

Mercer County Community College
Course Outline
Introductory Chemistry

<u>CHE 100</u>		<u>Introductory Chemistry</u>
Course Number		Course Title
<u>Science/Allied Health</u>	<u>3</u>	<u>3</u>
Division	Credits	Lecture Hours

Required Materials:

Essential Concepts of Chemistry
Sherman and Sherman
Houghton Mifflin, ISBN: 0-395-92127-9

Course Outline and Overhead Transparency Notes for CH100, Introductory Chemistry:
Dorneman
MCCC

Students must have a simple calculator that adds, subtracts, multiplies and divides. Calculators that can store, in memory, formulas or other information are not allowed. Calculators that can convert from one type of units to another are not allowed.

It is required that the student purchase a ring binder type of notebook and that these Transparency Notes be placed therein.

Optional Materials

The Student Solutions Manual for this textbook, and the Study Guide for this textbook.

Catalog Description: Selected fundamental principles of general chemistry. The course is designed for students who have not had high school chemistry and for those who need a review of chemistry before taking other chemistry courses. This course does not include laboratory instruction. 3 lecture hours.

Prerequisite - MAT 034 or equivalent proficiency.

Co requisite - placement in ENG 101.

<u>15 Week</u>	<u>Week 16</u>
Length of Semester	Final Examination

Course Coordinator: Michael Dorneman, Office MS 120, x3369, Email dorneman@mccc.edu subject line must begin "CHE100" and include your section and a subject. Others are deleted.

Academic Integrity Statement (Cheating):

A student who:

- a.) knowingly represents work of others as his/her own,
 - b.) uses or obtains unauthorized assistance in the execution of any academic work, or
 - c.) gives fraudulent assistance to another student
- is guilty of cheating. Violators will be penalized.

Classroom Conduct:

Students are expected to be on time for all classes. If a student walks into a class after it has begun, she/he should sit near the exit so as not to disrupt others. In addition, students are expected to follow ordinary rules of courtesy during class sessions. Buzzing and ringing communication devices and engaging in side conversations during class time is distracting to other students and the instructor. The instructor has the right to eject a disruptive student from the class at any time.

Attendance Policy:

Attendance is required at all classes. A missed test or quiz will count as zero. Students are also expected to be in class on time.

Homework:

Homework consists of your reading the textbook, memorizing certain facts and information, and doing homework problems. Additional studying must be done on a continuing basis so that information needed to solve problems and problem solving methods are remembered for quizzes and exams. It is expected that you will write out all assigned homework in a neat and organized fashion. All written homework is due the meeting after the corresponding material is covered in class.

HOMEWORK WILL BE COLLECTED AT VARIOUS TIMES THROUGHOUT THE SEMESTER!

It is useful to note that the textbook generally gives more information than you need to know for this course.

Course Notebook:

It is required that the student purchase a ring binder type of notebook and that these Transparency Notes be placed therein. The notebook must include additional blank loose-leaf (three-hole punched) paper between pages of the Transparency Notes so that the student can take notes during lecture. Homework must be written out, also on loose-leaf paper, and included in the notebook in a section exclusively for homework. Additional blank sheets should be included at the front of the notebook for important dates, such as exams, deadlines, etc.

Calculators:

Students must have a simple calculator that adds, subtracts, multiplies and divides. Calculators that can store, in memory, formulas or other information are not allowed. Calculators that can convert from one type of units to another are not allowed.

Evaluation:

The course grade will be based on exams, quizzes, class attendance, and homework assignments.

There will be 3 hour exams given in class at approximately the time indicated in the Homework Schedule, with the exact date to be determined when the material on the exam is completed. Additionally, a cumulative final exam will be given during the Final Exam period in the 16th week of the semester. You must be present for the exams, including the Final Exam.

Quizzes will be given every week. In addition surprise quizzes will be given.

Homework assignments will be collected and graded several times during the semester. For credit, homework must be written in a neat and organized fashion, showing work and explaining your answers.

The course grade will be determined by the total number of points accumulated. The following table describes the point value for each component.

	Points	Basis
Exam I	100	% score
Exam II	100	% score
Exam III	100	% score
Exam IV	100	% score
(Given in Finals Week and is cumulative)		
Quizzes (Total of 12 best)	120	10 points each
Attendance (see below)	20	for no absences
Homework	variable	
Total possible	540	

Attendance Points: **There are no excused absences.** It is expected that all students will attend all classes. Points are lost for missing classes: -0 for the first absence; -0 for the second; -0 for the third; -0 for the fourth; and -5 for the fifth and subsequent absences to a total of -20 points for missing 8 classes.

