 FINAL EXAM**

Course: Concepts in Chemistry/ CHE111

Revisions to the Syllabus: Students are responsible for learning all of the objectives and items in the course outline discussed in lecture and/or laboratory. The instructor reserves the right to revise the objectives, topical outline, or academic schedule contained in this syllabus without notice. However, if the revisions affect scheduled unit tests a 48-hour notice will be given for the new test date.

Make-ups:
Make-ups are granted only if a test or quiz is missed due to extenuating circumstances such as illness, bereavement, work commitment, travel emergency, or other condition beyond the control of the student. Students must contact the instructor as soon as possible, prior to the next class meeting to explain the absence and arrange for a make-up.
Labs can only be made up during the same week if another instructor can accommodate the student.
NOTE: Students with documented testing accommodations should schedule tests and/or quizzes well in advance to ensure seat availability.

- Testing Center: Room A117. Phone 860-215-9061. Email: testing@threerivers.edu
- Students can also schedule make-ups via the school website, under student services/placement testing

Grade Determination: Total points for the course: 1000 points

Unit Test 1	**125 points**
Unit Test 2	**125 points**
Unit Test 3	**125 points**
Quiz Average	**125 points**
Final Exam (cumulative)	**250 points**
Lab	**250 points**

Quizzes - There will be 5 Quizzes. The lowest quiz grade will be dropped and the remaining 4 best quizzes will be averaged. The averaged quiz grade is worth 125 points, and each quiz is worth 31.25 point
The lab grade is based on two lab practical scores and points earned for lab reports.
No individual extra assignments will be given.
How to calculate your grade: To determine your grade throughout the course it is best to set up a table with two columns. In the first column, list the total points available for each assignment and in the next column, list the points you have earned for each assignment. Next, add all the available points together. Then, add the earned points together. Your grade is determined by dividing the points you have earned by the total number of points available.

Example:

Assignment	Points available	Points earned
Unit 1 Test	125	110
Quiz 1	31.25	27
Lab Practical I	120	110
Lab Reports	4	3
Sum	280.25	250

250/280.25 x 100% = 89.21% = B+

Grade Scale:

There will be no grading on the normal distribution curve.

100.00 - 93.50 = A	79.49 - 77.50 = C+	59.49-55.00 = D-
93.49 - 90.00 = A-	77.49 - 73.50 = C	54.49 - 00.00 = F
89.99 - 87.50 = B+	73.49 - 69.50 = C-	
87.49 - 84.50 = B	69.49 - 63.50 = D+	
84.49 - 79.50 = B-	63.49 - 59.50 = D	

Academic and Classroom Misconduct: The instructor has primary responsibility for control over classroom and laboratory behavior and maintenance of academic integrity, and can request the temporary removal or exclusion from the classroom or laboratory of any student engaged in conduct that violates the general rules and regulations of the institution, or any student engaged in conduct deemed hazardous in the laboratory. Extended or permanent exclusion from lecture of laboratory activities or further disciplinary action can only be effected through appropriate procedures of the institution. Plagiarism, cheating on quizzes or tests, or any form of academic dishonesty is strictly prohibited. Students guilty of academic dishonesty directly or indirectly will receive a zero for the exercise or quiz or test and may receive an "F" grade for the course in addition to other possible disciplinary sanctions which may be imposed through the regular institutional procedures. Any student that believes that he or she has been erroneously accused may appeal the case through the appropriate institutional procedures if their grade was affected.

Disabilities Notice: If you have a disability that may affect your progress in this course, please meet with a Disability Service Provider (DSP) as soon as possible. Please note that accommodations cannot be provided until you provide written authorization from a DSP.

College Disabilities Service Providers	
Matt Liscum, Counselor (860) 215-9265 Room A113	• Learning Disabilities • ADD/ADHD • Autism Spectrum • Mental Health Disabilities
Elizabeth Willcox, Advisor (860) 215-9289 Room A113	• Medical Disabilities • Mobility Disabilities • Sensory Disability

Cell phones and other electronic devices: Electronic devices must be silenced at all times. Under no circumstances are phones to be answered in class. When there are extenuating circumstances requiring a student to be available by phone, the student must notify the instructor prior to class, so that together they can arrive at an agreement. *A cell phone is not permitted as a substitute for a calculator.*

Learning Portfolio: All students are required to maintain an online learning portfolio in Digication that uses the college template.

