

# Subject Matter Requirements for Multiple Subject Candidates:

## Content Specifications in Reading, Language, and Literature, History and Social Science, Mathematics, and Science

### Part I: Content Domains for Subject Matter Understanding and Skill in Reading, Language, and Literature<sup>1</sup>

<b>Domains Reading, Language, and Literature</b>	<b>Coursework, Assignments, Assessments</b>
<p><b>1.1 <u>Language Structure and Linguistics.</u></b></p> <p>Candidates for Multiple Subject Teaching Credentials are able to identify and demonstrate an understanding of the fundamental components of human language, including phonology, morphology, syntax, and semantics, as well as the role of pragmatics in using language to communicate. In the context of these components, they reflect on both the potential for differences among languages and the universality of linguistic structures. Candidates can demonstrate knowledge of phonemic awareness (e.g., the processes of rhyming, segmenting, and blending). They apply knowledge of similarities and differences among groups of phonemes (e.g., consonants and vowels) that vary in their placement and manner of articulation. Candidates know the differences between phoneme awareness and phonics. They know the predictable patterns of sound-symbol and symbol-sound relationships in English (the Alphabetic Principle). Candidates identify examples of parts of speech, and their functions, as well as the morphology contributing to their classification. They recognize and use syntactic components (such as phrases and clauses, including verbals) to understand and develop a variety of sentence types (e.g., simple, compound, and complex sentences).</p>	
<p><b>1.2 <u>Language Development and Acquisition.</u></b></p> <p>Candidates for Multiple Subject Teaching Credentials apply knowledge of both the development of a first language and the acquisition of subsequent ones. They can describe the principal observable milestones in each domain, and identify the major theories that attempt to explain the processes of development and acquisition. Candidates demonstrate that they understand the range of issues related to the interaction of first languages and other languages. They are able to recognize special features that may identify a pupil's language development as exceptional, distinguishing such features</p>	

<sup>1</sup> Glossary of terms can be found in Appendix A.

<b>Domains Reading, Language, and Literature</b>	<b>Coursework, Assignments, Assessments</b>
from interlanguage effects.	
<p><b>1.3 Literacy.</b></p> <p>Candidates for Multiple Subject Teaching Credentials understand and use the major descriptions of developing literacy. Across the continuum of English language acquisition, candidates can identify the progressive development of phonemic awareness, decoding, comprehension, word recognition, and spelling (including its complexities related to the interaction of phonology, the alphabetic principle, morphology, and etymology). Candidates understand how these processes interact with the development of concepts, of vocabulary (including relationships among etymologies and both denotative and connotative word meanings), and of contextual analysis. Candidates can identify indicators of reading fluency (i.e., accuracy, rate, and prosody). They understand interrelationships between decoding, fluency, vocabulary knowledge, and reading comprehension, and they can identify factors that affect comprehension.</p>	
<p><b>1.4 Assessment.</b></p> <p>In assessing developing literacy, candidates for Multiple Subject Teaching Credentials apply knowledge of the implications that language development and language differences have for the processes of learning to read and reading to learn. They know and apply a range of assessment methods and instruments to the respective and interrelated developing abilities in listening, speaking, reading (decoding and comprehension), writing, vocabulary, and spelling conventions.</p>	
<p><b>Domain 2: Non-Written and Written Communication</b></p>	
<p><b>2.1 Conventions of Language.</b></p> <p>Applying their knowledge of linguistic structure, candidates for Multiple Subject Teaching Credentials identify and use the conventions associated with standard English. They recognize, understand, and use a range of conventions in both spoken and written English, including varieties of sentence structure, preferred usage, and conventions of spelling, capitalization, and punctuation.</p>	
<p><b>2.2 Writing Strategies.</b></p> <p>Candidates for Multiple Subject Teaching Credentials demonstrate knowledge of the stages of the writing</p>	

<b>Domains Reading, Language, and Literature</b>	<b>Coursework, Assignments, Assessments</b>
<p>process. They understand the purpose and technique of various prewriting strategies for organizing and giving focus to their writing (e.g., outlining, using graphic organizers, note taking). Candidates develop and strengthen writing as needed by revising, editing, rewriting, or trying a new approach. They draw upon their understanding of principles of organization, transitions, point-of-view, word choice, and conventions to produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience. Candidates demonstrate the ability to use technology, including the Internet, to produce and publish individual or shared writing products.</p>	
<p><b>2.3 <u>Writing Applications.</u></b></p> <p>Candidates for Multiple Subject Teaching Credentials demonstrate knowledge of principles of composition such as appropriate structure, logical development of ideas, appropriate vocabulary, and context. Candidates compose and/or analyze writing in different genres, including arguments, informative/explanatory texts, and narratives, as well as summaries, letters, and research reports. Candidates demonstrate the ability to write arguments to support claims using valid reasoning and relevant and sufficient evidence. Candidates demonstrate the ability to write informative/explanatory texts, including career development documents (e.g., business letters, job applications), and to examine and convey ideas, concepts, and information through the effective selection, organization, and analysis of content. When writing an argument or informative/explanatory text, candidates draw evidence from literary and/or informational texts to support research, analysis, and reflection. Candidates demonstrate the ability to write narratives to develop real or imagined experiences or events using effective technique, relevant descriptive details, and well-structured event sequences.</p>	

