ADOPTED REGULATION OF THE

STATE BOARD OF EDUCATION

LCB File No. R075-99

Effective November 4, 1999

EXPLANATION – Matter in ***italics*** is new; matter in brackets ~~[omitted material]~~ is material to be omitted.

AUTHORITY: §§1-16, NRS 385.080 and 389.520, and section 45 of chapter 473, Statutes of Nevada 1997, at page 1780, as amended by section 18 of chapter 621, Statutes of Nevada 1999, at page 3390.

Section 1. Chapter 389 of NAC is hereby amended by adding thereto the provisions set forth as sections 2 to 16, inclusive, of this regulation to read as follows:

Sec. 2. ***By the end of the second grade, pupils must know and be able to do everything required in the previous grades for courses in English language arts offered in public schools. Instruction in the second grade in English language arts must be designed so that pupils meet the following performance standards by the completion of the second grade:***

1. For the area of reading:

(a) Know and use skills and strategies of word analysis to comprehend new words encountered in text, as demonstrated by the pupil's ability to:

(1) Read familiar or independently chosen texts appropriate for the pupil's grade level with fluency, accuracy, intonation and expression;

(2) Read high-frequency words to build fluency;

(3) Apply the knowledge of phonics and structural elements, including, without limitation, letter-sound relationships, affixes and spelling patterns to understand words in context; and

(4) Apply the knowledge of synonyms, antonyms, homophones and homographs to understand text.

(b) Use skills and strategies of reading process to build comprehension, as demonstrated by the pupil's ability to:

(1) Apply pre-reading strategies, including, without limitation, accessing prior knowledge, predicting, previewing and setting a purpose;

(2) Use strategies of self-correction, including, without limitation, self-questioning and rereading; and

(3) Recall and retell the main idea of text.

(c) Read to comprehend, interpret and evaluate literature from a variety of authors, cultures and times, as demonstrated by the pupil's ability to:

(1) Provide well-developed descriptions of simple story elements, such as setting, characters, character traits and plot;

(2) Compare and contrast different versions of the same stories from different cultures and eras;

(3) Identify the main idea of the text;

(4) Differentiate among rhythm, rhyme and alliteration in poetry; and

(5) Distinguish between poetry and prose.

(d) Read to comprehend, interpret and evaluate informational texts for specific purposes, as demonstrated by the pupil's ability to:

(1) Use the parts of a book to locate information, including the table of contents, chapter headings, diagrams, charts and graphs;

(2) Identify relationships of cause and effect and the main idea of a passage;

(3) Formulate questions to gain understanding of important information in text; and

(4) Read and follow simple directions to perform a task.

2. For the area of writing:

(a) Write a variety of texts that inform, persuade, describe, evaluate or tell a story and are appropriate to purpose and audience, as demonstrated by the pupil's ability to:

(1) Write informative papers using two sources;

(2) Write friendly letters using a standard format; and

(3) Write a variety of literary forms, including stories, poems and responses to literature.

(b) Write with a clear focus and logical development, evaluating, revising and editing for organization, style, tone and choice of words, as demonstrated by the pupil's ability to:

(1) Apply, with the assistance of a teacher, the appropriate steps of the writing process, including, without limitation, prewriting, drafting, revising, editing and sharing;

(2) Generate and organize ideas for writing;

(3) Write stories and other compositions with ample detail for a specific audience;

(4) Revise and edit writing, with the assistance of the teacher, to attain sufficient detail, ample clarity and appropriate use of words; and

(5) Share written work with others and use responses for appropriate revision.

(c) Write using standard English grammar, usage, punctuation, capitalization and spelling, as demonstrated by the pupil's ability to:

(1) Identify and write complete sentences using nouns, verbs, pronouns, adjectives and adverbs;

(2) Use correct punctuation, including, without limitation, the use of:

(I) Punctuation at the end of a sentence;

(II) Commas in the greeting and closing of a letter, in dates and between words in a series; and

(III) Apostrophes in contractions and possessives;

(3) Capitalize proper nouns and initials correctly;

(4) Spell words correctly in writing, especially high-frequency irregular words and words with long and r-controlled vowels, blends and digraphs; and

(5) Write compositions that are readable and legible.

3. For the areas of listening and speaking:

(a) Listen to and evaluate oral communications for content, style, purpose of the speaker and appropriateness for the audience, as demonstrated by the pupil's ability to:

(1) Determine the purposes for listening, such as to obtain information, to solve problems or to provide enjoyment;

(2) Listen and respond to public presentations and a variety of media;

(3) Distinguish generally among different dialects; and

(4) Follow two-step oral directions to complete a task.

(b) Speak using organization, style, tone, voice and media aids appropriate to the audience and purpose, as demonstrated by the pupil's ability to:

(1) Speak clearly, using an understandable pace and vocabulary to communicate ideas;

(2) Make oral presentations that maintain a clear focus;

(3) Recount experiences and tell stories that move through a logical sequence of events and include characters and a setting; and

(4) Give clear directions to complete a simple task.

(c) Participate in discussions to offer information, clarify ideas and support a position, as

demonstrated by the pupil's ability to:

(1) Allow others to speak, use eye contact and present ideas and information in conversations and group discussions; and

(2) Ask and answer questions to gather and provide information.