COURSE GRADE: ALTHOUGH THE MAJORITY OF THE COURSE GRADE COMES FROM EXAM SCORES, ATTENDANCE IN CLASS IS CRITICAL TO LEARNING. A STUDENT THAT MISSES SUBSTANTIAL PORTIONS OF THE COURSE WILL RECEIVE A FAILURE GRADE. MISSED EXAMS CANNOT BE "MADE UP", AND INCOMPLETE GRADES WILL NOT BE GIVEN.

Course Grade Calculation: **A student must pass the final exam to pass the course.** Your grade is based on points, not percent, see the chart below:

1. Total your percentage scores from all four exams.
2. Add in your Attendance points:
 - 20 points if you missed 4 or fewer classes
 - 15 points if you missed 5
 - 10 points if you missed 6
 - 5 points if you missed 7
 - 0 points if you missed 8 or more classes.
3. Add in your 12 best quiz scores.
4. Add in any points for homework or bonus.
5. Look up your **point total** here:

503 - 540 = A	(more than 93%)
486 - 502 = A-	(more than 90%-93%)
470 - 485 = B+	(more than 87%-90%)
449 - 469 = B	(more than 83%-87%)
432 - 448 = B-	(more than 80%-83%)
411 - 431 = C+	(more than 77%-80%)
368 - 410 = C	(more than 70%-77%)
303 - 368 = D	(more than 60%-70%)
Less than 303 = F	

General Course Objectives:

This course will take the place of a high school chemistry course for a curriculum at MCCC that requires such a course for entrance. You must therefore learn the technical terms and the principles that will be used in courses in Nursing, Mortuary Science, Fire Science etc. that have to do with chemistry.

This course, then, will be helpful to students taking the chemistry courses in the Nursing programs, or taking CHE 101, General Chemistry. Since CHE 100 is a fundamental science course, it will be helpful if you take such courses as BIO 101 or PHY 101 (biology or physics).

Introductory Chemistry is not an adequate course in the physical sciences for a student majoring in art, business, the liberal arts, or other areas.

Specific Course Objectives:

1. Define Chemistry, give its two major subdivisions, and define those subdivisions, describe the other subdivisions of chemistry, define matter.
2. Describe what each of the following societies or individuals had to do with the history of chemistry:

Ancient Egyptians, Ancient Greeks, Alchemists,
Robert Boyle, Antoine Lavoisier, Neils Bohr,
Albert Einstein.

3. Know the four steps in the scientific method and define and differentiate between an observation, a hypothesis, a theory, and a scientific law.
4. Define and differentiate between qualitative measurements and quantitative measurements; give examples of each.
5. Know and describe the 3 parts of a measurement.
6. Define and contrast accuracy and precision.
7. Define the term significant digits and, given a measurement, state the number of significant digits in the number. (Know and use the rules for significant digits.)
8. Define and give at least 3 examples of fundamental quantities and derived quantities.
9. Use the technique for rounding off numbers.
10. Use the rules for keeping the proper number of significant digits in the answer when doing a calculation involving multiplication and/or division; and when doing a calculation involving addition or subtraction.
11. For a number written in Scientific Notation, identify its parts (the coefficient and the order of magnitude) and be able to convert a number from the way it is normally written (decimal notation) to scientific notation or from scientific notation to decimal notation.
12. Define length, mass, weight, and volume and state the difference between mass and weight.
13. Know the metric units and measuring device for length and mass.
14. Know the metric units for volume (cm^3 , ml and L) and convert between them.
15. Define and convert between metric units with prefixes milli, centi, deci, and kilo, and give examples of objects of these sizes.
16. Know what unit factors are, how to make them, and be able to use them when solving problems and when converting between different units.
17. Define temperature, Fahrenheit, Celsius, and Kelvin temperatures, and use the formulas for conversion between Fahrenheit and Celsius. Be able to tell if a temperature is cold, room temperature, hot or very hot in each system. Be able to list the Freezing point and melting point of water, room temperature, and body temperature in both Fahrenheit and Celsius.

