Elements of General Chemistry

A community college course infused with Middle Eastern history/content

By: Amir Meraban
Physical Sciences and Engineering Faculty
Chandler-Gilbert Community College, Arizona

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Course/Project Description:

Elements of general chemistry for all students. You will be required to use both chemical notations and mathematical formalisms to solve a large variety of problems. Historical Middle Eastern literature and respective critical thinking exercises are also embedded in the curriculum to promote understanding and retention of the course content as well as awareness of the roles international predecessors have played in our scientific advancements. By the end of the course you should be able to use chemical notations and terminology to discuss matter, energy, stoichiometry, electronic structure, solids, liquids, gases, solutions, and acids/bases.

Weekly Outline

Unit I

Week 1

Required Readings
• Chapter 1 and 3.1-4 [Corwin, C. H. (2014). *Introductory chemistry: concepts and connections* (7th ed.). Upper Saddle River, NJ: Prentice Hall.]

Assessments
• Instructor's Discretion

Week 2

Required Readings
• Chapter 2.5, 4.1-5, and 5.1-4 (Corwin, 2014)
• Thesis II [Ibn Sina (Avicenna). *The Canon of Medicine*. 5 Vols. Translated by Laleh Bakhtiar. Chicago: Great Books of the Islamic World, 2012. Retrieved from https://archive.org/details/CanonOfMedicine/mode/2up)

Assessments
• Homework 1 (See Appendix A)
• Discussion 1 (See Appendix B)

Week 3

Required Readings
• Chapter 4.6-11 and 5.6-10 (Corwin, 2014)

Assessments
• Homework 2 (See Appendix A)

Week 4

Required Readings
• Chapter 3.5, 12.1-7, 12.10 (Corwin, 2014)

Assessments
• Homework 3 (See Appendix A)
• Unit I Exam

Unit II

Week 5

Required Readings
• Chapter 6 and PSS.1-7 (Corwin, 2014)
• Chapter XIII [Al-Biruni. *Alberuni's India: An account of the religion, philosophy, literature, geography, chronology, astronomy, customs, laws and astrology of India about A.D. 1030* (Vol. 2). Translated by Edward Sachau. London: Kegan Paul, Trench, Trubner & Co., 1910.]

Assessments
• Homework 4 (See Appendix A)
• Discussion 2 (See Appendix B)

Week 6

Required Readings
• Chapter 3.6-10 and 7.1-6 (Corwin, 2014)

Assessments
• Homework 5 (See Appendix A)

Week 7

Required Readings
• Chapter 2.1-10, 7.7-8, and 17.1-2 (Corwin, 2014)

Assessments
• Homework 6 (See Appendix A)

Week 8
Required Readings
• Chapter 7.9-11 (Corwin, 2014)

Assessments
• Unit II Exam

Unit III

Week 9

Required Readings
• Chapter 8.1-4 and 9.1-4 (Corwin, 2014)

Assessments
• Homework 7 (See Appendix A)

Week 10

Required Readings
• Chapter 13.3-11 (Corwin, 2014)

Assessments
• Homework 8 (See Appendix A)

Week 11

Required Readings
• Chapter 8.5-6, 9.5-9, 10, and 13.1 (Corwin, 2014)

Assessments
• Homework 9 (See Appendix A)

Week 12

Required Readings
• Chapter 8.7-9 (Corwin, 2014)

Assessments

• Instructor's Discretion

Week 13

Required Readings
• Student's Discretion

Assessments
• Unit III Exam

Unit IV

Week 14

Required Readings
• Chapter 11, 13.2, and 14 [Corwin, C. H. (2014). *Introductory chemistry: concepts and connections* (7th ed.). Upper Saddle River, NJ: Prentice Hall.]
• Chapter 4 [Ahmad ibn Mir Munshi al-Husaini. *Calligraphers and painters; a treatise by Qadi Ahmad, son of Mir-Munshi* (Vol. 3). Translated by Vladimir Minorsky. Maryland: The Lord Baltimore Press Inc., 1959. Retrieved from https://archive.org/details/calligrapherspa321959ahma/page/174/mode/2up]
Assessments
• Homework 10 (See Appendix A)
• Discussion 3 (See Appendix B)

Week 15

Required Readings
• Chapter 16.1-5 [Corwin, C. H. (2014). *Introductory chemistry: concepts and connections* (7th ed.). Upper Saddle River, NJ: Prentice Hall.]

