SOUTH CAROLINA COURSE ALIGNMENT PROJECT
COLLEGE READINESS REFERENCE STANDARDS REPORT

INTRODUCTION

This report, prepared for the South Carolina Commission on Higher Education by the Educational Policy Improvement Center (EPIC), provides a list of college readiness reference standards to be used as part of the South Carolina Course Alignment Project (SC CAP). The purpose of these standards is to serve as a common reference point for the development of courses that align from high school to college in the curricular areas of English/language arts, mathematics, and science. It is important to note that the standards are not meant to supersede or to substitute for existing South Carolina curriculum standards, nor are they related to admissions requirements at individual postsecondary educational institutions in the state.

The college readiness reference standards contained in this report were identified through a process managed by curriculum experts at EPIC. First, high school and college instructors trained in curriculum development as well as national experts who served as curriculum consultants to the project reviewed the South Carolina Curriculum Standards and selected those that corresponded most closely with the college readiness standards. Next, these consultants added standards from the *Knowledge and Skills for University Success* (KSUS), a nationally recognized set of college readiness standards that represent a comprehensive statement of what postsecondary faculty expect in well-prepared students. Finally, cross-disciplinary key cognitive and foundational skills derived from the work of Dr. David Conley, founder and director of the Center for Educational Policy Research (CEPR) and founder and chief executive officer of EPIC, were also included.

The list of college readiness reference standards was submitted to the South Carolina Commission on Higher Education, the South Carolina Department of Education, the SC CAP Steering Committee, and to additional faculty and administrators from South Carolina educational institutions in both the K-12 and postsecondary education systems, who were asked to review and provide feedback on them. The standards included in this report are based on the feedback received from these reviews.

ENGLISH LANUAGE ARTS STANDARDS

The recommended English Language Arts standards are based upon an analysis which compared the *South Carolina English Language Arts Academic Standards 2007* to the *Knowledge and Skills for University Success* (KSUS) standards, a set of college readiness standards developed under the direction of Dr. David Conley and sponsored by the Association of American Universities (AAU) and the Pew Charitable Trusts in 2003. Experienced state and national content experts examined the alignment between the South Carolina Academic Standards and the KSUS standards for content, rigor, and alignment.

I. READING LITERATURE

1. Read, comprehend, and discuss a variety of literary texts in print AND non-print formats.
2. Engage in an analytic process to enhance comprehension and create personal meaning when reading text. This engagement includes the ability to annotate, question, agree or disagree, summarize, critique, and formulate a personal response.
3. Make supported inferences and draw conclusions based on textual features, seeking such evidence in text, format, language use, expository structures, and arguments used.
4. Explain plot and character development in literature, including character motive, causes for actions, and the credibility of events.
5. Apply aesthetic qualities of style, such as diction or mood (for example), as a basis to evaluate literature that contains ambiguities, subtleties, or contradictions.
6. Identify basic beliefs, perspectives, and philosophical assumptions underlying an author's work, including identifying points of view, attitudes, and the values conveyed by specific use of language.
7. Discuss with understanding the effects of an author's style and use of literary devices to influence the reader and evoke emotions. Discussion should include, but not be limited to such devices as imagery, characterization, choice of narrator, use of sound, formal and informal language, allusions, symbols, irony, voice, flashbacks, foreshadowing, time and sequence, and mood.
8. Engage in an analytic process that enables students to make connections between different texts, including comparing and contrasting formal and thematic aspects.
9. Identify archetypes, such as universal destruction, journeys, tests, and banishment, that appear across a variety of types of literature, including American literature, world literature, myths, propaganda, and religious texts.
10. Discuss with understanding themes such as initiation, love and duty, heroism, and death and rebirth that appear across a variety of literary works and genres.
11. Apply reading skills and strategies to understand a variety of types of literature, for example, epic pieces (such as the Iliad), lyric poems, novels and other longer narratives, and philosophical pieces.
12. Summarize the salient characteristics of major types and genres of texts, including but not limited to novels, short stories, horror stories, science fiction, biographies, autobiographies, poems, and plays.
13. Explain the formal constraints of different types of texts and distinguish between, for example, a Shakespearean sonnet and a poem written in free verse.

14. Discuss with understanding the relationships between literature and its historical and social contexts.
15. Summarize major historical events that may be encountered in literature.
16. Employ a variety of strategies to understand the origins and meanings of new words, including analysis of word roots and the determination of word derivations, with an emphasis on the importance of Greek and Latin roots and affixes.
17. Recognize and comprehend narrative terminology and techniques, such as (for example) author versus narrator, stated versus implied author, and historical versus present-day reader.
18. Employ monitoring and self-correction, as well as reading aloud, as means to ensure comprehension.
19. Carry out independent reading for extended periods of time to derive pleasure.

II. READING INFORMATIONAL TEXTS

1. Read and comprehend a variety of informational texts in print and non-print formats.
2. Compare, contrast, and evaluate theses within and across informational texts.
3. Compare, contrast, and evaluate information within and across texts to draw conclusions and make inferences.
4. Analyze informational texts for indicators of author bias such as word choice, the exclusion and inclusion of particular information, and unsupported opinion.
5. Carry out independent reading for extended periods of time to gain information.
6. Analyze the impact that text elements have on the meaning of a given informational text.
7. Analyze information from graphic features such as charts and graphs in informational texts.
8. Analyze and evaluate informational texts to identify propaganda techniques.
9. Apply reading skills and strategies to understand informational texts.
10. Comprehend informational writing or instructions in software or software documentation, job descriptions, college applications, historical documents, government publications, newspapers, essays, and textbooks.
11. Comprehend and apply vocabulary and content, including subject area terminology; connotative and denotative meanings; and idiomatic meanings.
12. Exercise a variety of strategies to understand the origins and meanings of new words, including recognition of cognates and contextual clues
13. Read and interpret visual images, including charts and graphs.
14. Identify the primary elements of the types of charts, graphs, and visual media that occur most commonly in texts.
15. Interpret accurately the content of charts, graphs, and visual media that occur in texts.

III. WRITING AND SELF-EXPRESSION

1. Apply writing conventions to write clearly and coherently and write for a variety of purposes and audiences.
2. Apply several pre-writing strategies, including developing a focus; determining the purpose; planning a sequence of ideas; using structured overviews; and creating graphic organizers, models, and outlines.