4. For the area of research, formulate research questions and use a variety of sources to obtain information, weigh the evidence, draw valid conclusions and present findings, as demonstrated by the pupil's ability to:

(a) Formulate questions to explore areas of interest;

(b) Obtain information from reference materials and available technology to answer questions; and

(c) Present the findings of the research by using media that is available.

Sec. 3. *By the end of the third grade, pupils must know and be able to do everything required in the previous grades for courses in English language arts offered in public schools. Instruction in the third grade in English language arts must be designed so that pupils meet the following performance standards by the completion of the third grade:*

1. For the area of reading:

(a) Know and use skills and strategies of word analysis to comprehend new words encountered in text, as demonstrated by the pupil's ability to:

(1) Apply knowledge of word families, phonics and structural elements to determine the meanings of unfamiliar words in context;

(2) Apply knowledge of prefixes, suffixes, roots and base words with minimal assistance from the teacher to determine the meanings of words in context;

(3) Use dictionaries, glossaries and other resource materials to determine the meanings of words; and

(4) Develop and communicate an expanded vocabulary through the use of synonyms, antonyms, homophones and homographs.

(b) Use skills and strategies of reading process to build comprehension, as demonstrated by the pupil's ability to:

(1) Apply pre-reading strategies with a variety of texts, such as stories, poems and novels;

(2) Apply self-correcting strategies, such as self-questioning and rereading to understand text;

(3) Organize essential points of text and make revised predictions while reading;

(4) Restate facts and details of text to share information and organize ideas; and

(5) Adjust the rate of reading as appropriate for the level of difficulty of the text.

(c) Read to comprehend, interpret and evaluate literature from a variety of authors, cultures and times, as demonstrated by the pupil's ability to:

(1) Compare one or more elements of a story and points of view in a variety of works by a variety of authors from different times and cultures;

(2) With minimal assistance from the teacher, make inferences about the traits of characters and check text for verification;

(3) With minimal assistance from the teacher, identify and compare themes or messages in text;

(4) Identify a simile, metaphor, onomatopoeia and hyperbole in text; and

(5) Read and identify stories, plays, poetry and non-fiction selections.

(d) Read to comprehend, interpret and evaluate informational texts for specific purposes, as demonstrated by the pupil's ability to:

(1) Identify relevant information from the text;

(2) With minimal assistance from the teacher, distinguish between cause and effect, fact and opinion, and main idea and supporting detail;

(3) With some assistance from the teacher, ask questions and provide support for answers by connecting prior knowledge with literal and inferential information in text;

(4) With minimal assistance from the teacher, draw conclusions about text and support the conclusions with evidence from the text and experience; and

(5) With minimal assistance from the teacher, read and follow three and four-step directions to complete a simple task.

2. For the area of writing:

(a) Write a variety of texts that inform, persuade, describe, evaluate or tell a story and are appropriate to the purpose and audience, as demonstrated by the pupil's ability to:

(1) Use at least three sources to write informative papers;

(2) Write narratives, stories, responses to literature, and personal and business letters using appropriate organization and format;

(3) Write stories that develop sequentially and contain sufficient detail; and

(4) Write compositions that retell the events in a story in sequence.

(b) Write with a clear focus and logical development, evaluating, revising, and editing for organization, style, tone and choice of words, as demonstrated by the pupil's ability to:

(1) With minimal assistance from the teacher, use the steps of the writing process, such as prewriting, drafting, revising, editing and sharing;

(2) Write simple compositions that include a topic sentence, supporting sentences and details;

(3) Revise and edit written drafts for order of ideas and use of standard English; and

(4) Demonstrate effective use of tone by using appropriate words for given audiences.

(c) Write using standard English grammar, usage, punctuation, capitalization and spelling, as demonstrated by the pupil's ability to:

(1) Compose simple sentences using correct subject and verb agreement and correct use of past, present and future verb tenses;

(2) Write declarative, interrogative, imperative and exclamatory sentences;

(3) Use quotation marks in dialogue and correct punctuation for writing the name of a city, state, date and title of a book;

(4) Use correct capitalization and spelling; and

(5) Create readable and legible compositions in a standard format.

3. For the areas of listening and speaking:

(a) Listen to a speaker and evaluate oral communications for content, style, purpose of the speaker and appropriateness for the audience, as demonstrated by the pupil's ability to:

(1) Retell and explain what has been said by a speaker;

(2) Listen to make connections between prior experiences, insights and ideas and the message of the speaker;

(3) Identify language, sayings and dialects that reflect regions and cultures; and

(4) Follow three and four-step oral directions to complete a simple task.

(b) Speak using organization, style, tone, voice and media aids appropriate to audience and purpose, as demonstrated by the pupil's ability to:

(1) Use standard English to communicate ideas in a variety of tasks;

(2) Use appropriate techniques in public speaking and give organized and sequential presentations;

(3) Read aloud and recite prose and poetry with fluency, rhythm, pace, appropriate intonation and vocal patterns; and

(4) Give clear three and four-step directions to complete a simple task.

(c) Participate in discussions to offer information, clarify ideas and support a position, as demonstrated by the pupil's ability to:

(1) Speak, listen attentively and respond to questions with relevant detail in conversations and group discussions;

(2) Share ideas and information to complete a task; and

(3) Distinguish the difference between the opinion of the speaker and the facts.