<b>Domains Reading, Language, and Literature</b>	<b>Coursework, Assignments, Assessments</b>
<p><b>2.4 <u>Non-Written Communication.</u></b></p> <p>Candidates for Multiple Subject Teaching Credentials demonstrate knowledge of non-written genres and traditions (storytelling), and of their characteristics (e.g., organization), including narratives, persuasive pieces, research presentations, poetry recitations, and responses to literature. Candidates analyze the purpose of information presented in diverse media and formats (e.g., visually, quantitatively, orally) and evaluate the motives (e.g., social, commercial, political) behind its presentation. They demonstrate the ability to delineate a speaker's argument and specific claims, evaluating the soundness of the speaker's reasoning and the relevance and sufficiency of evidence presented. They apply understanding of language development stages, from pre-production (beginning) to intermediate fluency, to plan instruction according to children's developing abilities in such areas. Candidates analyze speech in terms of vocal characteristics (e.g., volume), fluency, and pronunciation (unrelated to accent or dialect). They identify the integration of nonverbal components (e.g., gesture, eye contact) with verbal elements (e.g., tone, volume). Candidates demonstrate knowledge of dialects, idiolects, and changes in what is considered standard oral English usage and their effects on perceptions of speaker performance, with attention to the dangers of stereotyping and bias. They demonstrate the ability to adapt speech to a variety of contexts and tasks, demonstrating command of formal English when indicated or appropriate. Candidates demonstrate knowledge of techniques and strategies for initiating and engaging effectively in a range of collaborative discussions (one-on-one, in groups, and teacher-led) with diverse partners, building on others' ideas and expressing their own clearly.</p>	

<b>Domains Reading, Language, and Literature</b>	<b>Coursework, Assignments, Assessments</b>
<p><b>2.5 <u>Research to Build and Present Knowledge.</u></b></p> <p>Candidates for Multiple Subject Teaching Credentials demonstrate the ability to gather relevant information from multiple authoritative print and digital research sources. They assess the credibility and accuracy of each source. They interpret their research findings and interpretations to construct their own reports and narratives and present claims and findings (e.g., argument, narrative, response to literature), emphasizing salient points in a focused, coherent manner with relevant evidence, reasoning, and details. Candidates accurately paraphrase the data and conclusions of others without plagiarizing. They understand the importance of citing research sources, using recognizable and accepted conventions for doing so. They demonstrate knowledge of effective strategies for integrating technology, multimedia, and visual displays into presentations to clarify information, strengthen claims and evidence, and add interest. Candidates demonstrate knowledge of appropriate and effective use of eye contact, vocal elements (e.g., volume, rate, pitch), and clear pronunciation when presenting claims and findings.</p>	
<p><b>Domain 3: Reading Comprehension and Analysis</b></p>	
<p><b>3.1 <u>Reading Literature.</u></b></p> <p>Candidates for Multiple Subject Teaching Credentials analyze works from different literary genres (e.g., novels, short stories, folktales and fairy tales, poems) as they are represented in diverse cultures, with special attention to children's literature, for both literary elements and structural features. They cite thorough textual evidence to support analysis of the explicit and implicit meaning of literary texts. When reading literary texts, they determine themes or central ideas, including those derived from cultural patterns and symbols found in rituals, mythologies, and traditions. Candidates analyze how dialogue and incidents in a work of fiction or drama move the action forward and/or reveal aspects of character. Candidates identify and evaluate literary devices in prose and poetry (e.g., rhyme, metaphor, alliteration). Candidates determine the meaning of words and phrases as they are used in literary texts, including figurative and connotative meanings. They analyze the impact of specific word choices on meaning and tone. They examine how an author's choices concerning structure contribute to a literary text's meaning and style.</p>	

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<p>Candidates analyze how differences in the points of view of characters and the audience or reader create such effects as suspense or humor.</p>	
<p><b>3.2 <u>Reading Informational Text.</u></b></p> <p>Candidates for Multiple Subject Teaching Credentials analyze the structure, organization, and purpose of informational texts. Candidates use thorough textual evidence to support analysis of the explicit and implicit meanings of texts. They demonstrate the ability to determine the central idea of an informational text and to analyze its development over the course of a text, including its relationship to supporting ideas. Candidates demonstrate the ability to provide an objective summary of an informational text, using academic language as appropriate. They determine the meaning of words and phrases as they are used in informational texts, including figurative, connotative, and technical meanings. They analyze the impact of specific word choices on meaning and tone, including analogies or allusions to other texts. Candidates demonstrate an understanding of how the structure of informational texts, including popular print and digital media, is used to develop and refine key concepts. They analyze the use of text features (e.g., graphics, headers, captions) in consumer materials. Candidates determine an author's point(s) of view and purpose(s) and analyze how the author acknowledges and responds to conflicting evidence or viewpoints. Candidates integrate and evaluate multiple sources of information presented in different media or formats, as well as in words. They evaluate the structure and purpose of visual text features such as graphics, illustrations, data, and maps. Candidates recognize and analyze instances of bias and stereotyping in informational texts.</p>	