3. Employ a variety of complete sentence structures appropriately in writing, including compound, complex, compound-complex, parallel, repetitive, and analogous sentence structures.
4. Apply paragraph structure in writing as manifested by the ability to construct coherent paragraphs and arrange paragraphs in logical order.
5. Present ideas to achieve overall coherence and logical flow in writing and employ appropriate techniques such as transitions and repetition to maximize cohesion.
6. Apply words correctly; apply words that mean what the writer intends to say; and employ a varied vocabulary.
7. Demonstrate development of a controlled yet unique style and voice in writing where appropriate.
8. Apply proofreading skills to edit for the correct use of written Standard American English.
9. Apply a variety of methods to develop arguments, including compare-contrast reasoning; logical arguments (inductive-deductive); and alternation between general and specific (e.g., connections between public knowledge and personal observation and experience).
10. Write to persuade the reader by anticipating and addressing counterarguments, by using rhetorical devices, and by developing an accurate and expressive style of communication that moves beyond mechanics to add flair and elegance to writing.
11. Apply revision strategies to improve the organization and development of content and the quality of voice in written works. These strategies include: reviewing ideas and structure in substantive ways to improve depth of information and logic of organization; reassessing the appropriateness of writing in light of genre, purpose, and audience; and using feedback from others to revise written work.
12. Create informational pieces such as letters of request, inquiry, or complaint that use language appropriate for the specific audience.
13. Create narratives such as personal essays, memoirs, or narrative poems that use descriptive language to create tone and mood.
14. Create descriptions for use in other modes of written works such as narratives and expository or persuasive pieces.
15. Produce clear and concise career-oriented/technical writings such as memos, business letters, résumés, technical reports, and information analyses.
16. Create narratives such as personal essays, memoirs, and narrative poems that use descriptive language to enhance setting and characterization.
17. Create persuasive writings such as editorials, essays, speeches, or reports that address a specific audience and support a clearly stated thesis with facts, statistics, and/or first-hand accounts, among other forms.
18. Create persuasive writings such as editorials, essays, speeches, or reports that address a specific audience and employ logical arguments supported by facts or expert opinions.
19. Create narratives such as personal essays, memoirs, and narrative poems that use descriptive language to enhance voice and tone.
20. Create responses to literary texts through a variety of methods in addition to writing, such as oral presentations, media productions, and the visual and performing arts, among other forms.
21. Create responses to informational texts through a variety of methods such as drawings, written works, oral presentations, and media productions, among other forms.

IV. RESEARCH AND INFORMATION TECHNOLOGY

1. Pursue research projects and make use of appropriate technologies in both research and writing.
2. Design and carry out research projects by selecting a topic, constructing inquiry questions, accessing resources, and organizing information.
3. Employ a variety of print or electronic primary and secondary sources including books, magazines, newspapers, journals, periodicals, and the Internet.
4. Select relevant sources when writing research papers and appropriately include information from such sources; logically introduce and incorporate quotations; synthesize information in a logical sequence; identify different perspectives; identify complexities and discrepancies in information; and offer support for conclusions.
5. Evaluate sources of information located on the Internet in particular to ascertain their credibility, origin, potential bias, and overall quality.
6. Employ direct quotations, paraphrasing, or summaries to incorporate into oral or written works the information gathered from a variety of research sources.
7. Comprehend the concept of plagiarism and how (or why) to avoid it and apply rules for paraphrasing, summarizing, and quoting, as well as conventions for incorporating information from Internet-based sources in particular.
8. Apply a standardized system of documentation (including a list of sources with full publication information and the use of in-text citations) to properly credit the work of others.
9. Create written works and oral and visual presentations that are designed for a specific audience and purpose.
10. Select appropriate graphics, in print or electronic form, to support written works and oral and visual presentations.
11. Apply the spell-checker and grammar check function in word processing software while understanding the limitations of relying upon these tools.

MATHEMATICS STANDARDS

The recommended mathematics standards are based upon an analysis which compared the *South Carolina Mathematics Academic Standards 2007* to the *Knowledge and Skills for University Success* (KSUS) standards. Experienced state and national content experts examined the alignment between the South Carolina Academic Standards and the KSUS standards for content, rigor, and alignment

I. RECOMMENDED ALGEBRA STANDARDS

A. Demonstrate and apply the techniques of problem solving, reasoning, communication, connections, and representation.

1. Employ mathematical terminology appropriately.
2. Apply algebraic methods to solve problems external to mathematics.
3. Judge the reasonableness of mathematical solutions.
4. Demonstrate an understanding of algebraic relationships symbolically, graphically, verbally, and numerically.
5. Represent algebraic relationships in concrete models, pictorial models, and diagrams.
6. Recognize the common mathematical meanings of equal signs, parentheses, superscripts, and subscripts.

B. Demonstrate processes and understanding of functions, systems of equations, and systems of linear inequalities.

1. Solve systems of linear inequalities algebraically.
2. Solve systems of linear inequalities graphically.
3. Model suitable problems by a system of linear inequalities.
4. Carry out procedures to perform operations on polynomial functions (including $f(x) + g(x)$, $f(x) – g(x)$, $f(x) \bullet g(x)$, and $f(x)/g(x)$).
5. Determine an algebraic expression for a composition of given functions.
6. Graph translations of a given function.
7. Apply the basic transformations to the graph of a function.
8. Graph discontinuous step and piecewise-defined functions.

C. Demonstrate an understanding of quadratic equations and the complex number system.

1. Perform operations with complex numbers.
2. Solve quadratic equations algebraically (including by factoring, completing the square, and applying the quadratic formula).
3. Apply the discriminant to determine the number and type of solutions of a quadratic equation.
4. Solve word problems involving quadratic models.
5. Recognize the basic shape of a graph of a quadratic function and the relationships between the graph and its roots.

D. Demonstrate an understanding of non-linear functions and algebraic expressions.

1. Perform operations (including multiplication, exponentiation, and division) with polynomial expressions.

2. Factor polynomial expressions (including factoring by grouping, factoring the difference between two squares, factoring the sum of two cubes, and factoring the difference between two cubes).
3. Simplify algebraic expressions involving rational exponents.
4. Simplify algebraic expressions involving logarithms.
5. Perform operations with expressions involving rational exponents (including addition, subtraction, multiplication, division, and exponentiation).
6. Perform operations with rational expressions (including addition, subtraction, multiplication, and division).
7. Solve radical equations algebraically.
8. Solve logarithmic equations algebraically.
9. Solve equations involving rational expressions.

II. RECOMMENDED GEOMETRY STANDARDS

A. Demonstrate and apply the mathematical processes of problem solving, reasoning and proof, communication, connections, and representation.