4. For the area of research, formulate research questions and use a variety of sources to obtain information, weigh the evidence, draw valid conclusions and present findings, as demonstrated by the pupil's ability to:

(a) Formulate questions to investigate topics;

(b) Use a variety of resources, including, without limitation, resources available at the library, technological resources and print and non-print resources to find and record information on a topic;

(c) Give appropriate credit for the ideas, images and information attributable to other persons by providing a list of sources; and

(d) Present research findings using available, selected media for different purposes and audiences.

Sec. 4. ***By the end of the fifth grade, pupils must know and be able to do everything required in the previous grades for courses in English language arts offered in public schools. Instruction in the fifth grade in English language arts must be designed so that pupils meet the following performance standards by the completion of the fifth grade:***

1. For the area of reading:

(a) Know and use skills and strategies of word analysis to comprehend new words encountered in text, as demonstrated by the pupil's ability to:

(1) Competently apply word attack skills to comprehend unfamiliar words in text;

(2) Determine the meanings of words by applying knowledge of Greek and Latin roots and affixes, with or without dictionaries and glossaries; and

(3) Recognize and apply clues in the context to identify unknown words in text.

(b) Use skills and strategies of reading process to build comprehension, as demonstrated by the pupil's ability to:

(1) Apply pre-reading strategies to aid comprehension;

(2) Use a variety of skills, strategies and rates while reading to aid comprehension; and

(3) Demonstrate comprehension of text through various activities such as note taking or writing reports.

(c) Read to comprehend, interpret, and evaluate literature from a variety of authors, cultures and times, as demonstrated by the pupil's ability to:

(1) Identify the elements of the main plot, conflicts and themes in a variety of texts;

(2) Identify figurative language in a variety of texts;

(3) Compare stated and implied themes in a variety of texts;

(4) Make and defend accurate inferences about the traits and motivations of characters;

(5) Describe differences in the purpose and structure among stories, plays, poetry and nonfictional materials;

(6) Make reasonable connections between a piece of literature and the historical events and cultures portrayed; and

(7) Describe how an author's writing style influences the response of the reader to the text.

(d) Read to comprehend, interpret and evaluate informational texts for specific purposes, as demonstrated by the pupil's ability to:

(1) Clarify and connect main ideas and concepts and identify their relationship to other sources and topics;

(2) Read to evaluate new information and hypotheses by comparing them to known information and ideas;

(3) Draw conclusions and make inferences about text supported by evidence from the text and experience;

(4) Identify the ideas and purposes of an author in various forms of text, including, without limitation, advertisements and public documents; and

(5) Read and follow multi-step directions to complete a task.

2. For the area of writing:

(a) Write a variety of texts that inform, persuade, describe, evaluate or tell a story, and are appropriate to purpose and audience, as demonstrated by the pupil's ability to:

(1) Write stories by developing a logical sequence of events and by using a sufficient number of descriptive details;

(2) Support reactions to or positions on literary selections by citing to some evidence, details or quotations from the text;

(3) Write informative compositions that develop the topic with appropriate facts from a variety of sources;

(4) Write accurate summaries of oral and written stories;

(5) Write letters giving complete information in accurate format; and

(6) Write short expository text that speculates on causes and effects and offers simple persuasive evidence.

(b) Write with a clear focus and logical development, evaluating, revising and editing for organization, style, tone and choice of words, as demonstrated by the pupil's ability to:

(1) With minimal assistance from the teacher, generate ideas for writing using a variety of strategies;

(2) Create written works with an organizational structure that logically flows from one idea to the next idea without confusion;

(3) Write with clarity and focus by developing the topic and providing general support;

(4) Use a variety of strategies for revising and editing to refine meaning, including, without limitation, adding words, deleting words, and clarifying and rearranging words and sentences; and

(5) Effectively communicate tone that is appropriate to the intended audience and use effective words.

(c) Write using standard English grammar, usage, punctuation, capitalization and spelling, as demonstrated by the pupil's ability to:

(1) Identify and correctly use pronoun case, comparative and superlative modifiers and often-confusing verbs;

(2) Identify and use prepositional phrases, appositives and independent clauses, and use transitions and conjunctions to elaborate ideas in writing;

(3) Use proper punctuation, including, without limitation:

(I) Colons to introduce a list;

(II) Quotation marks around exact words of speakers and names of poems, songs and short stories; and

(III) Application of the rules of capitalization; and

(4) Spell frequently-used words correctly, paying special attention to roots, suffixes and prefixes.

3. For the areas of listening and speaking:

(a) Listen to and evaluate oral communications for content, style, purpose of the speaker and appropriateness for the audience, as demonstrated by the pupil's ability to:

(1) Identify, interpret and evaluate a speaker's verbal and nonverbal messages, intent, viewpoints and techniques using identified criteria and distinguish fact from opinion;

(2) Identify and describe language and dialect that varies in different contexts, regions and cultures; and

(3) Follow multi-step oral directions to complete a task.