<b>Domains Reading, Language, and Literature</b>	<b>Coursework, Assignments, Assessments</b>
<p><b>3.3 <u>Text Complexity.</u></b></p> <p>Candidates for Multiple Subject Teaching Credentials evaluate text complexity using quantitative tools and measures, as well as knowledge of qualitative dimensions such as levels of meaning, structure, language conventionality and clarity, and background knowledge demands. Candidates apply knowledge of text complexity to select appropriate texts for supporting student learning goals. When matching readers to a text and task, candidates apply knowledge of reader variables (e.g., language, culture, motivation, background knowledge, skill levels, and experiences), and of task variables such as purpose and complexity.</p>	

## Content Specifications in History and Social Science

### Part I: Content Domains for Subject Matter Understanding and Skill in History and Social Science

Domains in History and Social Science	Curriculum, Assignments, Assessments
<b>Domain 1: World History</b>	
<p><b>1.1 <u>Ancient Civilizations.</u></b></p> <p>Candidates for Multiple Subject Teaching Credentials trace the impact of physical geography on the development of ancient civilizations (i.e., Mesopotamian, Egyptian, Kush, Hebrew, Greek, Indian, Chinese, and Roman civilizations). They identify the intellectual contributions, artistic forms, and traditions (including the religious beliefs) of these civilizations. They recognize patterns of trade and commerce that influenced these civilizations.</p>	
<p><b>1.2 <u>Medieval and Early Modern Times.</u></b> Candidates for Multiple Subject Teaching Credentials describe the influence of physical geography on the development of medieval and early modern civilizations (i.e., Chinese, Japanese, African, Arabian, Mesoamerican, Andean Highland, and European civilizations). They trace the decline of the Western Roman Empire and the development of feudalism as a social and economic system in Europe and Japan. They identify the art, architecture, and science of Pre-Columbian America. Candidates describe the role of Christianity in medieval and early modern Europe, its expansion beyond Europe, and the role of Islam and its impact on Arabia, Africa, Europe and Asia. They trace the development of the Renaissance and Scientific Revolution in Europe. They define the development of early modern capitalism and its global consequences. They describe the evolution of the idea of representative democracy from the Magna Carta through the Enlightenment.</p>	

Domains in History and Social Science	Curriculum, Assignments, Assessments
<p><b>Domain 2: United States History</b></p>	
<p><b><u>2.1 Early Exploration, Colonial Era, and the War for Independence.</u></b></p> <p>Candidates for Multiple Subject Teaching Credentials identify and describe European exploration and settlement, and the struggle for control of North America during the Colonial Era, including cooperation and conflict among American Indians and new settlers. They identify the founders and discuss their religious, economic, and political reasons for colonization of North America. They describe European colonial rule and its relationship with American Indian societies. Candidates describe the development and institutionalization of African slavery in the western hemisphere and its consequences in Sub-Saharan Africa. They describe the causes of the War for Independence, elements of political and military leadership, the impact of the war on Americans, the role of France, and the key ideas embodied within the Declaration of Independence.</p>	
<p><b><u>2.2 The Development of the Constitution and the Early Republic.</u></b></p> <p>Candidates for Multiple Subject Teaching Credentials describe the political system of the United States and the ways that citizens participate in it through executive, legislative, and judicial processes. They define the Articles of Confederation and the factors leading to the development of the U.S. Constitution, including the Bill of Rights. They explain the major principles of government and political philosophy contained within the Constitution, especially separation of powers and federalism. Candidates trace the evolution of political parties, describe their differing visions for the country, and analyze their impact on economic development policies. They identify historical, cultural, economic and geographic factors that led to the formation of distinct regional identities. They describe the westward movement, expansion of U.S. borders, and government policies toward American Indians and foreign nations during the Early Republic. They identify the roles of Blacks (both slave and free), American Indians, the Irish and other</p>	