1. Demonstrate an understanding of the axiomatic structure of geometry by using undefined terms, definitions, postulates, theorems, and corollaries.
2. Communicate knowledge of geometric relationships by using mathematical terminology appropriately.
3. Apply basic rules of logic to determine the validity of the converse, inverse, and contrapositive of a conditional statement.
4. Formulate and test conjectures by using a variety of tools such as drawing, written or concrete models, graphing calculators, spreadsheets, and dynamic geometry software.
5. Apply inductive reasoning to formulate conjectures.
6. Apply deductive reasoning to validate conjectures with formal and informal proofs, and give counterexamples to disprove a statement.
7. Connect geometry with other branches of mathematics.
8. Demonstrate an understanding of how geometry applies to in real-world contexts (including architecture, construction, farming, and astronomy).
9. Demonstrate an understanding of geometric relationships (including constructions through investigations by using a variety of tools such as straightedge, compass, Patty Paper, dynamic geometry software, and handheld computing devices).

B. Demonstrate an understanding of the properties of basic geometric figures and the relationships between and among them.

1. Apply properties of parallel lines, intersecting lines, and parallel lines cut by a transversal to solve problems.
2. Employ the congruence of figures to solve problems.
3. Employ direct measurement to determine the length of a segment, degree of an angle, and distance from a point to a line.
4. Carry out a procedure to create geometric constructions (including the midpoint of a line segment, the angle bisector, the perpendicular bisector of a line segment, the line through a given point that is parallel to a given line, and the line through a given point that is perpendicular to a given line).
5. Apply scale factors to solve problems involving scaled drawings and models.

C. Demonstrate an understanding of the properties of triangles and of relationships between and among triangles.

1. Compute the perimeter of a triangle.
2. Compute the area of a triangle.
3. Analyze how changes in dimensions affect the perimeter or area of triangles.
4. Apply properties of isosceles and equilateral triangles to solve problems.
5. Employ interior angles, exterior angles, medians, angle bisectors, altitudes, and perpendicular bisectors to solve problems.
6. Apply the sum of angles of a triangle to solve problems.
7. Apply the triangle inequality to solve problems.
8. Apply congruence and similarity relationships among triangles to solve problems.
9. Apply theorems to prove that triangles are either similar or congruent or neither.
10. Apply the Pythagorean Theorem and its converse to solve problems.
11. Employ the properties of 45-45-90 and 30-60-90 triangles to solve problems.

D. Demonstrate an understanding of the properties of quadrilaterals and other polygons and the relationships between and among them.

1. Demonstrate how to find the area and perimeter of basic figures.
2. Compute measures of interior and exterior angles of polygons.
3. Analyze how changes in dimensions affect the perimeter or area of quadrilaterals and regular polygons.
4. Apply properties and attributes of quadrilaterals and regular polygons and their component parts to solve problems.
5. Apply congruence and similarity relationships among shapes (including quadrilaterals and polygons) to solve problems.

E. Demonstrate an understanding of the properties of circles, the lines that intersect them, and the use of their special segments.

1. State the formulae for the area and the circumference of a circle and how to use them.
2. Analyze how a change in the radius affects the circumference or area of a circle.
3. Compute the length of an arc or the area of a sector of a circle.
4. Apply properties of the component parts of a circle (including radii, diameters, chords, sectors, arcs, and segments) to solve problems.
5. Apply properties of lines that intersect circles (including two secants, two tangents, and a secant and a tangent) to solve problems.
6. Apply properties of central angles, inscribed angles, and arcs of circles to solve problems.

F. Demonstrate an understanding of transformations in coordinate geometry and vector.

1. Employ the distance formula to solve problems.
2. Employ the midpoint formula to solve problems.
3. Apply transformations—translation, reflection, rotation, and dilation—to figures in the coordinate plane by using sketches, coordinates, and algebraic expressions.

G. Compute the surface area and volume of three-dimensional objects.

1. Compute the surface area of cones, cylinders, pyramids, prisms, spheres, and hemispheres.
2. Compute the volume of cones, cylinders, pyramids, prisms, spheres, hemispheres, and composite objects.

3. Apply congruence and similarity relationships among geometric objects to solve problems.

III. RECOMMENDED PRECALCULUS STANDARDS

A. Understand and utilize the mathematical processes of problem solving, reasoning and proof, communication, connections, and representation.

1. Distinguish between and among expressions, equations, relations and functions.
2. Connect algebra and trigonometry with other branches of mathematics.
3. Apply algebraic methods to solve problems in applied contexts.
4. Judge the reasonableness of mathematical solutions.
5. Demonstrate an understanding of algebraic and trigonometric relationships by using a variety of representations (including verbal, graphic, numerical, and symbolic).

B. Demonstrate an understanding of the behaviors of polynomial and rational functions.

1. Graph quadratic and higher-order polynomial functions by analyzing intercepts and end behavior.
2. Carry out a procedure to calculate the zeros of polynomial functions when given a set of possible zeros.
3. Determine characteristics of rational functions (including domain, range, intercepts, asymptotes, and discontinuities).
4. Formulate a polynomial function that models a given problem.
5. Solve polynomial equations algebraically.
6. Find the roots of a rational equation.
7. Carry out a procedure to solve polynomial inequalities algebraically.

C. Demonstrate through the mathematical processes an understanding of the behaviors of exponential and logarithmic functions.

1. Apply the laws of exponents to solve equations involving rational exponents.

D. Demonstrate an understanding of trigonometric functions.

1. Understand how angles are measured in either degrees or radians and how to convert between the two.
2. Know both the right triangle and unit circle definitions of the sine, cosine, and tangent functions.
3. Understand periodicity and recognize graphs of periodic functions, especially the trigonometric functions.
4. Simplify and evaluate trigonometric expressions.
5. Solve a triangle given the lengths of two sides and one angle.
6. Apply the laws of sines and cosines to solve problems.

E. Demonstrate an understanding of the conic sections both geometrically and algebraically.

1. Calculate the coordinates of point(s) where a line intersects a circle.

IV. RECOMMENDED PROBABILITY AND STATISTICS STANDARDS

A. Demonstrate and apply the mathematical processes of problem solving, reasoning and proof, communication, connections, and representation.

1. Conduct simple probability experiments and collect data using spinners, dice, cards, and coins.

B. Demonstrate an understanding of methodology for collecting, organizing, displaying, and interpreting data.

1. Organize and interpret data by using pictographs, bar graphs, pie charts, dot plots, histograms, time-series plots, stem-and-leaf plots, box-and-whiskers plots, and scatterplots.
2. Represent frequency distributions by using meaningful displays.
3. Classify graphically and analytically the correlation between two variables as either positive, negative, or zero.

C. Demonstrate an understanding of basic statistical methods for analyzing data.

1. Find measures of central tendency (mean, median, and mode) for given data.

D. Demonstrate an understanding of the basic concepts of probability.

1. Construct a sample space for an experiment and represent it as a list, chart, picture, or tree diagram.
2. Apply counting techniques to determine the number of possible outcomes for an event.
3. Classify events as either dependent or independent.
4. Employ the concept of complementary sets to compute probabilities.