(b) Speak using organization, style, tone, voice and media aids appropriate to audience and purpose, as demonstrated by the pupil's ability to:

(1) Use specific vocabulary, standard English and appropriate public speaking techniques to communicate ideas;

(2) Give organized oral reports that demonstrate a clear point of view and incorporate multimedia aids as necessary for enhancement; and

(3) Give multi-step oral directions to complete a task.

(c) Participate in discussions to offer information, clarify ideas and support a position, as demonstrated by the pupil's ability to:

(1) Participate in group discussions as a contributor and as a leader;

(2) Ask and answer questions in group discussions to clarify or extend ideas;

(3) Share ideas, opinions and information with a group, requiring minimal prompting or assistance from the teacher, and choose language that communicates messages clearly and effectively; and

(4) Compare and contrast ideas and viewpoints of speakers.

4. For the area of research, formulate research questions, use a variety of sources to obtain information, weigh the evidence, draw valid conclusions and present findings, as demonstrated by the pupil's ability to:

(a) Develop reasonable research questions that establish a focus and purpose for inquiry;

(b) Select sufficient information from multiple resources to answer a research question and provide a list of each source used;

(c) Take adequate notes to record information using identified formats; and

(d) Organize and communicate research findings using appropriate graphs, charts or maps with written text.

Sec. 5. *By the end of the eighth grade, pupils must know and be able to do everything required in the previous grades for courses in English language arts offered in public schools. Instruction in the eighth grade in English language arts must be designed so that pupils meet*

the following performance standards by the completion of the eighth grade:

1. For the area of reading:

(a) Know and use skills and strategies of word analysis to comprehend new words encountered in text, as demonstrated by the pupil's ability to:

(1) Apply knowledge of Greek and Latin roots and affixes to comprehend new words;

(2) Use dictionaries and glossaries to determine meanings of new words encountered in text; and

(3) Analyze figurative language to infer literal and figurative meaning from text.

(b) Use skills and strategies of reading process to build comprehension, as demonstrated by the pupil's ability to:

(1) Apply prereading strategies;

(2) Apply and analyze skills and strategies that enhance comprehension;

(3) Use outlines, maps and graphic organizers to aid comprehension; and

(4) Adjust the rate of reading as appropriate for the purpose and task assigned and the level of difficulty of the text.

(c) Read to comprehend, interpret and evaluate literature from a variety of authors, cultures and times, as demonstrated by the pupil's ability to:

(1) Analyze and evaluate the elements of a story to determine the importance of the elements to the story;

(2) Explain inferences regarding the motives of characters and consequences of action by citing to the text;

(3) Identify examples of connections that exist among an author, the cultural and historical context and the work;

(4) Distinguish theme from topic and cite to evidence from the text to support claims;

(5) Identify, analyze and compare techniques used by authors to elicit a response from the reader; and

(6) Compare characteristics and elements of various literary forms.

(d) Read to comprehend, interpret and evaluate informational texts for specific purposes, as demonstrated by the pupil's ability to:

(1) Use knowledge of the features of the text and common expository structures to comprehend the text;

(2) Locate, interpret, organize and synthesize information in text to answer specific questions and support ideas;

(3) Evaluate the validity, accuracy and adequacy of evidence that supports the ideas of the author and cite supporting evidence from the text;

(4) Summarize ideas and information in text, including, without limitation, advertisements and public documents; and

(5) Read and follow multi-step directions to complete a complex task.

2. For the area of writing:

(a) Write a variety of texts that inform, persuade, describe, evaluate or tell a story and are appropriate to purpose and audience, as demonstrated by the pupil's ability to:

(1) Write well-developed informative papers using a variety of sources;

(2) Write personal and business communications;

(3) Write organized narratives or short stories that include relevant dialogue and details and that reveal the author's opinion concerning the subject;

(4) Respond to literary selections using supporting evidence from the text;

(5) Write summaries by presenting main ideas and supporting information;

(6) Write well-organized expository text that states a thesis and answers readers' concerns and counter arguments; and

(7) Write organized, persuasive editorials or essays that state a thesis supported by details, reasons and examples.

(b) Write with a clear focus and logical development and evaluate, revise and edit for organization, style, tone and choice of words, as demonstrated by the pupil's ability to:

(1) Generate ideas using a variety of strategies;

(2) Organize ideas according to the purpose and task;

(3) Draft coherent compositions with a dominant impression or thesis statement;

(4) Revise writing using identified criteria;

(5) Edit for use of standard English; and

(6) Write with a tone that is expressive and appropriate to audience and purpose.

(c) Write using standard English grammar, usage, punctuation, capitalization and spelling, as demonstrated by the pupil's ability to:

(1) Apply the rules of usage and grammar correctly;

(2) Use varied sentence structure to reinforce style;

(3) Use internal and external punctuation correctly;

(4) Use rules of capitalization; and

(5) Demonstrate conventional spelling.

3. For the areas of listening and speaking:

(a) Listen to and evaluate oral communications for content, style, purpose of the speaker and appropriateness for the audience, as demonstrated by the pupil's ability to:

(1) Paraphrase the main ideas of the speaker and the supporting evidence to determine the meaning of the communication and to ask relevant questions concerning the communication;

(2) Evaluate content and delivery and provide constructive feedback;

(3) Analyze dialects associated with informal and formal speaking contexts as they are reflected in slang, jargon and language styles; and

(4) Follow multi-step oral directions to complete a complex task.