Course Withdrawal: Course withdrawals are recommended if you cannot complete the course and are accepted up until the week before classes end. Specific deadline dates are posted in the academic calendar and are strictly enforced. A grade of "W" will be assigned after you formally withdraw. If you stop attending classes without withdrawing, a grade of "W" will not be automatically assigned. Neglecting to withdraw may result in a grade of "F". It is strongly advised that you speak with your instructor before withdrawing. Instructor signature is not required to withdraw.
Once you withdraw from the course you are no longer eligible to attend class or take any remaining quizzes or tests.

Non-Discrimination Policy Statement:

Three Rivers Community College does not discriminate on the basis of race, color, religious creed, age, sex, national origin, marital status, ancestry, present or past history of mental disorder, learning disability or physical disability, sexual orientation, gender identity and expression, or genetic information in its programs and activities. In addition, the College does not discriminate in employment on the basis of veteran status or criminal records. The following person has been designated to handle inquiries regarding the non-discrimination policies:
Title IX Coordinator
Three Rivers Community College
574 New London Turnpike,
Norwich, CT 06360
860-215-9208

Sexual Misconduct Policy:
Three Rivers Community College strongly encourages all students to report any incidents of sexual misconduct, which includes, but it not limited to, sexual harassment, intimate partner violence, and sexual assault. Students have the right to the prompt and fair resolution of all claims, and the College will preserve the confidentiality of all who report to the fullest extent possible and allowed by law. College employees will explain the limits of confidentiality before information about the incident is revealed. To report sexual misconduct, or to learn more about your options, please contact the Title IX Coordinator. **If you need immediate, confidential assistance, please call the Sexual Assault Crisis Center of Eastern Connecticut hotline at 860-437-7766.**

Title IX Coordinator
Three Rivers Community College
574 New London Turnpike
Norwich, CT 06360
860-215-9208

Sexual Assault Crisis Center of Eastern Connecticut
Hotline: 860-437-7766
Office: 860-442-0604
78 Howard Street, 2nd Floor
New London, CT 06320

Course Objectives: Chemistry 111 – Concepts of Chemistry

1. The student will develop "critical thinking skills" and will learn to derive sound scientific conclusions by analyzing scientific data.
2. The student will demonstrate knowledge of the scientific method through examples.
3. The student will be able to define science.
4. The student will be able to define chemistry, list and describe the various branches of chemistry.
5. The student will be able to define matter.
6. The student will be able to identify the three physical states of matter and describe their basic characteristics.
7. The student will be able to distinguish between homogenous and heterogeneous matter.
8. The student will be able to explain the difference between pure substances, solutions, homogeneous mixtures, and heterogeneous mixtures.
9. The student will learn the laws of conservation of energy and mass, and explain the interrelationship between these two laws.
10. The student will learn the division of elements into metals and non-metals and will be able to describe their chemical and physical properties.
11. The student will learn the rules for identifying significant digits.
12. The student will learn the correct use of significant digits in basic mathematical operations.
13. The student will learn the metric system of measurements and its application in science.
14. The student will be able to make conversions within the metric system.
15. The student will be able to covert metric units to English units and vice versa.
16. The student will learn the basic measures of matter.
17. The student will learn the correct procedures for measuring mass (weight).
18. The student will learn the correct procedures for measuring volume.
19. The student will be able to define and/or describe the distinguishing characteristics of the following terms: mass, weight, energy, calorie, joule, Newton of force, specific heat, density, and specific gravity.
20. The student will be able to define the term atom, describe the structure of an atom and give the general characteristics of atoms.
21. The student will be able to name the subatomic particles, explain their unique characteristics, and describe the arrangement of these particles in an atom.
22. The student will be able to define the term isotope and explain how isotopes differ from each other.
23. The student will be able to describe the unique characteristics of natural radioactive isotopes.
24. The student will be able to understand the principle energy levels and their electron capacities in relationship to the Quantum Mathematical Model.
25. The student will be able to demonstrate the arrangement of electrons in the principle energy levels, the arrangement of electrons in the sub-levels and the arrangement of electrons in the orbitals.
26. The student will be able to explain what is meant by valence electrons.
27. The student will be able to explain ionic charge, valence, and oxidation numbers.
28. The student will be able to explain electron arrangement as it relates to chemical bonding (ionic and covalent).
29. The student will be able to define terms, ions (cation and anion), molecules and compounds.
30. The student will learn to write chemical formulas for compounds.
31. The student will be able to understand the structure of some representative compounds.