SCIENCE STANDARDS

The recommended science standards are based upon an analysis which compared the *South Carolina Science Academic Standards 2007* to the *Knowledge and Skills for University Success* (KSUS) standards. Experienced state and national content experts examined the alignment between the South Carolina Academic Standards and the KSUS standards for content, rigor, and alignment.

I. RECOMMENDED BIOLOGY STANDARDS

A. Demonstrate an understanding of how scientific inquiry and technological design, including mathematical analysis, can be used appropriately to pose questions, seek answers, and develop solutions.

1. Generate hypotheses (with testable and falsifiable predictions) based on credible, accurate, and relevant sources of scientific information.
2. Employ appropriate laboratory apparatuses, technology, and techniques safely and accurately when conducting a scientific investigation.
3. Employ scientific instruments to record measurement data in appropriate metric units that reflect the precision and accuracy of each particular instrument.
4. Design a scientific investigation with appropriate methods of control to test a hypothesis (including independent and dependent variables), and evaluate the designs of sample investigations.
5. Organize and interpret the data from a controlled scientific investigation by using mathematics, graphs, models, and/or technology.
6. Evaluate the results of a controlled scientific investigation in terms of whether or not they support hypothesis.
7. Present results of investigations and seek critique from others.
8. Apply appropriate safety procedures when conducting investigations.
9. Debate complex issues arising from the application of science and technology in society.

B. Demonstrate an understanding of the structure and function of cells and their organelles.

1. Recall the three major tenets of cell theory (all living things are composed of one or more cells; cells are the basic units of structure and function in living things; and all presently existing cells arose from previously existing cells).
2. Summarize the structures and functions of organelles found in a eukaryotic cell (including the nucleus, mitochondria, chloroplasts, lysosomes, vacuoles, ribosomes, endoplasmic reticulum [ER], Golgi apparatus, cilia, flagella, cell membrane, nuclear membrane, cell wall, and cytoplasm).
3. Compare the structures and organelles of prokaryotic and eukaryotic cells.
4. Explain the process of cell differentiation as the basis for the hierarchical organization of organisms (including cells, tissues, organs, and organ systems).
5. Explain how active, passive, and facilitated transport serve to maintain the homeostasis of the cell.
6. Summarize the characteristics of the cell cycle: interphase (called G1, S, G2); the phases of mitosis (called prophase, metaphase, anaphase, and telophase); and plant and animal cytokinesis.

7. Summarize how cell regulation controls and coordinates cell growth and division and allows cells to respond to the environment, and recognize the consequences of uncontrolled cell division.
8. Explain the factors that affect the rates of biochemical reactions (including pH, temperature, and the role of enzymes as catalysts).

C. Demonstrate an understanding of the flow of energy within and between living systems.

1. Summarize the overall process by which photosynthesis converts solar energy into chemical energy and interpret the chemical equation for the process.
2. Summarize the basic aerobic and anaerobic processes of cellular respiration and interpret the chemical equation for cellular respiration.
3. Recognize the overall structure of adenosine triphosphate (ATP)—namely, adenine, the sugar ribose, and three phosphate groups—and summarize its function (including the ATP-ADP [adenosine diphosphate] cycle).
4. Summarize the functions of proteins, carbohydrates, and fats in the human body.
5. Illustrate the flow of energy through ecosystems (including food chains, food webs, energy pyramids, number pyramids, and biomass pyramids).

D. Demonstrate an understanding of the molecular basis of heredity.

1. Compare DNA and RNA in terms of structure, nucleotides, and base pairs.
2. Summarize the relationship among DNA, genes, and chromosomes.
3. Explain how DNA functions as the code of life and the blueprint for proteins.
4. Summarize the basic processes involved in protein synthesis (including transcription and translation).
5. Summarize the characteristics of the phases of meiosis I and II.
6. Predict inherited traits by using the principles of Mendelian genetics (including segregation, independent assortment, and dominance).
7. Summarize the chromosome theory of inheritance and relate that theory to Gregor Mendel's principles of genetics.
8. Compare the consequences of mutations in body cells with those in gametes.
9. Exemplify ways that introduce new genetic characteristics into an organism or a population by applying the principles of modern genetics.

E. Demonstrate an understanding of biological evolution and the diversity of life.

1. Summarize the process of natural selection.
2. Explain how genetic processes result in the continuity of life-forms over time.
3. Explain how diversity within a species increases the chances of its survival.
4. Explain how genetic variability and environmental factors lead to biological evolution.
5. Provide examples of scientific evidence in the fields of anatomy, embryology, biochemistry, and paleontology that underlie the theory of biological evolution.
6. Summarize ways that scientists use data from a variety of sources to investigate and critically analyze aspects of evolutionary theory.
7. Explain ways in which living things can be classified based on each organism's internal and external structure, their development, and relatedness of DNA sequence.
8. Employ a phylogenetic tree to identify the evolutionary relationships among different groups of organisms.
9. Explain the theory of evolution (e.g., the Earth's present-day life forms evolved from earlier, distinctly different species).

F. Demonstrate an understanding of the interrelationships among organisms and the biotic and abiotic components of their environments.

1. Explain how the interrelationships among organisms (including predation, competition, parasitism, mutualism, and commensalism) generate stability within ecosystems.
2. Explain how populations are affected by limiting factors (including density-dependent, density-independent, abiotic, and biotic factors).
3. Illustrate the processes of succession in ecosystems.
4. Exemplify the role of organisms in the geochemical cycles (including the cycles of carbon, nitrogen, and water).
5. Explain how ecosystems are maintained through naturally occurring processes (including maintaining the quality of the atmosphere, generating soils, controlling the hydrologic cycle, disposing of wastes, and recycling nutrients).
6. Explain how human activities (including population growth, technology, and consumption of resources) impact the biosphere through changes in the physical, chemical, and biological cycles and processes.

II. RECOMMENDED CHEMISTRY STANDARDS

A. Demonstrate an understanding of how scientific inquiry and technological design, including mathematical analysis, can be used appropriately to pose questions, seek answers, and develop solutions.

1. Employ appropriate laboratory apparatuses, technology, and techniques safely and accurately when conducting a scientific investigation.
2. Experience the proper, hands-on use of some chemical equipment (e.g., pipet, buret, balance, spectrometer, gas chromatograph).
3. Record data and results from scientific measurements in a laboratory notebook properly, including the proper use of significant digits (both in recording a measurement and in calculating derived quantities) in appropriate metric units that reflect the precision and accuracy of each measurement.
4. Design a scientific investigation with appropriate methods of control to test a hypothesis (including independent and dependent variables), and evaluate the designs of sample investigations.
5. Organize and interpret the data from a controlled scientific investigation by using word processing, spreadsheets (including calculations, tables, and graphs), other technology, models, figures, and mathematics (including formulas, scientific notation, statistics, and dimensional analysis) to create a clear and concise scientific laboratory report.
6. Evaluate the results of a scientific investigation in terms of whether they verify or refute the hypothesis and what the possible sources of error are.