(b) Speak using organization, style, tone, voice and media aids appropriate to audience and purpose, as demonstrated by the pupil's ability to:

(1) Select and use vocabulary and techniques of public speaking that are appropriate to the audience and purpose;

(2) Organize and deliver planned and impromptu presentations appropriate to the audience and purpose; and

(3) Give clear and concise multi-step directions to complete a complex task.

(c) Participate in discussions to offer information, clarify ideas and support a position, as demonstrated by the pupil's ability to:

(1) Participate in conversations and group discussions as an active listener to provide constructive feedback;

(2) Examine and provide specific evidence to support an opinion;

(3) Follow group rules and understand individual roles in a variety of discussion formats; and

(4) Express opinions with evidence to support those opinions and consider multiple or divergent points of view.

4. For the area of research, formulate research questions, use a variety of sources to obtain information, weigh the evidence, draw valid conclusions and present findings, as demonstrated by the pupil's ability to:

(a) Formulate questions and develop a purpose that leads to inquiry, investigation and research across the curriculum;

(b) Locate and select relevant information from multiple primary and secondary sources;

(c) Document sources used in research in accordance with a given format;

(d) Record information using a variety of note-taking and organizational strategies; and

(e) Organize and present research findings using appropriate multimedia.

Sec. 6. *By the end of the 12th grade, pupils must know and be able to do everything required in the previous grades for courses in English language arts offered in public schools. Instruction in the 12th grade in English language arts must be designed so that pupils meet the following performance standards by the completion of the 12th grade:*

1. For the area of reading:

(a) Know and use skills and strategies of word analysis to comprehend new words encountered in text, as demonstrated by the pupil's ability to:

(1) Apply knowledge of Anglo-Saxon, Greek and Latin roots to determine the meanings of unknown words across the curriculum;

(2) Interpret the meanings of familiar literary allusions to comprehend text; and

(3) Discern connotative differences between closely related words.

(b) Use skills and strategies of reading process to build comprehension, as demonstrated by the pupil's ability to:

(1) Independently apply pre-reading strategies; and

(2) Monitor comprehension while reading and apply repair strategies if necessary.

(c) Read to comprehend, interpret and evaluate literature from a variety of authors, cultures and times, as demonstrated by the pupil's ability to:

(1) Interpret themes in literature and defend the interpretation with evidence from the text or application of historical and cultural contexts; and

(2) Determine the purpose of the author by analyzing the author's choice of genre and stylistic devices such as imagery, figurative language and irony.

(d) Read to comprehend, interpret and evaluate informational texts for specific purposes, as demonstrated by the pupil's ability to:

(1) Determine the purpose of the author in informational texts and public documents by analyzing the features of the text, rhetorical strategies, and historical and cultural contexts;

(2) Locate, organize, interpret and synthesize information in multiple primary and secondary sources to support opinions; and

(3) Read and apply multi-step directions to perform complex procedures and tasks.

2. For the area of writing:

(a) Write a variety of texts that inform, persuade, describe, evaluate, or tell a story and that are appropriate to the purpose and audience, as demonstrated by the pupil's ability to:

(1) Write research papers by adequately developing theses, using appropriate sources and conforming to an identified manual of style;

(2) Write subject-specific technical writings, including, without limitation, instructional manuals and field reports;

(3) Summarize large amounts of information into concise prose;

(4) Write narrative and reflective text that connects personal events to larger issues;

(5) Write responses to literature that reflect an understanding of literary elements; and

(6) Write persuasive essays that support, clarify and defend positions with relevant evidence.

(b) Write with a clear focus and logical development, evaluating, revising and editing for organization, style, tone and choice of words, as demonstrated by the pupil's ability to:

(1) Generate ideas for writing by selecting appropriate pre-writing strategies with attention to the audience and purpose;

(2) Organize ideas by selecting and applying structures appropriate to purpose, such as cause and effect and comparison and contrast;

(3) Write compositions that develop complex ideas in a clear, detailed and focused manner;

(4) Revise writing to improve the development of ideas, choice of words, organization and point of view by using rubrics and feedback from other persons; and

(5) Edit for use of standard English.

(c) Write using standard English grammar, usage, punctuation, capitalization and spelling, as demonstrated by the pupil's ability to:

(1) Apply the rules of usage, grammar and capitalization;

(2) Use a variety of sentence structures, such as coordination and subordination, with attention to varying sentence length; and

(3) Apply the rules of punctuation and manipulate the rules if necessary for emphasis in writing.

3. For the areas of listening and speaking:

(a) Listen to and evaluate oral communications for content, style, the purpose of the

speaker and appropriateness for the audience, as demonstrated by the pupil's ability to:

(1) Summarize and evaluate oral communications according to the purpose of the speaker;

(2) Create and apply criteria for evaluating the content and delivery of oral and multimedia presentations; and

(3) Apply knowledge of the effects of language and dialect on the response of the audience.

(b) Speak using organization, style, tone, voice and media aids that are appropriate to the audience and purpose, as demonstrated by the pupil's ability to:

(1) Make planned speeches, which may be enhanced by multimedia, and use language and techniques of public speaking that are appropriate to the audience and purpose; and

(2) Deliver extemporaneous and impromptu presentations that address a particular topic and engage the audience.