32. The student will learn the general characteristics of the series and groups of elements in the periodic table.
33. The student will learn how to use the periodic table of elements as one of the tools for studying chemistry.
34. The student will learn the scientific methods for naming inorganic compounds.
35. The student will learn to calculate formula weights of elements, ions, molecules and compounds.
36. The student will learn to calculate the molar masses of elements, ions, molecules and compounds.
37. The student will learn to calculate the percent composition of each element in a compound.
38. The student will learn to calculate the empirical formula for compounds.
39. The student will learn the basic concepts of chemical equations.
40. The student will learn the terms and symbols used in writing a chemical equation, as well as their meanings.
41. The student will learn the guidelines for balancing chemical equations.
42. The student will be able to write and balance chemical equations.
43. The student will be able to do simple calculations involving chemical equations (Stoichiometry).
44. The student will be able to demonstrate knowledge of the unique characteristics of gases and the gas laws.
45. The student will be able to perform calculations involving the gas laws.
46. The student will demonstrate knowledge of the characteristics of water and other liquids.
47. The student will demonstrate knowledge of the characteristics of solids.
48. The student will be able to define the term solution, identify and give the characteristics of different types of solutions.
49. The student will be able to explain solubility and list factors that affect solubility, as well as, factors that affect the rate of solubility.
50. The student will be able to explain the difference between saturated, unsaturated and supersaturated solutions.
51. The student will be able perform calculations involving solutions (percent mass, molal, molar, normal).
52. The student will be able to give various definitions of acids and bases, and explain their properties.
53. The student will be able to define pH.
54. The student will be able to define the term buffer and explain the process of neutralization.
55. The student will be able to distinguish between electrolytes and non-electrolytes.
56. The student will be able to understand oxidation-reduction reactions and balance Redox equations.
57. The student will be able to understand reaction rates and chemical equilibrium.
58. The student will be able to define organic chemistry.
59. The student will be able to give the chemical composition and the basic characteristics of carbohydrates, lipids, proteins, nucleic acids and vitamins.
60. The student will be able to define the following terms: metabolism, anabolism and catabolism.
61. The student will learn the basic biochemical mechanisms of photosynthesis, DNA and RNA synthesis, protein synthesis, and cellular respiration.
62. The student will learn the characteristics and classification of the major groups of hydrocarbons.

63. The student will learn the IUPAC system for naming hydrocarbons.
64. The student will learn the chemical composition of some of the derivatives of the hydrocarbons.

Course Outline*: Chemistry 111 - Concepts of Chemistry
***Class lectures will present this information in a different order**

UNIT I

I) Introduction
- A) What is Science?
- B) The Scientific Method
- C) Chemistry
- D) Branches of Chemistry
  1. Inorganic
  2. Organic
  3. Analytical
  4. Physical
  5. Biochemistry

II) Matter and Energy
- A) Definition of Matter
- B) Physical States of Matter
  1. Solids
  2. Liquids
  3. Gases
- C) Divisions of Matter
  1. Homogeneous matter
     - a) pure substance
     - b) solution
     - c) homogeneous mixture
  2. Heterogeneous matter (mixture)
- D) Definition of Energy
- E) Forms of Energy
  1. Potential
  2. Kinetic
- F) Types or Kinds of Energy
  1. Solar or light
  2. Radiation
  3. Electrical
  4. Chemical
  5. Mechanical
  6. Heat
     - a) endothermic
     - b) exothermic
- G) Law of Conservation of Energy
- H) Law of Conservation of Mass
- I) Energy – Mass Relationship
- J) Elements

1. Definition
2. Composition
3. Division of the elements (metals and nonmetals)
    a) physical properties
    b) chemical properties

