SPRINGFIELD TECHNICAL COMMUNITY COLLEGE

ACADEMIC AFFAIRS

Course Number: CHEM 101 Department: Chemistry

Course Title: Survey of Chemistry 1 Semester: Spring Year: 1997

Objectives/Competencies

Course Objective	Competencies
1. Understand and apply the rules for significant figures. 2. Develop good problem-solving skills. 3. Identify metric and metric-English equivalencies. 4. Define density. 5. Solve problems involving density, unit conversions, or temperature conversions. 6. Classify matter according to physical state, composition, or metallic properties. 7. Classify properties and changes of matter. 8. Interpret symbols and formulas. 9. Describe the structure of an atom. 10. Recognize isotopic forms of elements. 11. Understand and apply the mole concept. 12. Calculate empirical formula, molecular formula, and per cent composition. 13. Write, balance, and interpret chemical equations. 14. Perform stoichrometric calculations. 15. Describe the quantum mechanical model of the atom.	1. Express any number in scientific notation. 2. Find the number of significant figures in a measurement. 3. Express answers to calculations to the proper number of significant figures. 4. Set up and solve problems utilizing the method of dimensional analysis (factor-label method). 5. Convert from a metric unit to the corresponding English unit using the factor-unit method. 6. Convert from an English unit to the corresponding metric unit using the factor-unit method. 7. Make temperature conversions among Fahrenheit, Celsius, and Kelvin scales. 8. Differentiate between heat and temperature. 9. Calculate the density, mass, or volume of an object from the appropriate data. 10. Identify the three physical states of matter. 11. Distinguish between the physical and chemical properties of matter.

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16. Write electron configurations and electron-dot formulas. 17. Interpret the periodic chart. 18. Use the periodic chart to predict trends in metallic properties, atomic size, and ionization energy. 19. Understand the concept of bonding. 20. Predict and illustrate bonding types. 21. Understand the gas laws. 22. Use the gas laws to solve problems. 23. Understand the properties of solutions. 24. Calculate solution concentrations. 25. Understand the concept of acids and bases.	12. Classify changes undergone by matter as either physical or chemical. 13. Classify common materials as elements, compounds, or mixtures. 14. Write the symbols when given the names or write the names when given the symbols, of the common elements. 15. Understand how symbols, including subscripts and parentheses, are used to write chemical formulas. 16. Differentiate among atoms, molecules, and ions. 17. List the characteristics of metals, nonmetals, and metalloids. 18. Give the names, symbols, and relative masses of the three principal sub-atomic particles. 19. Describe the atom as conceived by Ernest Rutherford after his alpha-scattering experiment. 20. Find the number of protons, electrons, and neutrons in an atom of an element. 21. Determine the number of protons, neutrons, and electrons from the atomic number and atomic mass of an atom. 22. Explain what isotopes are and give examples. 23. Use the standard isotopic notation for mass number and atomic number. 24. Determine the atomic number, mass number, or number of neutrons of an isotope when given the values of any two of these three items. 25. Explain the meaning of the mole. 26. Calculate the number of moles in a sample of an element

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	when you are given the mass of the sample. 27. Calculate the mass, in grams, of a sample of an element when you are given the number of moles. 28. Determine the molar mass of a compound from the formula. 29. Calculate the number of moles in a sample of a compound when you are given the mass of the sample. 30. Calculate the mass, in grams, of a sample of a compound when you are given the number of moles. 31. Calculate the percent composition of a compound from its formula. 32. Calculate the percent composition of a compound from experimental data on combining masses. 33. Calculate the empirical formula of a compound when you are given its percentage composition. 34. Calculate the molecular formula of a compound from its percent composition and molar mass. 35. Know the format used in setting up chemical equations. 36. Recognize the various symbols commonly used in writing chemical equations. 37. Balance simple chemical equations. 38. Interpret a balanced equation in terms of the relative numbers or amounts of molecules, atoms, grams, or moles of each substance represented. 39. Write mole ratios for any two substances involved in chemical reactions. 40. Outline the mole or mole-ratio method for making

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	stoichiometric calculations. 41. Calculate the number of moles of a desired substance obtainable from a given number of moles of a starting substance in a chemical reaction (mole-to-mole calculations). 42. Calculate the mass of a desired substance obtainable from a given number of moles of a starting substance in a chemical reaction, and vice versa (mole-to-mass and mass-to-mole calculations). 43. Calculate the mass of a desired substance involved in a chemical reaction from a given mass of a starting substance (mass-to-mass calculation). 44. Describe the atom as conceived by Niels Bohr. 45. Describe what is meant by an electron orbital. 46. Determine the maximum number of electrons that can exist in the principal energy levels and sub levels. 47. Write the electron configuration for any of the first 56 elements. 48. Explain what is represented by the Lewis-dot (electron-dot) structure of an element. 49. Write the Lewis-dot (electron-dot) symbols for the first twenty elements. 50. Understand the basis for the octet rule. 51. Indicate the locations of the metals, nonmetals, metalloids, and noble gases in the periodic table. 52. Indicate in the periodic table the areas where the *s, p, d,* and *f* orbitals are being filled.

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	53. Describe how atomic radii vary (a) from left to right in a period, and (b) from top to bottom in a group. 54. Describe how the ionization energies of the elements vary with respect to (a) the position in the periodic table and (b) the removal of successive electrons. 55. Predict trends for properties such as atomic radium, ionization potential, and electron affinity. 56. Determine the number of valence electrons in any atom for any Group A element. 57. Distinguish between representative elements and transition elements. 58. Write Lewis-dot symbols for the representative elements from their position in the periodic table. 59. Describe (a) the formation of ions by electron transfer and (b) the nature of the chemical bond formed by electron transfer. 60. Show by means of Lewis-dot structures the formation of an ionic compound from atoms. 61. Describe the covalent bond and predict whether a given covalent bond would be polar or non polar. 62. Write electron-dot structures for various covalent compounds. 63. Describe the changes in electronegativity in (l) moving across a period and (2) moving down a group in the periodic table. 64. Predict formulas of simple compounds formed between the representative (Group A) elements using the periodic

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	table. 65. Describe the effect of electronegativity on the type of chemical bonds in a compound. 66. Describe the difference between polar and non polar bonds. 67. Distinguish clearly between ionic and molecular substances. 68. Predict whether the bonding in a compound will be primarily ionic or covalent. 69. Convert pressures in atmospheres to pressures in torr, and vice versa. 70. Use Boyle's Law to calculate changes in pressure and volume at constant temperature. 71. Use Charles's Law to calculate changes in temperature and volume at constant temperature. 72. Use the Combined Gas Law to calculate changes in temperature, pressure or volume. 73. Use the Ideal Gas Law to calculate the pressure, volume, temperature, or number of moles of a gas when you are given the other three. 74. Define the terms solution, solute, and solvent. 75. Calculate the normality, number of equivalents, or volume of a solution when you are given the other two quantities. 76. Calculate the molarity of a solution from the volume and the mass, or moles, of solute. 77. Calculate the mass of a substance necessary to prepare a

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	solution of specified volume and molarity. 78. Determine the resulting molarity in a typical dilution problem. 79. Define the terms acid and base in the way Arrhenius did. 80. List the important characteristics of acids and bases. 81. Write equations for important chemical reactions of acids and bases. 82. Define the term titration. 83. Understand the process of acid-base neutralization. 84. Calculate the molarity, normality, or volume of an acid or base solution from appropriate titration data. 85. Understand pH as an expression of hydrogen ion concentration or hydronium ion concentration.