18. Define heat, calorie, Calorie, kilocalorie, joule and specific heat.
19. Define density, know the formula for density ($D=M/V$), be able to calculate density, know how a change in M or V affects D, and tell which substance will float or sink in a liquid and why. Define specific gravity and state how it is related to density.
20. Define physical properties, give 6 examples, and identify physical properties of a substance.
21. Define and describe the four physical states of matter, including in the description volume and shape, attraction between, motion of, and distance between the elementary particles in that state, and identify the state of a substance.
22. Identify and define the various types of matter (pure, compound, element mixture, homogeneous, heterogeneous, phases of mixture, substance) and give examples.
23. Define chemical properties, give 6 examples and identify the chemical properties of a substance.
24. Describe and differentiate between physical and chemical properties and physical and chemical changes, and identify which occur during an event.
25. Define energy, potential energy, kinetic energy, heat energy, chemical potential energy, and, in a particular situation, identify energy as either potential or kinetic, and describe how these are related to chemical or physical changes.
26. State the law of conservation of matter and the law of conservation of energy, give examples of where and how these laws are important, and how this is related to chemical changes. Describe the roles of Lavoisier and Einstein with respect to these laws.
27. Define an element, give examples, identify them from a list of choices, and state how elements are related to atoms.
28. List (not necessarily in order) the 6 most common elements in the human body, and the 4 most common elements in the earth's crust.
29. Define and identify the symbol for an element, given the name of an element write the symbol and given a symbol, write the name for selected elements (from lecture).
30. Define, differentiate between, and give examples of compounds, ionic compounds, molecular compounds, ions, cations, anions, and molecules. State what type of bond

- holds different types of compounds together, and which type of elements form which kind of compound.
31. State how an element, compound, and mixture differ; identify something as a compound, mixture, or element.
 32. Calculate the % of a component in a mixture, or the amount of a component in a mixture given its percent.
 33. Define chemical formula and subscript, given a formula, state the elements involved and how many atoms of each element; also use parenthesis in formulas.
 34. Know the classes of elements and properties of each class; where they are located in the periodic table, which elements are gaseous at room temperature, which are diatomic, which elements are monatomic gasses, and what the terms diatomic and monatomic mean.
 35. Define a binary compound; give examples; given a formula, identify it as binary or not, and give its name (if binary).
 36. Define a chemical equation (reaction), define and identify reactants, products, coefficients; given the reactants and products, balance a chemical equation, state the coefficient on each formula in a chemical equation.
 37. State the name, charge, relative mass, and location in an atom of the three types of sub-atomic particles in an atom.
 38. Define atomic number, state how it is related to the sub-atomic particles in an atom, and how it is related to different atoms.
 39. Describe the arrangement of the periodic table and note the placement and importance of families or groups, periods, A and B subgroups, alkali metals, Halogens, Noble Gasses, metals, non-metals, semi-metals, Transition metals, and Representative elements.
 40. For the representative elements, from their position on the periodic table, give the correct formula for a binary compound.
 41. Describe Rutherford's picture of an atom in detail.
 42. Describe Bohr's theory of atomic structure. Define energy levels and orbits and relate them to Bohr's theory.
 43. Describe the quantum mechanical theory of the structure of the atom, and how this differs from the Bohr structure. Define energy levels.

44. Describe electron structure, define Principal Quantum Shell and state what each represents. State how many electrons the Principal Quantum Shell can hold, and define valence shell.
45. Define orbitals; state where they are located, how each is designated, how they are related to principal quantum levels, how many electrons each can contain, and how they are related to energy levels.
46. State what importance sub-orbitals have and how many electrons a sub-orbital can hold; draw and describe the s and p sub-orbitals.
47. Given a periodic table, give the electronic structure (or electron configuration) for an element. Give the Valence Configuration for an element.
48. State what is special about the Noble Gasses and why, with respect to their electron configuration. Define stability.
49. Define atomic weight, mass number, atomic number and isotopes and state how they are related. Given a periodic table, give the atomic number or atomic weight of any element. Relate these concepts to the subatomic particles that are contained in a specific atom.
50. Describe how and why the size of the atoms changes in relation to their position on the period table. Given a list of elements, state which will have a larger or smaller atom.
51. Describe in detail how the periodic table is related to electron structure.
52. Define ionization and ionization energy and state how and why the ease of ionization changes in relation to an elements' position in the periodic table. Given a list of elements, state which will be easier or harder to ionize, and which will have the higher (or lower) ionization energy.
53. Define electron affinity, state how it is related to ionization and to the electronic structure of an atom.
54. State the octet rule; given a periodic table, tell which elements gain and which elements lose electrons to complete their octets; state what happens to an atom when it completes its octet.
55. Use the octet rule to give the charge on the monatomic ion for any representative element.
56. Describe ionic bonding, including what type of elements form this bond, how the electrons are involved, and the