<b>Domains in History and Social Science</b>	<b>Curriculum, Assignments, Assessments</b>
immigrants, women and children in the political, cultural and economic life of the new country.	
<p><b>2.3 <u>Civil War and Reconstruction.</u></b></p> <p>Candidates for Multiple Subject Teaching Credentials recognize the origin and the evolution of the anti-slavery movement, including the roles of free Blacks and women, and the response of those who defended slavery. They describe evidence for the economic, social and political causes of the Civil War, including the constitutional debates over the doctrine of nullification and secession. They identify the major battles of the Civil War and the comparative strengths and weaknesses of the Union and the Confederacy. They describe the character of Reconstruction, factors leading to its abandonment, and the rise of Jim Crow practices.</p>	
<p><b>2.4 <u>The Rise of Industrial America.</u></b></p> <p>Candidates for Multiple Subject Teaching Credentials recognize the pattern of urban growth in the United States, the impact of successive waves of immigration in the nineteenth century, and the response of renewed nativism. They understand the impact of major inventions on the Industrial Revolution and the quality of life.</p>	
<b>Domain 3: California History</b>	
<p><b>3.1 <u>The Pre-Columbian Period through the Gold Rush.</u></b></p> <p>Candidates for Multiple Subject Teaching Credentials identify the impact of California's physical geography on its history. They describe the geography, economic activities, folklore and religion of California's American Indian peoples. They discuss the impact of Spanish exploration and colonization, including the mission system and its influence on the development of the agricultural economy of early California. They describe Mexican rule in California. They state the causes of the war between Mexico and the United States and its consequences for California. They describe the discovery of gold and its cultural, social, political and economic effects in California, including its impact on American Indians and Mexican nationals.</p>	

Domains in History and Social Science	Curriculum, Assignments, Assessments
<p><b><u>3.2 Economic, Political, and Cultural Development Since the 1850's.</u></b></p> <p>Candidates for Multiple Subject Teaching Credentials identify key principles of the California Constitution, including the Progressive-era reforms of initiative, referendum and recall, and they recognize similarities and differences between it and the U. S. Constitution. They identify patterns of immigration to California, including the Dust Bowl migration, and discuss their impact on the cultural, economic, social and political development of the state. They identify the effects of federal and state law on the legal status of immigrants. They describe historical and contemporary perspectives on cultural diversity in the United States and in California. Candidates understand the development and identify the locations of California's major economic activities: mining, large-scale agriculture, entertainment, recreation, aerospace, electronics and international trade. They identify factors leading to the development of California's water delivery system, and describe its relationship to California geography.</p>	

## **Part II: Subject Matter Skills and Abilities**

### **Applicable to the Content Domains in History and Social Science**

Candidates for Multiple Subject Teaching Credentials utilize chronological and spatial thinking. They construct and interpret timelines, tables, graphs, maps and charts. They locate places based on ordinal directions, latitude and longitude, the equator, prime meridian, the tropics, the hemispheres, time zones and the international dateline. They identify and interpret major geographical features of the earth's surface including continents and other large landmasses, mountain ranges, forested areas, grasslands, deserts and major bodies of water and rivers. They describe the cultural, historical, economic and political characteristics of world regions, including human features of the regions such as population, land use patterns and settlement patterns.

Candidates apply and explain concepts from history and social studies, including political science and government, geography, economics, demography, anthropology, philosophy, and sociology.

They explain basic concepts of:

- political science and government, including political institutions, power and authority, monarchy, totalitarianism, republicanism, democracy, limited government, and the roles and responsibilities of citizenship;
- geography, including maps and globes, places and regions, the earth's physical and human systems, human settlement and migration, spatial relationships, cultural diffusion, and human-environment interactions;
- economics, including scarcity, opportunity cost, the operation of supply and demand, the circular flow model of economic exchanges, the business cycle, fiscal and monetary policy, and international trade and economic globalization;
- demography, including factors associated with human migration;
- anthropology, including the nature and content of culture and the historical and cultural development of human society, including hunting and gathering, nomadic pastoralism, domestication of plants and animals, and the creation and evolution of human settlements and cities;
- philosophy (including religion and other belief systems) and its impact on history and society; and
- sociology related to individuals; interpersonal relationships; institutions, including family and community; and social structure, including occupation, socio-economic class, ethnicity, and gender.

Candidates for Multiple Subject Teaching Credentials analyze, interpret and evaluate research evidence in history and the social sciences. They interpret primary and secondary sources, including written documents, narratives, photographs, art and artifacts revealed through archeology. In relation to confirmed research evidence they assess curricular materials and contrast differing points of view on historic and current events.

Candidates determine the meaning of academic language as used in a text, including analyzing how an author uses and refines the meaning of a key term over the course of a text. They analyze

in detail how a complex primary source is structured, including how key sentences, paragraphs, and larger portions of the text contribute to the whole.

Candidates for Multiple Subject Teaching Credentials determine the central ideas or information of a primary or secondary source and provide an accurate summary that makes clear the relationships between key details and ideas. They are able to cite specific textual evidence to support analysis of primary and secondary sources, connecting insights gained from specific details to an understanding of the text as a whole. Candidates evaluate various explanations for actions or events and determine which explanation is best supported by textual evidence and they acknowledge where the text leaves matters uncertain.