III) Measurements
- A) Significant Digits
- B) Mathematical Operations Involving Measurements and Significant Digits
- C) Mass and Weight
    1. Definitions
    2. Measurements
- D) Quantitative Measurements of Matter
    1. Mass (Weight)
    2. Volume
    3. Linear (Area)
- E) Metric System
    1. Standard units
        a) Gram for Mass
        b) Liter for Volume
        c) Meter for Length
    2. Prefixes and their meanings
        a) mega
        b) kilo
        c) hecto
        d) deca
        e) deci
        f) centi
        g) milli
    3. Conversions within the metric system
    4. English to Metric conversions and Metric to English conversions.
    5. Energy
    6. Heat Energy(Temperature measurements)
        a) calorie
        b) joule
    7. Temperature scales
        a) Fahrenheit scale - ^{o}F
        b) Celsius scale - ^{o}C
        c) Kelvin scale - K
    8. Conversions within the temperature scales
        a) Fahrenheit to Celsius
        b) Celsius to Fahrenheit
        c) Celsius to Kelvin
        d) Kelvin to Celsius
- F) Specific Heat
- G) Density
- H) Specific Gravity

IV) The Atom

A) Definition
B) Atomic Theories
C) Subatomic Particles
    1. Electrons
    2. Protons
    3. Neutrons
D) Atomic Number
E) Atomic Mass or Atomic Weight
F) Isotopes
    1. Definition
    2. Natural radioactivity particles
        a) Alpha
        b) Beta
        c) Gamma
G) Electron Configuration and Distribution
    1. Principle energy levels and their capacities
    2. Sublevels and their capacities
    3. Orbitals and their capacities
    4. The arrangements of electrons in the principle energy levels and sublevels
    5. The arrangement of electrons in the orbitals – the order of filling
    6. The electron dot method
H) Electron Arrangement versus Reactivity
    1. Ions – cations, anions, - ionic charge and valence
    2. Oxidation Numbers
    3. Chemical Bonding
        a) Ionic or electrovalent bonds
        b) Covalent bonds
            1) polar
            2) nonpolar
    4. Molecules and Compounds
    5. Writing Chemical Formulas
        a) Rules for writing chemical formulas
        b) Chemical symbols and subscripts

UNIT II

I) The Periodic Classification of the Elements
    A) The Periodic Law
    B) The Periodic Table of Elements
        1. Periods or series
        2. Groups or families
        3. Metals
        4. Nonmetals
    C) General Characteristics of the Groups
    D) General Characteristics of the Periods
    E) The use of the Periodic Table

II) Chemical Nomenclature of Inorganic Compounds

A) Systemic Chemicals Names
1. Binary Compounds
a) inorganic compounds combining metals with a fixed oxidation number with a nonmetal
b) inorganic compounds combining metals with variable oxidation numbers with a nonmetal
c) inorganic compounds combining two nonmetals
1) Greek prefixes and their meanings
a. mono
b. di
c. tri
d. tetra
e. penta
f. hexa
g. hepta
h. octa
i. ennea (nona)
j. deca
2. Ternary and Higher Compounds
a) polyatomic ions
b) oxyanions (ate or ite endings)
3. Naming bases
4. Naming acids
a) binary acids
b) ternary acids

B) Common Names of Some Compounds

III) Calculation Involving Elements and Compounds
A) Calculation of Formula Weights
1. Formula Mass
2. Molecular Mass
B) Avogadro's Number
C) The Mole
D) Calculating Molar Masses
E) Conversions From Moles to Grams and Grams to Moles
F) Molar Volume of Gasses
G) Conversions From Moles to Liters and Liters to Moles
H) Simple Calculations – Percent Composition of Compounds
I) Calculation of Empirical and Molecular Formulas

IV) Chemical Equations
A) What is a Chemical Equation?
B) Definition of Terms
1. Reactants
2. Products
3. Catalyst

C) Symbols and Their Meanings
1. Single arrow pointing from left to right
2. Double arrows pointing in opposite directions

3. Arrow pointing upward
4. Arrow pointing downward
5. Plus (+) sign
6. Delta sign above or below the directional arrow
7. Chemical symbol(s) above or below the directional arrow
8. g, l, s, aq.

