



# GACE® Chemistry Assessment Test I (028) Curriculum Crosswalk

## Required Coursework Numbers

<b>Subarea I. Scientific Inquiry, Processes, Technology, and Society (32%)</b>																			
<i>Objective 1: Understands scientific inquiry and technology, and the relationship to society and the environment</i>																			
A. Understands the processes involved in scientific inquiry																			
• Formulating problems																			
• Forming and testing hypotheses																			
• Development of theories, models, postulates, assumptions, and laws																			
• Process skills, including observing, concluding, comparing, inferring, categorizing, and generalizing																			
B. Understands experimental design																			
• Testing hypotheses																			
• Significance of controls																			
• Use and identification of variables																			
• Data collection planning																			
C. Understands the nature of scientific knowledge																			
• Subject to change																			
• Consistent with experimental evidence																			
• Reproducibility																			

## Required Coursework Numbers

<ul style="list-style-type: none"> <li>Unifying concepts and processes, including systems, models, constancy and change, equilibrium, and form and function</li> </ul>																
<ul style="list-style-type: none"> <li>Communicating experimental findings</li> </ul>																
<ul style="list-style-type: none"> <li>Undergoes peer review</li> </ul>																
D. Understands the major historical developments in chemistry and the contributions of major historical figures																
<ul style="list-style-type: none"> <li>How current chemical principles and models developed over time</li> </ul>																
<ul style="list-style-type: none"> <li>Major developments in chemistry such as the atomic model and gas laws, including major historical figures</li> </ul>																
E. Understands the impact of chemistry and technology on the environment																
<ul style="list-style-type: none"> <li>Acid rain</li> </ul>																
<ul style="list-style-type: none"> <li>Air and water pollution</li> </ul>																
<ul style="list-style-type: none"> <li>Greenhouse gases</li> </ul>																
<ul style="list-style-type: none"> <li>Ozone layer depletion</li> </ul>																
<ul style="list-style-type: none"> <li>Waste disposal and recycling</li> </ul>																
<ul style="list-style-type: none"> <li>Green chemistry</li> </ul>																
F. Understands applications of chemistry in daily life																
<ul style="list-style-type: none"> <li>Plastics, soaps, batteries, fuel cells, and other consumer products</li> </ul>																
<ul style="list-style-type: none"> <li>Water purification</li> </ul>																
<ul style="list-style-type: none"> <li>Chemical properties of household products</li> </ul>																

## Required Coursework Numbers

<ul style="list-style-type: none"> <li>Pharmaceuticals</li> </ul>															
<ul style="list-style-type: none"> <li>Medical imaging</li> </ul>															
G. Understands the advantages and disadvantages associated with various types of energy production															
<ul style="list-style-type: none"> <li>Renewable and nonrenewable energy resources</li> </ul>															
<ul style="list-style-type: none"> <li>Conservation, recycling, and sustainability</li> </ul>															
<ul style="list-style-type: none"> <li>Pros and cons of power generation based on various sources, such as fossil and nuclear fuel, hydropower, wind power, solar power, and geothermal power</li> </ul>															
<i>Objective 2: Understands how to conduct laboratory processes, including the collection and analysis of data</i>															
A. Understands how to collect, evaluate, manipulate, interpret, and report data															
<ul style="list-style-type: none"> <li>Significant figures in collected data and calculations</li> </ul>															
<ul style="list-style-type: none"> <li>Organization and presentation of data</li> </ul>															
<ul style="list-style-type: none"> <li>Interpret and draw conclusions from data presented in tables, graphs, and charts</li> </ul>															
<ul style="list-style-type: none"> <li>Note trends in data and relationships between variables</li> </ul>															
<ul style="list-style-type: none"> <li>Make predictions and conclusions based on data</li> </ul>															
B. Understands units of measurement, notation systems, conversions, and mathematics used in chemistry															
<ul style="list-style-type: none"> <li>Standard units of measurement</li> </ul>															

## Required Coursework Numbers

• Unit conversion and dimensional analysis																	
• Scientific notation																	
• Measurement equipment																	
C. Understands basic error analysis																	
• Determining mean																	
• Accuracy and precision																	
• Identifying sources and effects of error																	
• Percent error																	
D. Understands the appropriate preparation, use, storage, and disposal of materials in the laboratory																	
• Appropriate use																	
• Safe disposal																	
• Appropriate storage																	
• Preparation for classroom use																	
• Safe procedures and safety precautions																	
E. Understands the appropriate use and need for maintenance and calibration of laboratory equipment																	
• Appropriate use																	
• Appropriate storage																	
• Maintenance																	
• Calibration																	
• Preparation for classroom use																	
• Safety procedures and precautions when using equipment																	

## Required Coursework Numbers

F. Understands safety procedures and precautions for the high school chemistry laboratory																			
<ul style="list-style-type: none"> <li>Location and use of standard safety equipment, such as eyewash stations and showers</li> </ul>																			
<ul style="list-style-type: none"> <li>Laboratory safety rules for students</li> </ul>																			
<ul style="list-style-type: none"> <li>Appropriate apparel and conduct in the laboratory, such as wearing goggles</li> </ul>																			
<ul style="list-style-type: none"> <li>Emergency procedures</li> </ul>																			
<b>Subarea II. Nature of Matter and Energy (40%)</b>																			
<i>Objective 1: Understands basic principles of matter and energy</i>																			
A. Understands the organization of matter																			
<ul style="list-style-type: none"> <li>Pure substances (elements and compounds)</li> </ul>																			
<ul style="list-style-type: none"> <li>Mixtures (homogeneous, heterogeneous, solutions, suspensions)</li> </ul>																			
<ul style="list-style-type: none"> <li>States of matter (solid, liquid, gas, plasma)</li> </ul>																			
<ul style="list-style-type: none"> <li>Atoms, ions, molecules</li> </ul>																			
B. Understands the differences between chemical and physical properties/changes																			
<ul style="list-style-type: none"> <li>Chemical versus physical properties</li> </ul>																			
<ul style="list-style-type: none"> <li>Chemical versus physical changes</li> </ul>																			
<ul style="list-style-type: none"> <li>Intensive versus extensive properties</li> </ul>																			
<ul style="list-style-type: none"> <li>Conservation of matter</li> </ul>																			