Assessments
• Homework 11 (See Appendix A)

Week 16

Required Readings
• Student's Discretion

Assessments
• Final Exam
• Paper (See Appendix C)

Appendices

Appendix A

Homework 1
- Chapter 4 Exercises (Dalton: 1; Thompson: 5, 7; Rutherford: 11, 15; Atomic Notation: 17, 21; Atomic Mass: 25, 31 ,33)
- Chapter 5 (Periodic Law: 5, 7; Groups and Periods: 9, 13, 15, 17, 21, 25; Periodic Trends: 29, 31, 33, 35)

Homework 2

- Chapter 4 Exercises (Wave Nature of Light: 37, 39, 41; Quantum: 47, 49; Bohr: 53, 55, 57, 59, 63; Energy Levels: 65, 67, 69; Electron Configuration: 73, 75, 77; Quantum Model Atom: 79, 81, 83, 85; General Exercises: 87, 91; Challenge: 93)
- Chapter 5 Exercises (Properties of Elements: 37, 41, 45; Blocks of Elements: 47, 49, 53, 55; Valence Electrons: 59; Ionization Energy: 63, 65, 67, 69; Ionic Charges: 73, 75, 77, 79)

Homework 3

- Chapter 12 Exercises (Bond Concept: 1, 3, 5; Ionic Bond: 11, 13, 15, 17, 19, 25, 27 ; Covalent Bonds: 29, 31; Polar Covalent Bonds: 45, 49, 51, 53; NonPolar Covalent Bonds: 55, 57; Hydrogen Bonding: 69; Electron Dot Formulas Molecules: 33, 35; Electron Dot Formulas of Polyatomic Ions: 41, 43; Shapes of Molecules: 73, 77; Challenge: Provide Lewis Structure/VSEPR Shape for XeO2)

Homework 4

- Chapter 6 Exercises (Classification of Compounds: 1; Monatomic Ions: 5, 7, 9, 13; Polyatomic Ions: 15, 17; Binary/Ternary Ionic Formulas: 19, 21; Binary/Ternary Ionic Names: 25, 27, 29, 33, 35, 37, 39; Binary Molecular: 45, 47; Binary Acids: 49; Ternary Oxyacids: 51, 53, 55; General Exercises: 71)
- PSS Exercises (Measurements and Uncertainty: 1, 5, 7; Significant Figures: 13; Rounding: 15, 45; Math and Rounding: 21, 25, 47, 51, 53; Exponential/Scientific: 27, 31, 35, 37)

Homework 5

- Chapter 7 Exercises (Evidence for Chemical Reactions: 1, 3; Writing Chemical Equations: 7, 13; Balancing Chemical Reactions: 17; Classifying Chemical Reactions: 21; Combination Reactions: 25, 35; Decomposition Reactions: 37, 45; The Activity Series Concept: 47; Single Replacement Reactions: 53, 61)

Homework 6

- Chapter 2 Exercises (Basic Units and Symbols: 3, 7; Metric Conversion Factors: 13; Metric-Metric Conversions: 17; Metric-English Conversions: 21, 23, 25, 75, 81, 83, 87, 93; Percent Concept: 29, 31; Volume by Calculation: 35, 41; Volume by Displacement: 43; Density Concept: 47, 53, 57; Temperature: 59, 61, 63; Heat Concept: 67, 69, 71)
- Chapter 7 Exercises (Solubility Rules: 67, 69; Double Replacement Reactions: 71, 73; Neutralization Reactions: 75, 77; General Exercises: 79, 85)
- Chapter 17 Exercises (Oxidation numbers: 3, 7; Oxidation-Reduction Reactions: 9, 11, 13, 18)