B. Demonstrate an understanding of atomic structure and nuclear processes.

1. Illustrate electron configurations by using orbital notation for representative elements.
2. Summarize atomic properties (including electron configuration, ionization energy, electron affinity, atomic size, and ionic size).
3. Summarize the periodic table's property trends (including electron configuration, ionization energy, electron affinity, atomic size, ionic size, and reactivity).
4. Compare the nuclear reactions of fission and fusion to chemical reactions (including the parts of the atom involved and the relative amounts of energy released).

5. Explain the concept of half-life, its use in determining the age of materials, and its significance to nuclear waste disposal.

C. Demonstrate an understanding of the structures and classifications of chemical compounds.

1. Predict the type of bonding (ionic or covalent) and the shape of simple compounds by using Lewis dot structures and oxidation numbers.
2. Interpret the names and formulas for ionic and covalent compounds.
3. Explain how the types of intermolecular forces present in a compound affect the physical properties of compounds (including polarity and molecular shape).
4. Explain the unique bonding characteristics of carbon that have resulted in the formation of a large variety of organic structures.
5. Explain the effect of electronegativity and ionization energy on the type of bonding in a molecule.

D. Demonstrate an understanding of the types, the causes, and the effects of chemical reactions.

1. Analyze and balance equations for simple synthesis, decomposition, single replacement, double replacement, and combustion reactions.
2. Predict the products of acid-base neutralization and combustion reactions.
3. Analyze the energy changes (endothermic or exothermic) associated with chemical reactions.
4. Apply the concept of moles to determine the number of particles of a substance in a chemical reaction, the percent composition of a representative compound, the mass proportions, and the mole-mass relationships.
5. Predict the percent yield, the mass of excess, and the limiting reagent in chemical reactions.
6. Explain the role of activation energy and the effects of temperature, particle size, stirring, concentration, and catalysts in reaction rates.
7. Summarize the oxidation and reduction processes (including oxidizing and reducing agents).
8. Summarize the concept of chemical equilibrium and Le Châtelier's principle.

E. Demonstrate an understanding of the structure and behavior of the different phases of matter.

1. Explain the effects of the intermolecular forces on the different phases of matter.
2. Explain the behaviors of gas; the relationship among pressure, volume, and temperature; and the significance of the Kelvin (absolute temperature) scale, using the kinetic-molecular theory as a model.
3. Apply the gas laws to problems concerning changes in pressure, volume, or temperature (including Charles's law, Boyle's law, and the combined gas law).
4. Apply the ideal gas law ($pV = nRT$) to solve problems.
5. Employ density to determine the mass, volume, or number of particles of a gas in a chemical reaction.

F. Demonstrate an understanding of the nature and properties of various types of chemical solutions.

1. Summarize the process by which solutes dissolve in solvents, the dynamic equilibrium that occurs in saturated solutions, and the effects of varying pressure and temperature on solubility.

2. Compare solubility of various substances in different solvents (including polar and non-polar solvents and organic and inorganic substances).
3. Carry out calculations to find the concentration of solutions in terms of molarity and percent weight (mass).
4. Summarize the properties of salts, acids, and bases.
5. Distinguish between strong and weak common acids and bases.
6. Represent common acids and bases by their names and formulas.
7. Explain how the use of a titration can determine the concentration of acid and base solutions
8. Employ a variety of procedures for separating mixtures (including distillation, crystallization filtration, paper chromatography, and centrifuge).
9. Employ solubility rules to write net ionic equations for precipitation reactions in aqueous solution.
10. Represent neutralization reactions and reactions between common acids and metals by using chemical equations.

III. RECOMMENDED PHYSICS STANDARDS

A. Demonstrate an understanding of how scientific inquiry and technological design, including mathematical analysis, can be used appropriately to pose questions, seek answers, and develop solutions.

1. Apply established rules for significant digits, both in reading scientific instruments and in calculating derived quantities from measurement.
2. Employ appropriate laboratory apparatuses, technology, and techniques safely and accurately when conducting a scientific investigation.
3. Employ scientific instruments to record measurement data in appropriate metric units that reflect the precision and accuracy of each particular instrument.
4. Design a scientific investigation with appropriate methods of control to test a hypothesis (including independent and dependent variables), and evaluate the designs of sample investigations.
5. Organize and interpret the data from a controlled scientific investigation (including calculations in scientific notation, formulas, error and dimensional analysis) by using graphs, tables, models, diagrams, and/or technology.
6. Evaluate the results of a controlled scientific investigation in terms of whether they refute or verify the hypothesis.
7. Evaluate conclusions based on qualitative and quantitative data (including the impact of parallax, instrument malfunction, or human error) on experimental results.
8. Communicate and defend a scientific argument or conclusion.
9. Apply appropriate safety procedures when conducting investigations.

B. Demonstrate an understanding of the principles of force and motion and relationships between them.

1. Represent vector quantities (including displacement, velocity, acceleration, and force) and apply vector addition.
2. Apply formulas for velocity or speed and acceleration to one and two-dimensional problems including projectile motion.
3. Interpret the velocity or speed and acceleration of one and two-dimensional motion on distance-time, velocity-time or speed-time, and acceleration-time graphs.

4. Interpret the resulting motion of objects by applying Newton's three laws of motion: inertia; the relationship among net force, mass, and acceleration (using F = ma); and action and reaction forces.
5. Employ a free-body diagram to determine the net force and component forces acting upon an object.
6. Distinguish between static and kinetic friction and the factors that affect the motion of objects.
7. Explain how torque is affected by the magnitude, direction, and point of application of force.
8. Explain the relationships among speed, velocity, acceleration, and force in rotational systems.

C. Demonstrate an understanding of the concepts of mechanical energy and momentum, including conservation of mechanical energy and conservation of momentum.

1. Apply energy formulas to determine potential and kinetic energy and explain the transformation from one to the other.
2. Apply the law of conservation of energy to the transfer of mechanical energy through work.
3. Explain, both conceptually and quantitatively, how energy can transfer from one system to another (including work, power, and efficiency).
4. Explain, both conceptually and quantitatively, the factors that influence periodic motion.
5. Explain the factors involved in producing a change in momentum (including impulse and the law of conservation of momentum in both linear and rotational systems).
6. Compare elastic and inelastic collisions in terms of conservation laws.