(c) Participate in discussions to offer information, clarify ideas and support a position, as demonstrated by the pupil's ability to:

(1) Participate in conversations or group discussions by identifying, synthesizing and evaluating data to solve problems or propose possible options;

(2) Attend to issues that facilitate group productivity, such as adhering to time limits for speakers and deadlines for decision-making; and

(3) Justify a position by using logic and refuting opposing points of view.

4. For the area of research, formulate research questions, use a variety of sources to obtain information, weigh the evidence, draw valid conclusions and present findings, as demonstrated by the pupil's ability to:

(a) Formulate focused research questions and use appropriate research designs to gather information;

(b) Evaluate the credibility and usefulness of possible sources of information;

(c) Cite sources of information using a standard method of documentation; and

(d) Organize and present findings in a multimedia format.

Sec. 7. *By the end of the second grade, pupils must know and be able to do everything required in the previous grades for courses in mathematics offered in public schools. Instruction in the second grade in mathematics must be designed so that pupils meet the following performance standards by the completion of the second grade:*

1. For the areas of numbers, number sense and computation, to solve problems, communicate, reason and make connections within and beyond the field of mathematics, a pupil must accurately calculate and use estimation techniques, number relationships, operation rules and algorithms, and determine the reasonableness of answers and the accuracy of solutions. A pupil must demonstrate the ability to:

(a) Identify and model basic addition facts for sums through 18 and the corresponding subtraction facts;

(b) Immediately recall from memory addition facts for sums through 10 and the corresponding subtraction facts;

(c) Add and subtract multi-place numbers without regrouping;

(d) Generate, write and solve one-step addition and subtraction problems based on practical situations;

(e) Use decimals to show amounts of money;

(f) Use the patterns in numbers to skip count by 2s, 3s, 5s, and 10s through 100 and beyond;

(g) Read and write numerals and order and compare numbers for 0 through 999;

(h) Estimate, with reasonable results, the number of objects in a set through 20;

(i) Read and write numbers through 20 and use modeling and identifying for the first through twentieth ordinal positions;

(j) Use modeling and identifying to place value positions of 1s, 10s and 100s; and

(k) Identify, model and label 1/2 and 1/4 as parts of a whole.

2. For the areas of patterns, functions and algebra, to solve problems, communicate, reason and make connections within and beyond the field of mathematics, a pupil must use various algebraic methods to analyze, illustrate, extend and create numerous representations, including, without limitation, words, numbers, tables, and graphs of patterns, functions and algebraic relations. A pupil must demonstrate the ability to:

(a) Recognize, describe, extend, create and use repeating and increasing patterns, symbols, objects and manipulatives to solve problems;

(b) Use variables and open sentences to express relationships; and

(c) Create, model, explain and solve problems by using addition and subtraction.

3. For the area of measurement, to solve problems, communicate, reason and make connections within and beyond the field of mathematics, a pupil must use appropriate tools and techniques of measurement to determine, estimate, record and verify direct and indirect measurements. A pupil must demonstrate the ability to:

(a) Compare and order objects by various measurable attributes, including, without limitation, time, temperature, length, weight, capacity, volume and area, and describe and define those various attributes;

(b) Compare objects that are greater than, less than, or equal to a given unit of measurement such as an inch, yard, centimeter and meter;

(c) Determine the value of any given set of coins and bills;

(d) Recite and use the months of the year in sequential order and use a calendar to identify days, weeks, months and years; and

(e) Read the time of day to the nearest quarter hour and distinguish between "a.m." and "p.m."

4. For the areas of spatial relationships and geometry, to solve problems, communicate and make connections within and beyond the field of mathematics, a pupil must identify, represent, verify and apply spatial relationships and geometric properties. A pupil must demonstrate the ability to:

(a) Identify, name, sort, sketch, describe and compare circles, triangles and rectangles, including squares, regardless of position;

(b) Describe the location of objects and place objects in position using descriptive words such as before, far, below and left;

(c) Compare the size of similar two-dimensional figures and identify shapes that are congruent;

(d) Identify symmetry in figures in the environment and create figures and designs that have a line of symmetry; and

(e) Identify, name, sort, describe, compare and contrast two-dimensional and three-dimensional figures.

5. For the area of data analysis, to solve problems, communicate, reason and make connections within and beyond the field of mathematics, a pupil must collect, organize, display, interpret and analyze data to determine statistical relationships and probability projections. A pupil must demonstrate the ability to collect, organize, record and explain the classification of data using concrete materials.

6. For the area of problem solving, to develop the ability to solve problems, a pupil must engage in developmentally appropriate opportunities for problem solving in which there is a need to use various approaches to investigate and understand mathematical concepts to formulate problems, find solutions to problems, develop and apply strategies to solve problems, and integrate mathematical reasoning, communication and connections. A pupil must demonstrate the ability to:

(a) Use efficient approaches to investigate and understand mathematical concepts;

(b) Find solutions to problems that occur in everyday situations;

(c) Select, modify, develop and apply strategies to solve a wide variety of problems;

(d) Transfer and generalize previous experience to new problem-solving situations;

(e) Demonstrate persistence in problem solving;

(f) Explain and verify results; and

(g) Use technology as a tool in problem solving.