Candidates evaluate multiple sources of information presented in diverse formats and media. They integrate information from diverse primary and secondary sources into a coherent understanding of an idea or event, noting discrepancies between sources.

Candidates evaluate authors' differing points of view on the same historical event or issue by assessing the author's premises, claims, reasoning, and evidence by corroborating or challenging them with other information.

In the interpretation of historical and current events, candidates identify, explain and discuss multiple causes and effects. They recognize the differing ramifications of historical and current events for people of varying ethnic, racial, socio-economic, cultural and gender backgrounds.

Candidates for Multiple Subject Teaching Credentials write arguments that introduce and develop precise, knowledgeable claims and counterclaims, and prepare informative/explanatory texts, including the narration of historical events. Candidates are able to introduce a topic and organize complex ideas, concepts, and information into a unified whole. They select significant and relevant facts, definitions, details, and examples to develop their topic; use precise language and varied transitions and sentence structures to link major sections of a text, create cohesion, and clarify the relationships between ideas; and provide a concluding statement or section that follows from and supports the information or explanation provided.

## Content Specifications in Mathematics

### Part I: Content Domains for Subject Matter Understanding and Skill in Mathematics

Domains in Mathematics	Coursework, Assignments, Assessments
<b>Domain 1: Number Sense</b>	
<p><b><u>1.1 Numbers, Relationships Among Numbers, and Number Systems.</u></b></p> <p>Candidates for Multiple Subject Teaching Credentials understand base ten place value, number theory concepts (e.g., greatest common factor), and the structure of the whole, integer, rational, and real number systems. They order real numbers, including integers, mixed numbers, rational numbers (e.g., fractions, decimals, percents) and irrational numbers on a number line. They represent and perform operations on numbers in exponential and scientific notation. They describe the relationships between the algorithms for addition, subtraction, multiplication, and division. They understand properties of number systems and their relationship to the algorithms, [e.g., 1 is the multiplicative identity; <math>27 + 34 = 2 \times 10 + 7 + 3 \times 10 + 4 = (2 + 3) \times 10 + (7 + 4)</math>]. Candidates perform operations with positive, negative, and fractional exponents, as they apply to whole numbers and fractions.</p>	
<p><b><u>1.2 Computational Tools, Procedures, and Strategies.</u></b> Candidates demonstrate fluency in standard algorithms for computation and evaluate the correctness of nonstandard algorithms. They demonstrate an understanding of the order of operations. They round numbers, estimate the results of calculations, and place numbers accurately on a number line. They demonstrate the ability to use technology, such as calculators or software, for complex calculations.</p>	
<b>Domain 2: Algebra and Functions</b>	
<p><b><u>2.1 Patterns and Functional Relationships.</u></b> Candidates represent patterns, including relations and functions, through tables, graphs, verbal rules, or symbolic rules. They use proportional reasoning such as ratios, equivalent fractions, and similar triangles, to solve numerical, algebraic, and geometric problems. They use mathematics to represent and analyze quantitative relationships between dependent and</p>	

Domains in Mathematics	Coursework, Assignments, Assessments
independent variables in real-world problems.	
<p><b><u>2.2 Linear and Quadratic Equations and Inequalities.</u></b></p> <p>Candidates are able to find equivalent expressions for equalities and inequalities, explain the meaning of symbolic expressions (e.g., relating an expression to a situation and vice versa), find the solutions, and represent them on graphs. They recognize and create equivalent algebraic expressions (e.g., <math>2(a+3) = 2a + 6</math>), and represent geometric problems algebraically (e.g., the area of a triangle). They use mathematics to solve real-world problems using numerical and algebraic expressions and equations. Candidates have a basic understanding of linear equations and their properties (e.g., slope, perpendicularity); the multiplication, division, and factoring of polynomials; and graphing and solving quadratic equations through factoring and completing the square. They interpret graphs of linear and quadratic equations and inequalities, including solutions to systems of equations.</p>	
<p><b>Domain 3: Measurement and Geometry</b></p>	
<p><b><u>3.1 Two- and Three-dimensional Geometric Objects.</u></b> Candidates for Multiple Subject Teaching Credentials understand characteristics of common two- and three-dimensional figures, such as triangles (e.g., isosceles and right triangles), quadrilaterals, and spheres. They are able to draw conclusions based on the congruence, similarity, or lack thereof, of two figures. They identify different forms of symmetry, translations, rotations, and reflections. They understand the Pythagorean theorem and its converse. They are able to work with properties of parallel lines.</p>	
<p><b><u>3.2 Representational Systems, Including Concrete Models, Drawings, and Coordinate Geometry.</u></b> Candidates use concrete representations, such as manipulatives, drawings, and coordinate geometry to represent geometric objects. They construct basic geometric figures using a compass and straightedge, and represent three-dimensional objects through two-dimensional drawings. They combine and dissect two- and three-dimensional figures into familiar shapes, such as dissecting a parallelogram and rearranging the pieces to form a rectangle of equal area.</p>	