D. Demonstrate an understanding of the properties of electricity and magnetism and the relationships between them.

1. Explain the characteristics of static charge and how a static charge is generated.
2. Employ diagrams to illustrate an electric field (including point charges and electric field lines).
3. Summarize current, potential difference, and resistance in terms of electrons.
4. Compare how current, voltage, and resistance are measured in a series and in a parallel electric circuit and identify the appropriate units of measurement.
5. Analyze the relationships among voltage, resistance, and current in a complex circuit by using Ohm's law to calculate voltage, resistance, and current at each resistor, any branch, and the overall circuit.
6. Differentiate between alternating current (AC) and direct current (DC) in electrical circuits.
7. Carry out calculations for electric power and electric energy for circuits.
8. Summarize the function of electrical safety components (including fuses, surge protectors, and breakers).
9. Explain the effects of magnetic forces on the production of electrical currents and on current carrying wires and moving charges.
10. Explain how magnetic fields can be produced by electrical currents or by permanent magnets.
11. Distinguish between the function of motors and generators on the basis of the use of electricity and magnetism by each.

E. Demonstrate an understanding of the properties and behaviors of mechanical and electromagnetic waves.

1. Analyze the relationships among the properties of waves (including energy, frequency, amplitude, wavelength, period, phase, and speed).
2. Compare the properties of electromagnetic and mechanical waves.
3. Analyze wave behaviors (including reflection, refraction, diffraction, and constructive and destructive interference).
4. Distinguish the different properties of waves across the range of the electromagnetic spectrum.

F. Demonstrate an understanding of the properties and behaviors of sound.

1. Summarize the production of sound and its speed and transmission through various media.
2. Explain how frequency and intensity affect the parts of the sonic spectrum.
3. Explain pitch, loudness, and tonal quality in terms of wave characteristics that determine what is heard.
4. Compare intensity and loudness.
5. Apply formulas to determine the relative intensity of sound.

G. Demonstrate an understanding of the properties and behaviors of light and optics.

1. Explain the particulate nature of light as evidenced in the photoelectric effect.
2. Apply the inverse square law to determine the change in intensity of light with distance.
3. Illustrate the polarization of light.
4. Summarize the operation of fiber optics in terms of total internal reflection.
5. Summarize the production of continuous, emission, or absorption spectra.
6. Illustrate the diffraction and interference of light.
7. Identify the parts of the eye and explain their function in image formation.

H. Demonstrate an understanding of nuclear physics and modern physics.

1. Predict the resulting isotope of a given alpha, beta, or gamma emission.
2. Apply appropriate procedures to balance nuclear equations (including fusion, fission, alpha decay, beta decay, and electron capture).
3. Interpret a representative nuclear decay series.
4. Explain the relationship between mass and energy that is represented in the equation $E = mc^2$ according to Einstein's special theory of relativity.

I. Demonstrate an understanding of the principles of fluid mechanics.

1. Predict the behavior of fluids (including changing forces) in pneumatic and hydraulic systems.
2. Explain the factors that affect buoyancy.
3. Explain how the rate of flow of a fluid is affected by the size of the pipe, friction, and the viscosity of the fluid.
4. Exemplify the relationship between velocity and pressure by using Bernoulli's principle.

J. Demonstrate an understanding of the principles of thermodynamics.

1. Summarize the first and second laws of thermodynamics.
2. Explain the relationship among internal energy, heat, and work.
3. Explain thermal expansion in solids, liquids, and gases in terms of kinetic theory and the unique behavior of water.

4. Differentiate heat and temperature in terms of molecular motion.
5. Summarize the concepts involved in phase change.
6. Apply the concepts of heat capacity, specific heat, and heat exchange to solve calorimetry problems.

IV. RECOMMENDED PHYSICAL SCIENCE STANDARDS

Physical Science: Scientific Inquiry

A. Demonstrate an understanding of how scientific inquiry and technological design, including mathematical analysis, can be used appropriately to pose questions, seek answers, and develop solutions.

1. Generate hypotheses on the basis of credible, accurate, and relevant sources of scientific information.
2. Employ appropriate laboratory apparatuses, technology, and techniques safely and accurately when conducting a scientific investigation.
3. Employ scientific instruments to record measurement data in appropriate metric units that reflect the precision and accuracy of each particular instrument.
4. Design a scientific investigation with appropriate methods of control to test a hypothesis (including independent and dependent variables), and evaluate the designs of sample investigations.
5. Organize and interpret the data from a controlled scientific investigation by using mathematics (including formulas and dimensional analysis), graphs, models, and/or technology.
6. Evaluate the results of a controlled scientific investigation in terms of whether they refute or verify the hypothesis.
7. Evaluate a technological design or product on the basis of designated criteria (including cost, time, and materials).
8. Compare the processes of scientific investigation and technological design.
9. Apply appropriate safety procedures when conducting investigations.

Chemistry: Structure and Properties of Matter

A. Demonstrate an understanding of the structure, bonding, and properties of atoms and molecules.

1. Compare the subatomic particles (protons, neutrons, electrons) of an atom with regard to mass, location, and charge, and explain how these particles affect the properties of an atom (including identity, mass, volume, and reactivity), as well as employ the atomic number and mass number to calculate the number of subatomic particles for a given isotope of an element.
2. Predict the charge that a representative element will acquire according to the arrangement of electrons in its outer energy level and explain that elements interact by transferring or sharing outermost electrons to form various kinds of bonds (ionic, covalent, metallic).
3. Compare fission and fusion and explain the consequences that the use of nuclear applications (including medical technologies, nuclear power plants, and nuclear weapons) can have.

B. Demonstrate an understanding of various properties and classifications of matter including compounds, mixtures, and solutions.

1. Explain the trends of the periodic table based on the elements' valence electrons and atomic numbers.
2. Distinguish chemical properties of matter (including reactivity) from physical properties of matter (including boiling point, freezing/melting point, density [with density calculations], solubility, viscosity, and conductivity).
3. Infer the practical applications of organic and inorganic substances on the basis of their chemical and physical properties.
4. Illustrate the difference between a molecule and an atom.
5. Classify matter as a pure substance (either an element or a compound) or as a mixture (either homogeneous or heterogeneous) on the basis of its structure and/or composition.
6. Compare the properties of the four states of matter—solid, liquid, gas, and plasma—in terms of the arrangement and movement of particles and explain processes of phase change (in terms of temperature, heat transfer, and particle arrangement).
7. Classify various solutions as acids or bases according to their physical properties, chemical properties (including neutralization and reaction with metals), generalized formulas, and pH (using pH meters, pH paper, and litmus paper).
8. Explain the role of bonding in achieving chemical stability.