7. For the area of mathematical communication, to develop the ability to communicate mathematically, a pupil must solve problems in which there is a need to obtain information, translate the information into mathematical language and symbols, process the information

mathematically and present the results in written, oral and visual formats. A pupil must demonstrate the ability to:

(a) Obtain information by reading, listening, observing and inquiring and use that information to solve mathematical problems;

(b) Use mathematical language and symbols to explain thinking and processes and translate ideas into everyday language;

(c) Present mathematical ideas and solutions in written, oral and visual forms;

(d) Discuss, explain, justify and evaluate mathematical ideas and solutions;

(e) Use physical, pictorial and symbolic forms to represent mathematical ideas and relationships; and

(f) Make conjectures, present arguments and evaluate discussions concerning mathematical ideas presented in various written and oral forms.

8. For the area of mathematical reasoning, to develop the ability to reason mathematically, a pupil must solve problems in which there is a need to investigate significant mathematical ideas and construct his own learning in all content areas to justify and enhance his ability to think and reason logically. A pupil must demonstrate the ability to:

(a) Construct meaning and justify thinking by investigating mathematical ideas, patterns and relationships;

(b) Reinforce and extend abilities for logical reasoning;

(c) Ask questions to reflect on, clarify and extend thinking;

(d) Review, refine, explain and justify mathematical processes, arguments and solutions using manipulatives, physical models and abstract ideas;

(e) Determine the relevancy and sufficiency of information to solve mathematical problems;

(f) Follow, create and defend valid and logical mathematical arguments; and

(g) Recognize and apply inductive and deductive reasoning in both concrete and abstract contexts.

9. For the area of mathematical connections, to develop the ability to make mathematical connections, a pupil must solve problems in which there is a need to view mathematics as an integrated whole, including identifying relationships between content strands and integrating mathematics with other disciplines, thereby allowing the flexibility to approach problems in a variety of ways within and beyond the field of mathematics. A pupil must demonstrate the ability to:

(a) View mathematics as an integrated whole and identify relationships between content strands;

(b) Identify practical applications of mathematical principles that can be applied to other disciplines;

(c) Use and analyze the connections within and beyond the field of mathematics in a variety of ways to solve problems;

(d) Link new concepts to prior knowledge;

(e) Explain the relationship of concepts to procedures using models; and

(f) Apply mathematical thinking and modeling to solve problems that arise in other disciplines and in everyday life.

Sec. 8. ***By the end of the third grade, pupils must know and be able to do everything required in the previous grades for courses in mathematics offered in public schools.***

Instruction in the third grade in mathematics must be designed so that pupils meet the following performance standards by the completion of the third grade:

1. For the areas of numbers, number sense and computation, to solve problems, communicate, reason and make connections within and beyond the field of mathematics, a pupil must accurately calculate and use estimation techniques, number relationships, operation rules and algorithms, and determine the reasonableness of answers and the accuracy of solutions. A pupil must demonstrate the ability to:

(a) Immediately recall and use addition and subtraction facts and multiplication facts for products through 81;

(b) Add and subtract multi-place numbers with regrouping;

(c) Generate and solve two-step addition and subtraction problems based on practical situations by using paper and pencil, mental computation and estimation;

(d) Generate and solve one-step multiplication problems based on practical situations by using paper and pencil, mental computation and estimation;

(e) Add and subtract decimals that represent amounts of money;

(f) Use addition to model and explain multiplication;

(g) Read and write numerals and compare and order numbers from 0 through 9,999;

(h) Determine the reasonableness of answers by rounding to the nearest 10 and 100;

(i) Use, model and identify the place value positions through 10,000;

(j) Model, sketch and label fractions with denominators through 10; and

(k) Write commonly used fractions using both numerals and words.

2. For the areas of patterns, functions and algebra, to solve problems, communicate, reason and make connections within and beyond the field of mathematics, a pupil must use

various algebraic methods to analyze, illustrate, extend and create numerous representations, including, without limitation, words, numbers, tables, and graphs of patterns, functions and algebraic relations. A pupil must demonstrate the ability to:

(a) Recognize, describe, extend and create repeating and increasing patterns by using numbers, number patterns and their extensions to solve problems; and

(b) Identify missing symbols and missing numbers in open sentences involving number facts in addition and subtraction.

3. For the area of measurement, to solve problems, communicate, reason and make connections within and beyond the field of mathematics, a pupil must use appropriate tools and techniques of measurement to determine, estimate, record and verify direct and indirect measurements. A pupil must demonstrate the ability to:

(a) Measure to a required degree of accuracy, record the measurement, evaluate the measurement for error and describe the appropriateness of selected units of measure;

(b) Estimate measurements and use measuring devices with standard and non-standard units to measure length, area of a region, liquid volume, capacity, temperature and weight, and communicate the concepts of more, less and equivalent;

(c) Read, write and use notations of money and determine possible combinations of coins and bills to equal given amounts; and

(d) Read the time of day to the nearest minute using analog and digital clocks and measure time that has elapsed.