## Required Coursework Numbers

C. Understands different forms of energy and conservation of energy																		
• Kinetic and potential energy																		
• Chemical, electrical, electromagnetic, nuclear, and thermal energy																		
• Conversions between different forms of energy within chemical systems																		
• Law of conservation of energy																		
D. Understands kinetic molecular theory, including ideal gases																		
• Assumptions of the kinetic molecular theory																		
• Ideal gases and the ideal gas laws																		
• Ideal versus real gas behavior																		
<i>Objective 2: Understands the atomic model of matter</i>																		
A. Understands the current model of atomic structure																		
• Description of atomic model, including subatomic particles, orbitals/quantum numbers (energy levels and sublevels; s, p, d, ...)																		
• Experimental basis, including the gold foil experiment and spectral lines																		
• Isotopes (mass number, average atomic mass)																		
B. Understands the electron configuration of the elements based on the periodic table																		
• Aufbau principle, Hund's rule, Pauli exclusion principle																		

## Required Coursework Numbers

<ul style="list-style-type: none"> <li>Correlation between electron configuration and the periodic table</li> </ul>															
<ul style="list-style-type: none"> <li>Relationship between electron configuration and chemical and physical properties</li> </ul>															
C. Understands radioactivity															
<ul style="list-style-type: none"> <li>Characteristics of alpha particles, beta particles, and gamma radiation</li> </ul>															
<ul style="list-style-type: none"> <li>Radioactive decay processes</li> </ul>															
<ul style="list-style-type: none"> <li>Half-life</li> </ul>															
<ul style="list-style-type: none"> <li>Fission and fusion</li> </ul>															
<ul style="list-style-type: none"> <li>Balancing nuclear reactions and identifying products of nuclear reactions</li> </ul>															
D. Understands how the electronic absorption and emission spectra of elements are related to electron energy levels															
<ul style="list-style-type: none"> <li>Electronic energy transitions in atoms; e.g., ground state, excited states, emission/absorption of energy</li> </ul>															
<ul style="list-style-type: none"> <li>Energy of electronic absorption/emission spectral lines in various regions of the electromagnetic spectrum</li> </ul>															
<ul style="list-style-type: none"> <li>Relationship between energy, frequency, and wavelength</li> </ul>															
<i>Objective 3: Understands the basic principles of thermodynamics</i>															
A. Understands temperature, thermal energy, and heat capacity, including temperature scales, units of energy, and calculations involving these concepts															

## Required Coursework Numbers

• Temperature and temperature scales																	
• Thermal energy and units of energy																	
• Heat transfer																	
• Heat capacity and specific heat																	
• Calorimetry calculations																	
B. Understands concepts and calculations involving phase transitions between the various states of matter																	
• Phase transitions																	
• Phase diagrams (triple point)																	
• Heats of vaporization, fusion, and sublimation																	
• Heating curves																	
C. Understands the energetics of chemical reactions																	
• Exothermic and endothermic reactions																	
• Bond energy																	
• Hess's law																	
D. Understands how the laws of thermodynamics relate to chemical reactions and phase changes																	
• Laws of thermodynamics (first, second, third)																	
• Spontaneous processes and reversible processes																	
• Change in enthalpy and entropy in chemical/physical processes																	



## Required Coursework Numbers

<b>Subarea III. Nomenclature, Chemical Composition, and Bonding and Structure (28%)</b>																			
<i>Objective 1: Understands the nomenclature of compounds and their chemical composition</i>																			
A. Understands the systematic names and chemical formulas of simple inorganic compounds																			
• Binary compounds																			
• Acids, bases, and salts																			
• Hydrates																			
B. Understands the names of common organic compounds based on their functional groups																			
• Alkanes, alkenes, and alkynes																			
• Alcohols, ethers, ketones, aldehydes, amines																			
C. Understands the mole concept and how it applies to chemical composition																			
• Avogadro's number, molar mass, and mole conversions																			
• Calculation of empirical and molecular formulas																			
• Percent composition																			
<i>Objective 2: Understands various types of bonding, the structure of molecules, and intermolecular forces</i>																			
A. Understands types of bonds and their properties																			
• Relative bond lengths																			
• Relative bond strengths																			

## Required Coursework Numbers

• Covalent bonding																	
• Ionic bonding																	
• Metallic bonding																	
B. Understands structural formulas and molecular geometry (shape)																	
• Lewis structures, including formal charges																	
• Resonance structures																	
• Molecular geometry (shape and approximate bond angles)																	
• Polar and nonpolar molecules																	
C. Understands intermolecular interactions																	
• Hydrogen bonding																	
• London forces (instantaneous induced dipole-dipole)																	
• Dipole-dipole																	
• Dipole-induced dipole																	
D. Understands how bonding and molecular geometry correlate with physical properties																	
• Boiling points																	
• Melting points																	
• Solubility																	
• Equilibrium vapor pressure																	