C. Demonstrate an understanding of chemical reactions.

1. Explain how the process of covalent bonding provides chemical stability through the sharing of electrons and classify compounds as crystalline or molecular based on whether their outer electrons are transferred or shared.
2. Predict the ratio by which the representative elements combine to form binary ionic compounds, and represent that ratio in a chemical formula.
3. Distinguish between chemical changes (including the formation of gas or reactivity with acids) and physical changes (including changes in size, shape, color, and/or phase).
4. Summarize characteristics of balanced chemical equations (including conservation of mass and changes in energy in the form of heat—that is, exothermic or endothermic reactions).
5. Summarize evidence (including the evolution of gas; the formation of a precipitate; and/or changes in temperature, color, and/or odor) that a chemical reaction has occurred.
6. Apply a procedure to balance equations for a simple synthesis or decomposition reaction.
7. Recognize simple chemical equations (including single replacement and double replacement) as being balanced or not balanced.
8. Predict the amount of product or reactant from the other using the mole concept and balanced chemical equation.

Physics: The Interactions of Matter and Energy

A. Demonstrate an understanding of the nature of forces and motion.

1. Explain the relationship among distance, time, direction, and the velocity of an object.
2. Apply the formula v = d/t to solve problems related to average speed or velocity.

3. Explain how changes in velocity and time affect the acceleration of an object.
4. Apply the formula $a = (v_f - v_i)/t$ to determine the acceleration of an object.
5. Explain how acceleration due to gravity affects the velocity of an object as it falls.
6. Represent the linear motion of objects on distance-time graphs.
7. Explain the motion of objects on the basis of Newton's three laws of motion: inertia; the relationship among force, mass, and acceleration; and action and reaction forces.
8. Apply the formula F = ma to solve problems related to force.
9. Explain the relationship between mass and weight by using the formula FW = mag.
10. Explain how the gravitational force between two objects is affected by the mass of each object and the distance between them.

B. Demonstrate an understanding of the nature, conservation, and transformation of energy.

1. Explain how the law of conservation of energy applies to the transformation of various forms of energy (including mechanical energy, electrical energy, chemical energy, light energy, sound energy, and thermal energy).
2. Explain the factors that determine potential and kinetic energy and the transformation of one to the other.
3. Explain work in terms of the relationship among the force applied to an object, the displacement of the object, and the energy transferred to the object.
4. Apply the formula W = Fd to solve problems related to work done on an object in motion.
5. Explain how objects can acquire a static electric charge through friction, induction, and conduction, and explain that materials that contain equal amounts of positive and negative charges are electrically neutral, but that a very small excess or deficit of negative charges on a material produces noticeable electrical forces.
6. Explain the relationships among voltage, resistance, and current in Ohm's law.
7. Apply the formula V = IR to solve problems related to electric circuits.
8. Represent an electric circuit by drawing a circuit diagram that includes the symbols for a resistor, switch, and voltage source.
9. Compare the functioning of simple series and parallel electrical circuits.
10. Compare alternating current (AC) and direct current (DC) in terms of the production of electricity and the direction of current flow.
11. Explain the relationship of magnetism to the movement of electric charges in electromagnets, simple motors, and generators.

C. Demonstrate an understanding of the nature and properties of mechanical and electromagnetic waves.

1. Illustrate ways that the energy of waves is transferred by interaction with matter (including transverse and longitudinal/compressional waves).
2. Summarize characteristics of waves (including displacement, frequency, period, amplitude, wavelength, and velocity as well as the relationships among these characteristics).
3. Summarize the characteristics of the electromagnetic spectrum (including range of wavelengths, frequency, energy, and propagation without a medium).
4. Summarize reflection and interference of both sound and light waves and the refraction and diffraction of light waves.

V. RECOMMENDED EARTH SCIENCE STANDARDS

A. Demonstrate an understanding of how scientific inquiry and technological design, including mathematical analysis, can be used appropriately to pose questions, seek answers, and develop solutions.

1. Apply established rules for significant digits, both in reading scientific instruments and in calculating derived quantities from measurement.
2. Employ appropriate laboratory apparatuses, technology, and techniques safely and accurately when conducting a scientific investigation.
3. Employ scientific instruments to record measurement data in appropriate metric units that reflect the precision and accuracy of each particular instrument.
4. Design a scientific investigation with appropriate methods of control to test a hypothesis (including independent and dependent variables), and evaluate the designs of sample investigations.
5. Organize and interpret the data from a controlled scientific investigation by using mathematics (including calculations in scientific notation, formulas, and dimensional analysis), graphs, tables, models, diagrams, and/or technology.
6. Evaluate the results of a controlled scientific investigation in terms of whether they refute or verify the hypothesis.

B. Demonstrate an ability to problem solve.

1. Apply various strategies to approach problem-solving situations and to revise solution processes.
2. Explain the meaning of a mathematical expression (i.e., a statement using numbers and symbols to represent mathematical ideas and real world situations).

C. Explain and apply concepts of probability and statistics.

1. Explain that predictions based on sample data are inferential.

D. Explain and apply concepts of measurement.

1. Explain how to make estimates and approximations and when to use those approaches to solve problems.
2. Explain the differences between the metric and the traditional U.S. measurement system and perform simple conversions between the two.
3. Explain the difference between accuracy and precision and explain how to use significant digits appropriately.
4. Explain that investigations and public communication among scientists must meet certain criteria in order to result in new understanding and methods. For example: explain that arguments must be logical and demonstrate consistency between natural phenomena revealed by investigations, and explain that the historical body of scientific evidence, and the methods and procedures used to obtain evidence, must be clearly reported and reproducible to enhance opportunities for further investigation.
5. Evaluate conclusions based on qualitative and quantitative data (including the impact of parallax, instrument malfunction, or human error) on experimental results.
6. Communicate and defend a scientific argument or conclusion.

E. Demonstrate an understanding of the structure and properties of the universe.

1. Summarize the properties of the solar system that support the theory of its formation along with the planets.

2. Identify properties and features of the Moon that make it unique among other moons in the solar system.
3. Summarize the evidence that supports the big bang theory and the expansion of the universe (including the red shift of light from distant galaxies and the cosmic background radiation).
4. Explain the formation of elements that results from nuclear fusion occurring within stars or supernova explosions.
5. Classify stars by using the Hertzsprung-Russell diagram.
6. Compare the information obtained through the use of x-ray, radio, and visual (reflecting and refracting) telescopes.
7. Summarize the life cycles of stars.
8. Explain how gravity and motion affect the formation and shapes of galaxies (including the Milky Way).