- nature of the attractive force. Give the properties of ionic compounds.
57. Draw Lewis Dot structures for elements, ionic compounds, and simple covalent compounds (such as water, ammonia, carbon dioxide, methane, HCl). Relate Lewis Dot structures to valence electron configuration and the octet rule.
 58. Determine the correct formula for an ionic compound, given the elements or polyatomic ions involved.
 59. Describe covalent bonding including what type of elements form this bond, how the electrons are involved, and the nature of the attractive force - describe a bonding orbital, how it is made and how many electrons it contains. Describe a single, double, and triple bond. Give the properties of covalent compounds.
 60. Define electronegativity, state which element is most and which is least electronegative and where they are on the periodic table. Given a list, select the most and least electronegative elements. Tell how electronegativity is related to bonding, bond type, and polarity of a molecule or polarity of a bond. List the four most electronegative elements in order.
 61. Define a polar molecule and a polar bond; given a series of binary compounds, decide which is most or least polar. State why H₂O or NH₃ are polar and CO₂ or CH₄ are not; state what elements are involved in non-polar bonds.
 62. Define polyatomic ion. State the name, formula and charge of selected polyatomic ions (sulfate, sulfite, nitrate, carbonate, phosphate, cyanide, hypochlorite, hydroxide, bicarbonate, and ammonium).
 63. Define oxidation number and state how it relates to the charge of an ion. Given a periodic table, give the oxidation number for any representative element alone or as part of any compound. Give examples of elements that can have more than one oxidation state. Give the formula and oxidation numbers of selected elements that have more than one oxidation state (Cu, Fe, Sn, Pb, Hg).
 64. Given the elements or ions involved in a compound, give the correct formula of that compound.
 65. Given the formula for any of the following types of compounds, give the correct chemical name for that compound, and given the name, give the correct formula. Binary - metal and non-metal, i.e., PbCl₄, FeCl₃, Binary - 2 non-metals, i.e., CO₂, SO₂, SO₃, P₂O₅, Binary - with hydrogen cation, i.e., HCl, HBr, Ternary - oxy-acids, i.e., H₂SO₄, HNO₃, H₂CO₃, Ternary - bases (hydroxides), Ternary - metal and polyatomic anion.

66. Define a salt; given an acid or base, give examples of its salts; given a salt, name the corresponding acid. Define neutralization reaction.
67. Define a mole in terms of atoms or molecules, and grams of a substance.
68. Given a number of moles, using unit factors, calculate a number of atoms or molecules; given a number of atoms or molecules, calculate a number of moles.
69. Given a number of grams of an element or compound, calculate (using unit factors) the number of moles. Given a number of moles of an element or compound, calculate the number of grams.
70. Given a number of grams, calculate using unit factors a number of molecules or atoms.
71. Given a name or formula of a compound, calculate the formula weight of that compound.
72. Given a formula or name of a compound, calculate the percent composition. Given 2 or more compounds that all contain a particular element, indicate which has the largest or smallest % of that element.
73. Define empirical formula; describe its relation to and difference from molecular formula.
74. Define chemical equation and balanced equation. Given a chemical equation, identify the reactants, products, and coefficients, and balance the equation.
75. Given the reactants only, give the 3 steps in completing and balancing a chemical equation, and complete and balance the equation.
76. Describe a synthesis reaction, give examples of the 4 types of synthesis reactions (metal and non-metal, element and oxygen, water and metal oxide, water and non-metal oxide), complete and balance all these types of reactions.
77. Describe decomposition reactions, give examples and complete and balance this type of reaction.
78. Describe single displacement reactions and give examples. Define and describe the activity series and how this relates to single displacement reaction. Give examples of common metals more or less active than iron. Define oxidation and reduction, state how this relates to reactions and give examples. Complete and balance single displacement reactions.