Homework 7

- Chapter 8 Exercises (Avogadro’s Number: 3; Mole Calculations I: 9, 11; Molar Mass: 13, 15; Mole Calculations II: 17, 19, 21)
- Chapter 9 Exercises (Interpreting a Chemical Equation: 1a, 5; Mole-Mole Relationships: 7, 11; Types of Stoichiometry Problems: 13, 15; Mass-Mass Problems: 19, 27)

Homework 8

- Chapter 13 Exercises (Solids in Solution: 17; The Dissolving Process: 23; Mass/Mass Percent Concentration: 43; Molar Concentration: 55, 57, 59; Dilution: 67; Solution Stoichiometry: 69)

Homework 9

- Chapter 8 Exercises (Percent Composition: 39, 41; Empirical Formula: 47, 49, 53; Molecular Formula: 59, 65)
- Chapter 9 Exercises (The Limiting Reactant Concept: 49; Limiting Reactant Problems: 59, 65; Percent Yield: 75)
- Chapter 10 Exercises (Properties of Gases: 1; Atmospheric Pressure: 7; Variables Affecting Gas Pressure: 9, 11; Combined Gas Law: 33, 37; Vapor Pressure Concept: 43; Ideal Gas Behavior: 55; Ideal Gas Law: 63)

Homework 10

- Chapter 11 Exercises (Properties of Liquids: 1; Structure of Water: 49l Physical Properties of Water: 53, 55)
- Chapter 13 Exercises (Gases in Solution: 1; Liquids in Solution: 9, 11, 13)
- Chapter 14 Exercises (Properties of Acids and Bases: 3; Arrhenius Acids and Bases: 7, 11; Bronsted-Lowry Acids and Bases: 15, 19; Acid Base Titrations: 27; Ionization of Water: 45; The pH Concept: 49, 51, 57; Strong and Weak Electrolytes: 61, 63, 65, 69; Net Ionic Equations: 73)

Homework 11

- Chapter 16 Exercises (Collision Theory: 1, 5, ; Energy Profiles of Chemical Reactions: 11; General Equilibrium Constant, Keq: 25; Equilibria Shifts for Gases: 31)

Appendix B

Sample Discussion Prompt 1:
Please construct 3 multiple choice questions based on your evaluation of the main points presented in this week's historical Middle Eastern literature for your classmates to complete.
The initial posting should be your response to the above prompts. Please make sure to reply to at least two of your classmates' original posts, tying in the respective course lecture content to address the questions. Remember: the more effort you put into the discussion, the richer and more valuable your learning experience will be.

Sample Discussion Prompt 2:
Discuss how the content presented in this week's historical Middle Eastern literature broke ground for the respective course lecture content as well as how the lecture content makes sense of the historically observed phenomena.
The initial posting should be your response to the above prompts. Please make sure to reply to at least two of your classmates' original posts. Remember: the more effort you put into the discussion, the richer and more valuable your learning experience will be.

Appendix C

Sample Paper Prompt:
In the context of content presented in the lectures, describe the types of changes that our scientific thought and ideologies have undergone in the past few centuries. Discuss why and how these advancements are mad and the importance of diversity and global connectedness (both between countries as well as time periods) in these processes. Based on these implications, describe what you envision as the future of scientific thought and ideologies looking and what we can expect from them.

Assignments have a page limit of three pages and should be typed in 12-point font, single line space, with one-inch margins on all sides. Page limits have been carefully set to allow the amount of space needed to fulfill the assignment. If they seem too short, it is likely that your ideas are not as clear as they should be.

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