F. Demonstrate an understanding of the internal and external dynamics of solid Earth.

1. Summarize theories and evidence of the origin and formation of Earth's systems by using the concepts of gravitational force and heat production.
2. Explain the differentiation of the structure of Earth's layers into a core, mantle, and crust based on the production of internal heat from the decay of isotopes and the role of gravitational energy.
3. Summarize theory of plate tectonics (including the role of convection currents, the action at plate boundaries, and the scientific evidence for the theory).
4. Explain how forces due to plate tectonics cause crustal changes as evidenced in earthquake activity, volcanic eruptions, and mountain building.
5. Analyze surface features of Earth in order to identify geologic processes (including weathering, erosion, deposition, and glaciation) that are likely to have been responsible for their formation.
6. Explain how the dynamic nature of the rock cycle accounts for the interrelationships among igneous, sedimentary, and metamorphic rocks.
7. Classify minerals and rocks on the basis of their physical and chemical properties and the environment in which they were formed.
8. Summarize the formation of ores and fossil fuels and the impact on the environment that the use of these fuels has had.

G. Demonstrate an understanding of the dynamics of Earth's atmosphere.

1. Summarize the thermal structures, the gaseous composition, and the location of the layers of Earth's atmosphere.
2. Summarize the changes in Earth's atmosphere over geologic time (including the importance of photosynthesizing organisms to the atmosphere).
3. Summarize the cause and effects of convection within Earth's atmosphere.
4. Attribute global climate patterns to geographic influences (including latitude, topography, elevation, and proximity to water).
5. Explain the relationship between the rotation of Earth and the pattern of wind belts.
6. Explain that relationships exist among the earth (geology and soil science), the water (hydrology and oceanography), and the atmosphere (meteorology and atmospherics), and that the relationship is best exemplified by the water cycle.
7. Summarize possible causes of and evidence for past and present global climate changes.
8. Explain that the earth is a body in space whose environmental system (the atmosphere, lithosphere, cryosphere, hydrosphere, and biosphere) depends largely

on the sun for light and heat and that the current environment (e.g., geography and climate) is subject to change.
9. Explain environmental processes (e.g., the carbon and nitrogen cycles) and their role in processing matter crucial for sustaining life.
10. Summarize the evidence for the likely impact of human activities on the atmosphere (including ozone holes, greenhouse gases, acid rain, and photochemical smog).
11. Predict weather conditions and storms (including thunderstorms, hurricanes, and tornados) on the basis of the relationship among the movement of air masses, high and low pressure systems, and frontal boundaries.

H. Demonstrate an understanding of Earth's freshwater and ocean systems.

1. Summarize the location, movement, and energy transfers involved in the movement of water on Earth's surface (including lakes, surface-water drainage basins [watersheds], freshwater wetlands, and groundwater zones).
2. Illustrate the characteristics of the succession of river systems.
3. Explain how karst topography develops as a result of groundwater processes.
4. Compare the physical and chemical properties of seawater and freshwater.
5. Explain the results of the interaction of the shore with waves and currents.
6. Summarize the advantages and disadvantages of devices used to control and prevent coastal erosion and flooding.
7. Explain the effects of the transfer of solar energy and geothermal energy on the oceans of Earth (including the circulation of ocean currents and chemosynthesis).
8. Analyze environments to determine possible sources of water pollution (including industrial waste, agriculture, domestic waste, and transportation devices).

I. Demonstrate an understanding of the dynamic relationship between Earth's conditions over geologic time and the diversity of its organisms.

1. Summarize the conditions of Earth that enable the planet to support life.
2. Summarize the divisions of the geologic time scale and illustrate the changes (in complexity and/or diversity) of organisms that have existed across these time units.
3. Summarize how fossil evidence reflects the changes in environmental conditions on Earth over time.
4. Match dating methods (including index fossils, ordering of rock layers, and radiometric dating) with the most appropriate application for estimating geologic time.
5. Infer explanations concerning the age of the universe and the age of Earth on the basis of scientific evidence.

CROSS-DISCIPLINARY STANDARDS

This section comprises standards which address cross-disciplinary key cognitive skills (such as reasoning, problem solving, and work habits) and key academic foundational skills (such as reading, writing, research across the curriculum, and the use of data and technology). Research on entry-level college courses has confirmed both the importance of these skills in entry-level courses as well as the significant shortcomings entering students demonstrate in these areas. These cross-disciplinary standards can be thought of as the intellectual behaviors and proficiencies students need to be able to apply knowledge across the curriculum.

I. KEY COGNITIVE STRATEGIES

A. Intellectual curiosity

1. Engage in scholarly inquiry and dialogue.
2. Accept constructive criticism and revise personal views when valid evidence warrants.

B. Reasoning

1. Consider arguments and conclusions of self and others.
2. Construct well-reasoned arguments to explain phenomena, validate conjectures, or support positions.
3. Gather evidence to support arguments, findings, or lines of reasoning.
4. Support or modify claims based on the results of an inquiry.

C. Problem solving

1. Analyze a situation to identify a problem to be solved.
2. Develop and apply multiple strategies to solving a problem.
3. Collect evidence and data systematically and directly relate to solving a problem.

D. Academic behaviors

1. Self-monitor learning needs and seek assistance when needed.
2. Employ study habits necessary to manage academic pursuits and requirements.
3. Strive for accuracy and precision.
4. Persevere to complete and master tasks.

E. Work habits

1. Work independently.
2. Work collaboratively.

F. Academic integrity

1. Attribute ideas and information to source materials and people.
2. Evaluate sources for quality of content, validity, credibility, and relevance.
3. Include the ideas of others and the complexities of the debate, issue, or problem.
4. Adhere to ethical codes of conduct.

II. FOUNDATIONAL SKILLS

A. Reading across the curriculum

1. Employ effective pre-reading strategies.
2. Apply a variety of strategies to understand the meanings of new words.
3. Identify the intended purpose and audience of the text.
4. Identify the key information and supporting details.
5. Analyze textual information critically.
6. Annotate, summarize, paraphrase, and outline texts when appropriate.
7. Adapt reading strategies according to structure of texts.
8. Connect reading to historical and current events and personal interest.

B. Writing across the curriculum

1. Write clearly and coherently using standard writing conventions.
2. Write in a variety of forms for various audiences and purposes.
3. Compose and revise drafts.

C. Research across the curriculum

1. Identify which topics or questions are to be investigated.
2. Explore a research topic.
3. Refine research topic based on preliminary research and devise a timeline for completing work.
4. Evaluate the validity and reliability of sources.
5. Synthesize and organize information effectively.
6. Design and present an effective product.
7. Integrate source material.
8. Present final product.

D. Use of data

1. Identify patterns or departures from patterns among data.
2. Employ statistical and probabilistic skills necessary for planning an investigation, and collecting, analyzing, and interpreting data.
3. Present analyzed data and communicate findings in a variety of formats.

E. Technology

1. Employ technology to gather information.
2. Employ technology to organize, manage, and analyze information.
3. Employ technology to communicate and display findings in a clear and coherent manner.
4. Employ technology appropriately.