D) Balancing Chemical Equations
1. Combination reactions
2. Decomposition reactions
3. Single replacement reactions
4. Double replacement reactions
5. Combustion reactions
6. Neutralization reactions

E) Predicting the Product(s) and Balancing the Chemical Equation

F) Writing and Balancing Word Equations

V) Stoichiometry – Calculation involving Chemical Equations

A) Three Basic Steps for Solving Stoichiometry Problems the Mole Method

B) Types of Stoichiometry Problems
1. Mass – Mass
2. Mass – Volume / Volume – Mass
3. Volume – Volume

VI) Gases

A) Basic Characteristics of Gases

B) The Kinetic Theory

C) The Gas Laws
1. Boyle's law
2. Charles' law
3. Gay-Lussac's law
4. The combined gas law
5. The ideal gas law
6. Dalton's law of the partial pressure of gases
7. Henry's law
8. Problem solving related to the gas laws

VII) Water and Other Liquids

A) Water
1. Chemical properties
2. Physical properties
4. Hydrates

B) Liquids
1. Basic characteristics
2. Evaporation
3. Vapor pressure
4. Boiling point
5. Distillation

VIII) Solids

A) Basic Characteristics

B) Structural Forms

1. Crystalline solids
2. Amorphous solids

C) Melting or Freezing Point
D) Sublimation
E) Deposition

UNIT III

I) Solutions
A) Definition
B) Components of a Solution
C) Solubility and Factors Affecting Solubility
1. Chemical properties of the solute and the solvent
2. Temperature
3. Pressure
D) Factors Affecting the Rate of Solubility
1. Temperature
2. Stirring
3. Particle size
E) Concentrations of the Solute in Solutions
1. Saturated
2. Unsaturated
3. Supersaturated
F) Types of Solutions and Their Basic Characteristics
1. True solutions
2. Suspensions
3. Colloids
G) Calculations Involving Solutions
1. Percent by mass
2. Molarity
3. Molality
4. Normality

II) Acids, Bases and Ionic Equations
A) Definition(s) of Acids
B) The Properties of Acids
C) Definition(s) of Bases
D) The Properties of Bases
E) pH and pH Values
F) Buffers and Neutralization
G) Methods of Neutralization – Titration
H) Ionization
I) Electrolytes and Non-electrolytes
J) Writing Compounds in Ionic Form
K) Rules for writing ionic equations

III) Oxidation and Reduction
A) Definitions
B) Oxidizing and Reducing Agents
C) Electrochemical cells
1. Electrolytic
2. Voltaic (Galvanic)

a) Dry cells

D) Writing and Balancing Oxidation – Reduction Equations
1. The Oxidation Number Method
2. The Ion Electron Method

IV) Reaction Rates and Chemical Equilibrium
A) The Law of Mass Action
B) Factors Affecting Reaction Rates
1. The nature of the reactants
2. The concentration of the reactants
3. Temperature
4. Catalysts
C) Chemical Equilibrium
1. Irreversible reactions
2. Reversible reactions
D) Principles of Chemical Equilibrium
1. LeChatelier's principle
2. Weak electrolyte equilibria
3. Solubility product equilibria

V) Concepts of Organic and Biochemistry
A) Definitions and Basic Characteristics
B) The major classes of organic compounds in living systems, their composition and their biological usage's
1. Carbohydrates
2. Lipids
3. Proteins
4. Nucleic acids
a) DNA
b) RNA
5. Vitamins
C) Metabolism
1. Anabolism
2. Catabolism
D) Enzymes
E) Biosynthesis
1. Photosynthesis
2. Cellular respiration
a) Glycolysis
b) Krebs cycle

c) The electron transport system
3. Anaerobic metabolism – fermentation
4. DNA synthesis
5. Protein synthesis
a) transcription
b) translation
F) Hydrocarbon
1. Chemical composition
2. Divisions of hydrocarbons

3. Classification and unique characteristics of the aliphatic hydrocarbons
    a) alkanes
    b) alkenes
) alkynes
4. The IUPAC system for naming the aliphatic hydrocarbons
5. Aromatic hydrocarbons
6. Derivatives of hydrocarbons
    a) alcohols
    b) phenols
    c) ethers
    d) esters
    e) ketones
    f) carboxylic acids
    g) aldehydes
    h) amides
    i) amines
    j) organic halides