<b>Domains in Mathematics</b>	<b>Coursework, Assignments, Assessments</b>
<p><b><u>3.3 Techniques, Tools, and Formulas for Determining Measurements.</u></b></p> <p>Candidates estimate and measure time, length, angles, perimeter, area, surface area, volume, weight/mass, and temperature through appropriate units and scales. They identify relationships between different measures within the metric or customary systems of measurements and estimate an equivalent measurement across the two systems. They calculate perimeters and areas of two-dimensional objects and surface areas and volumes of three-dimensional objects, and use mathematics to solve real-world problems involving the volume of cones, cylinders, and spheres. They relate proportional reasoning to the construction of scale drawings or models. They use measures such as miles per hour to analyze and solve problems.</p>	
<p><b>Domain 4: Statistics, Data Analysis, and Probability</b></p>	
<p><b><u>4.1 Collection, Organization, and Representation of Data.</u></b></p> <p>Candidates represent a collection of data through graphs, tables, or charts, incorporating technology as appropriate. They understand the mean, median, mode, and range of a collection of data. They have a basic understanding of the design of surveys, such as the role of a random sample.</p>	
<p><b><u>4.2 Inferences, Predictions, and Arguments Based on Data.</u></b></p> <p>Candidates interpret a graph, table, or chart representing a data set. They investigate patterns of association in bivariate data (e.g., linear associations, goodness of fit) in scatter plots and frequency tables. They draw conclusions about a population from a random sample, and identify potential sources and effects of bias.</p>	

<b>Domains in Mathematics</b>	<b>Coursework, Assignments, Assessments</b>
<p><b>4.3 <u>Basic Notions of Chance and Probability.</u></b> Candidates can define the concept of probability in terms of a sample space of equally likely outcomes. They use their understanding of complementary, mutually exclusive, dependent, and independent events to calculate probabilities of simple events. They can express probabilities in a variety of ways, including ratios, proportions, decimals, and percents. They find probabilities of compound events using various representations (e.g., organized lists, tables, tree diagrams, simulations).</p>	

**Part II: Subject Matter Skills and Abilities**  
**Applicable to the Content Domains in Mathematics**

Candidates for Multiple Subject Teaching Credentials identify and prioritize relevant and missing information in mathematical problems. They make sense of problems and persevere in solving them. They look for and make use of structure, analyzing complex problems to identify similar simple problems that might suggest solution strategies. They model with mathematics, representing a problem in alternate ways, such as with words, symbols, concrete models, diagrams, and technology in order to gain greater insight. They consider examples and patterns as means to formulating a conjecture.

Candidates reason abstractly and quantitatively, and apply logical reasoning and techniques from arithmetic, algebra, geometry, and probability/statistics to solve mathematical problems. They look for and express regularity in repeated reasoning, use appropriate tools strategically, and analyze problems to identify alternative solution strategies. They evaluate the truth of mathematical statements (i.e., whether a given statement is always, sometimes, or never true). They apply different solution strategies (e.g., estimation) to check the reasonableness of a solution. They demonstrate whether or not a solution is correct.

Candidates explain their mathematical reasoning through a variety of methods, such as words, numbers, symbols, charts, graphs, tables, diagrams, and concrete models. They use academic language to construct viable arguments and critique the reasoning of others. They use appropriate mathematical notation with clear and accurate language, and they attend to precision. They explain how to derive a result based on previously developed ideas, and explain how a result is related to other ideas.

## Content Specifications in Science

### Part I: Content Domains for Subject Matter Understanding and Skill in Science

Domains in Science	Coursework, Assignments, Assessments
<b>Domain 1. Physical Science</b>	
<p><b>1.1 <u>Structure and Properties of Matter.</u></b></p> <p>Candidates for Multiple Subject Teaching Credentials understand the physical properties of solids, liquids, and gases, such as color, mass, density, hardness, and electrical and thermal conductivity. They know that matter can undergo physical changes (e.g., changes in state such as the evaporation and freezing of water) and chemical changes (i.e., atoms in reactants rearrange to form products with new physical and chemical properties). They know that matter consists of atoms and molecules in various arrangements, and can give the location and motions of the parts of an atom (protons, neutrons, and electrons). They can describe the constituents of molecules and compounds, naming common elements (e.g., hydrogen, oxygen, and iron), and explain how elements are organized on the Periodic Table on the basis of their atomic and chemical properties. They can describe characteristics of solutions (such as acidic, basic, and neutral solutions) and they know examples with different pH levels such as soft drinks, liquid detergents, and water. They know that mixtures may often be separated based on physical or chemical properties</p>	
<p><b>1.2 <u>Principles of Motion and Energy.</u></b></p> <p>Candidates for Multiple Subject Teaching Credentials describe an object's motion based on position, displacement, speed, velocity, and acceleration. They know that forces (pushes and pulls), such as gravity, magnetism, and friction act on objects and may change their motion if these forces are not in balance. They know that "like" electrical charges or magnetic poles produce repulsive forces and "unlike" charges or poles produce attractive forces. They describe simple machines in which small forces are exerted over long distances to accomplish difficult tasks (e.g., using levers or pulleys to move or lift heavy objects). Candidates identify forms of energy including solar, chemical, electrical, magnetic, nuclear, sound, light, and electromagnetic. They know that total energy in a system is conserved but may be changed from one form to another, as in an electrical motor or generator. They understand the difference between heat, (thermal energy) and</p>	