79. Describe double displacement reactions, complete and balance them. Define and describe a neutralization reaction, give the general formula for a neutralization reaction, complete and balance neutralization reactions.
80. Tell why chemical reactions occur, define exothermic and endothermic reactions and give examples of each.
81. Identify a reaction as a combustion reaction; state the products in combustion of a hydrocarbon, and given only the reactants, complete and balance a combustion reaction.
82. Given a balanced reaction, give all the mole ratios (unit factors) for that reaction, and tell which are used to calculate moles of one substance from moles of another.
83. Given a balanced reaction, and (for one compound in the reaction) a number of moles of a compound, calculate the moles of all other compounds used or produced. (Perform mole - mole calculations from balanced chemical equations).
84. Given a mass (or moles) of one participant in a balanced reaction, calculate the mass (or moles) of all other substances used or produced in the reaction.
85. Define stoichiometry.
86. Define evaporation, heat of vaporization, boiling point, heat of fusion, freezing, sublimation, condensation. State which processes are exothermic and which are endothermic.
87. State how water differs from H_2S , H_2Se , H_2Te and why. Define hydrogen bonding, what elements are involved in hydrogen bonding, and how hydrogen bonding affects the physical properties of water.
88. Write a reaction for the formation of water from its elements, the electrolysis of water, the reaction of a metal oxide or non-metal oxide with water. List 3 non-metal oxides in Acid Rain, and where they come from.
89. Define a hydrate; given a hydrate, write the balanced decomposition reaction for its dehydration. Define anhydrous salt.
90. Describe ozone; give its formula, state how it is formed, how it is destroyed, why it is important, where it is pollution, where it is not pollution, and why.
91. Define and identify solution, solute and solvent, give examples.

92. Define concentration, dilute, concentrated, unsaturated, saturated, supersaturated, miscible, immiscible.
93. Describe (generally) why things dissolve in water (and why things do not dissolve in water), what affects the amount that dissolves, and how fast things dissolve.
94. Define molarity and molar solution, given a volume of solution and moles of solute or grams of solute, calculate molarity. Given molarity and a volume, calculate moles of solute.
95. Define percent by weight, given a mass of solute and solvent (or solution), calculate the percent concentration, define a weight/volume percent, calculate a weight/volume percent define a volume/volume percent.
96. Define PPM (parts per million); give examples of things measured in PPM. Given the mass of solute and solvent, calculate a concentration of PPM.
97. Know and be able to use the formula $M_1V_1=M_2V_2$ to solve dilution problems.
98. Define, describe, and explain colligative properties, osmosis, diffusion, and osmotic pressure, including examples.

Self-Instructional Program Textbook

"Chemical Problem-Solving by Dimensional Analysis"

By Loebel, Arnold B.

This book is in the library on reserve under Professor Dorneman's name.

DO NOT WRITE IN THE TEXTBOOK!

This is a programmed textbook, that is, it leads you through a section of material and requires you to answer questions on the material as you proceed. It takes you through a particular type of problem in a step-by-step manner, asking questions that you will answer and checking your answers at every step.

This book does not do everything exactly as done in lecture, but they are done in a very similar fashion. The major difference is in terminology. Specifically, what our course calls unit factors, this book calls conversion factors and what this book calls gram molecular weight (or gram atomic weight) our course shortens to molecular weight (or atomic weight).

The sections of this book are independent and can be used if you are having problems with a specific topic or need review.

<u>Specific Topic</u>	<u>Chapter</u>	<u>Section</u>
Scientific Notation	1	A
Significant Figures	1	C
Rounding Off Numbers	1	C
Metric System	3	A
Unit Factors	2	A, B
	4	A
Temperature Scales and Conversions	3	C
Density Calculations	4	A
Per centages	4	C
Balancing Chemical Equations	8	A
Oxidation Numbers	8	C
Nomenclature(skip meta, ortho, pyro)	9	A, C D, F
Salts of Acids	9	F
Mole, Avogadro's Number, and Mass Calculations	5	C
Mole Ratios and Calculations from Chemical Equations	10	A, B
Molarity	14	A
Weight %	4	C
Dilution	14	D

GRADE RECORD CHART

QUIZZES	TESTS
Quiz 1 _____	Test 1 _____
Quiz 2 _____	Test 2 _____
Quiz 3 _____	Test 3 _____
Quiz 4 _____	Test 4 _____
Quiz 5 _____	
Quiz 6 _____	
Quiz 7 _____	ATTENDANCE
Quiz 8 _____	Dates Missed:
Quiz 9 _____	_____
Quiz.10 _____	_____
Quiz 11 _____	_____
Quiz 12 _____	
Quiz 13 _____	
Quiz 14 _____	BONUS
Quiz 15 _____	_____
Quiz 16 _____	_____
Quiz 17 _____	_____

Mid-semester evaluation - Calculate the percentage of points that you have acquired to date and compare that to the chart below.

To do this, calculate your points, then calculate the total points possible, then calculate the percentage.

(total your quiz scores) + (your score on the first exam) = your points

(amount of quizzes given to date x 10) + 100 = total points possible

$$\% = \frac{\text{your points}}{\text{total points possible}} \times 100$$

91% - 100% = A

81% - 90.9% = B

70% - 80.9% = C

60% - 69.9% = D

Final Course Grade - See the directions on pages 2 and 3 of this Course Outline