<b>Domains in Science</b>	<b>Coursework, Assignments, Assessments</b>
<p>temperature, and understand temperature measurement systems. Candidates know how heat may be transferred by conduction, convection, and radiation (e.g., involving a stove, the Earth's mantle, or the sun). They describe sources of light including the sun, light bulbs, or excited atoms (e.g., neon in neon lights) and interactions of light with matter (e.g., vision and photosynthesis). They know and can apply the optical properties of waves, especially light and sound, including reflection (e.g., by a mirror) or refraction (e.g., bending light through a prism). They explain conservation of energy resources in terms of renewable and non-renewable natural resources and their use in society.</p>	
<p><b>Domain 2: Life Science</b></p>	
<p><b><u>2.1 Structure of Living Organisms and Their Function (Physiology and Cell Biology).</u></b></p> <p>Candidates for Multiple Subject Teaching Credentials describe levels of organization and related functions in plants and animals, including, organ systems (e.g., the digestive system), organs, tissues (e.g., ovules in plants, heart chambers in humans), cells, and subcellular organelles (e.g., nucleus, chloroplast, mitochondrion). They know structures and related functions of systems in plants and animals, such as reproductive, respiratory, circulatory, and digestive. They understand principles of chemistry underlying the functioning of biological systems (e.g., carbon's central role in living organisms, water and salt, DNA, and the energetics of photosynthesis).</p>	
<p><b><u>2.2 Living and Nonliving Components in Environments (Ecology).</u></b></p> <p>Candidates for Multiple Subject Teaching Credentials know the characteristics of many living organisms (e.g., growth, reproduction, and stimulus response). They understand the basic needs of all living organisms (e.g., food, water, and space), and can distinguish between environmental adaptations and accommodations. They describe the relationship between the number and types of organisms an ecosystem can support and relationships among members of a species and across species. They illustrate the flow of energy and matter through an ecosystem from sunlight to food chains and food webs (including primary producers, consumers, and decomposers). They identify the resources available in an ecosystem, and describe the environmental factors that support the ecosystem, such as temperature, water, and soil composition.</p>	

<b>Domains in Science</b>	<b>Coursework, Assignments, Assessments</b>
<p><b><u>2.3 Life Cycle, Reproduction, and Evolution (Genetics and Evolution).</u></b></p> <p>Candidates for Multiple Subject Teaching Credentials diagram life cycles of familiar organisms (e.g., butterfly, frog, mouse). They explain the factors that affect the growth and development of plants, such as light, gravity, and stress. They distinguish between sexual and asexual reproduction, and understand the process of cell division (mitosis), the types of cells and their functions, and the replication of plants and animals. They distinguish between environmental and genetic sources of variation, and understand the principles of natural and artificial selection. They know how evidence from the fossil record, comparative anatomy, and DNA sequences can be used to support the theory that life gradually evolved on earth over billions of years. They understand the basis of Darwin's theory, that species evolved by a process of natural selection</p>	
<p><b>Domain 3: Earth and Space Science</b></p>	
<p><b><u>3.1 The Solar System and the Universe (Astronomy).</u></b></p> <p>Candidates for Multiple Subject Teaching Credentials identify and describe the planets, their motion, and that of other planetary bodies (e.g., comets and asteroids) around the sun. They explain time zones in terms of longitude and the rotation of the earth, and understand the reasons for changes in the observed position of the sun and moon in the sky during the course of the day and from season to season. They name and describe bodies in the universe including the sun, stars, and galaxies.</p>	
<p><b><u>3.2 The Structure and Composition of the Earth (Geology).</u></b></p> <p>Candidates for Multiple Subject Teaching Credentials describe the formation and observable physical characteristics of minerals (e.g., quartz, calcite, hornblende, mica, and common ore minerals) and different types of rocks (e.g., sedimentary, igneous, and metamorphic). They identify characteristics of landforms, such as mountains, rivers, deserts, and oceans. They explain chemical and physical weathering, erosion, deposition, and other rock forming and soil changing processes and the formation and properties of different types of soils and rocks. They describe layers of the earth (crust, lithosphere, mantle, and core) and plate tectonics, including its convective source. They explain how mountains are created and why volcanoes and earthquakes occur, and describe their mechanisms and effects. They know the commonly cited evidence supporting the theory of plate tectonics. They</p>	

<b>Domains in Science</b>	<b>Coursework, Assignments, Assessments</b>
<p>identify factors influencing the location and intensity of earthquakes. They describe the effects of plate tectonic motion over time on climate, geography, and distribution of organisms, as well as more general changes on the earth over geologic time as evidenced in landforms and the rock and fossil records, including plant and animal extinction</p>	
<p><b>3.3 <u>The Earth's Atmosphere (Meteorology).</u></b></p> <p>Candidates for Multiple Subject Teaching Credentials explain the influence and role of the sun and oceans in weather and climate and the role of the water cycle. They describe causes and effects of air movements and ocean currents (based on convection of air and water) on daily and seasonal weather and on climate.</p>	
<p><b>3.4 <u>The Earth's Water (Oceanography).</u></b></p> <p>Candidates for Multiple Subject Teaching Credentials compare the characteristics of bodies of water, such as rivers, lakes, oceans, and estuaries. They describe tides and explain the mechanisms causing and modifying them, such as the gravitational attraction of the moon, sun, and coastal topography.</p>	

## **Part II: Subject Matter Skills and Abilities** **Applicable to the Content Domains in Science**

Candidates for Multiple Subject Teaching Credentials know how to plan and conduct a scientific investigation to test a hypothesis, including:

- using print and electronic resources for preparation and research;
- applying the principles of experimental design, including formulation of testable questions and hypotheses, and evaluation of the accuracy and reproducibility of data;
- distinguishing between dependent and independent variables and controlled parameters, and between linear and nonlinear relationships on a graph of data;
- using academic language appropriately (e.g., observation, organization, experimentation, inference, prediction, evidence, opinion, hypothesis, theory, law);
- following precisely a multistep procedure when carrying out experiments, taking measurements, or performing technical tasks;
- analyzing experimental results according to explanations in a text; and
- communicating accurately the steps and results of a scientific investigation in both verbal and written formats.

Candidates select and use a variety of scientific tools. They know how to record length, mass, and volume measurements using the metric system. They interpret results of experiments and interpret events by sequence and time (e.g., relative age of rocks, phases of the moon) from evidence of natural phenomena. They communicate the steps in an investigation, record data, and interpret and analyze numerical and non-numerical results using charts, maps, tables, models, graphs, and labeled diagrams.

Candidates integrate and evaluate multiple sources of information presented in diverse formats and media in order to address a question or solve a problem. They analyze a scientific or technical text to determine the central ideas or conclusions and accurately summarize complex information, concepts, and processes in a text by paraphrasing them in simpler terms. Candidates cite specific textual evidence to support analysis of scientific and technical texts, recognizing gaps or inconsistencies that may exist in the text.

Candidates analyze how informational texts structure the subject matter into categories and hierarchies. They determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in grade-level scientific and technical contexts. They analyze the author's purpose in presenting specific information in a text or passage.

Candidates evaluate hypotheses, data, analysis, and conclusions in a scientific or technical text, verifying the data when possible and corroborating or challenging conclusions with other sources of information. They synthesize information from a range of sources (e.g., texts, experiments, simulations) into a coherent understanding of a process, phenomenon, or concept.

## Appendix A

### Glossary of Specialized Terms: Content Specifications in Reading, Language, and Literature

Specialized Terms	Definitions of Specialized Terms
Derivational morpheme morpheme	Meaningful unit combined with roots or stems to form new words with new meanings, with the potential to change the part of speech (e.g., <i>-ish</i> added to the noun <i>boy</i> results in an adjective <i>bovish</i> ).
Pragmatics	The system of principles and assumptions for using language and related gestures communicatively in social contexts; also, the study of language use for the discovery of this rule system.
Affix	A bound morpheme attached before (prefix), after (suffix), in (infix), around (circumfix), or above (suprafix) a root or base word to modify its meaning or linguistic function; includes prefixes and suffixes.
Denotative meaning	Dictionary meaning; what a word refers to.
Idiolect	The linguistic system (language forms, structures, and styles) used by an individual; distinguished from the term <i>dialect</i> , which refers to linguistic systems characteristic of communities.
Morphology	The study of meaningful units of language and how their patterns of distribution contribute to the forms and structure of words; distinct from <i>etymology</i> , which is the study of the historical and cultural origins of words.
Phoneme awareness	The conscious awareness that words and utterances are made up of segments of our own speech that are represented with letters in an alphabetic orthography; also called <i>phonemic awareness</i> .
Phonics	An approach to the study of the relationships between letters and the sounds they represent; also used to describe reading instruction that teaches sound-symbol correspondences, such as "the phonics approach."
Phonology	The rule system within a language by which phonemes are sequenced, patterned and uttered to represent meanings; also, the study of this rule system.
Prosody	The rhythmic and tonal aspects of speech: the "music" of oral language; prosodic features are variations in pitch (intonation), stress patterns (syllable prominence), and duration (length of time) that contribute to expressive reading of a text.