4. For the areas of spatial relationships and geometry, to solve problems, communicate and make connections within and beyond the field of mathematics, a pupil must identify,

represent, verify and apply spatial relationships and geometric properties. A pupil must demonstrate the ability to:

(a) Describe, sketch, compare and contrast plane geometric figures;

(b) Demonstrate and describe the transformation of a geometric figure as a slide, rotation or flip; and

(c) Describe, sketch, model, build, compare and contrast two-dimensional and three-dimensional geometric figures.

5. For the area of data analysis, to solve problems, communicate, reason and make connections within and beyond the field of mathematics, a pupil must collect, organize, display, interpret and analyze data to determine statistical relationships and probability projections. A pupil must demonstrate the ability to:

(a) Collect, organize, display and describe simple data using number lines, pictographs, bar graphs and frequency tables by hand and with computers, if available; and

(b) Use concepts of probability such as impossible, unlikely, likely and certain to make predictions about future events.

6. For the area of problem solving, to develop the ability to solve problems, a pupil must engage in developmentally appropriate opportunities for problem solving in which there is a need to use various approaches to investigate and understand mathematical concepts to formulate problems, find solutions to problems, develop and apply strategies to solve problems, and integrate mathematical reasoning, communication and connections. A pupil must demonstrate the ability to:

(a) Use efficient approaches to investigate and understand mathematical concepts;

(b) Find solutions to problems that occur in everyday situations;

(c) Select, modify, develop and apply strategies to solve a wide variety of problems;

(d) Transfer and generalize previous experience to new problem-solving situations;

(e) Demonstrate persistence in problem solving;

(f) Explain and verify results; and

(g) Use technology as a tool in problem solving.

7. For the area of mathematical communication, to develop the ability to communicate mathematically, a pupil must solve problems in which there is a need to obtain information, translate the information into mathematical language and symbols, process the information mathematically and present the results in written, oral and visual formats. A pupil must demonstrate the ability to:

(a) Obtain information by reading, listening, observing and inquiring and use that information to solve mathematical problems;

(b) Use mathematical language and symbols to explain thinking and processes and translate those ideas into everyday language;

(c) Present mathematical ideas and solutions in written, oral and visual forms;

(d) Discuss, explain, justify and evaluate mathematical ideas and solutions;

(e) Use physical, pictorial and symbolic forms to represent mathematical ideas and relationships; and

(f) Make conjectures, present arguments and evaluate discussions concerning mathematical ideas presented in various written and oral forms.

8. For the area of mathematical reasoning, to develop the ability to reason mathematically, a pupil must solve problems in which there is a need to investigate significant

mathematical ideas and construct his own learning in all content areas to justify and enhance his ability to think and reason logically. A pupil must demonstrate the ability to:

(a) Construct meaning and justify thinking by investigating mathematical ideas, patterns and relationships;

(b) Reinforce and extend abilities for logical reasoning;

(c) Ask questions to reflect on, clarify and extend thinking;

(d) Review, refine, explain and justify mathematical processes, arguments and solutions using manipulatives, physical models and abstract ideas;

(e) Determine the relevancy and sufficiency of information to solve mathematical problems;

(f) Follow, create and defend valid logical mathematical arguments; and

(g) Recognize and apply inductive and deductive reasoning in both concrete and abstract contexts.

9. For the area of mathematical connections, to develop the ability to make mathematical connections, a pupil must solve problems in which there is a need to view mathematics as an integrated whole, including identifying relationships between content strands and integrating mathematics with other disciplines, thereby allowing the flexibility to approach problems in a variety of ways within and beyond the field of mathematics. A pupil must demonstrate the ability to:

(a) View mathematics as an integrated whole and identify relationships between content strands;

(b) Identify practical applications of mathematical principles that can be applied to other disciplines;

(c) Use and analyze the connections within and beyond the field of mathematics in a variety of ways to solve problems;

(d) Link new concepts to prior knowledge;

(e) Explain the relationship of concepts to procedures using models; and

(f) Apply mathematical thinking and modeling to solve problems that arise in other disciplines and in everyday life.

Sec. 9. *By the end of the fifth grade, pupils must know and be able to do everything required in the previous grades for courses in mathematics offered in public schools. Instruction in the fifth grade in mathematics must be designed so that pupils meet the following performance standards by the completion of the fifth grade:*

1. For the areas of numbers, number sense and computation, to solve problems, communicate, reason and make connections within and beyond the field of mathematics, a pupil must accurately calculate and use estimation techniques, number relationships, operation rules and algorithms, and determine the reasonableness of answers and the accuracy of solutions. A pupil must demonstrate the ability to:

(a) Immediately recall and use multiplication and corresponding division facts using factors of 0 through 12;

(b) Multiply and divide multi-place numbers by two-digit numbers, including multiples of 10;

(c) Generate and solve addition, subtraction, multiplication and division problems that involve whole numbers and order of operations based on practical situations;

(d) Compare and order negative numbers based on practical situations and plot integer values on a number line;

(e) Estimate to determine the reasonableness of an answer by identifying and using the correct place value position; and

(f) Model, draw, identify, compare, add and subtract decimals and fractions with like denominators to solve problems.

2. For the areas of patterns, functions and algebra, to solve problems, communicate, reason and make connections within and beyond the field of mathematics, a pupil must use various algebraic methods to analyze, illustrate, extend and create numerous representations, including, without limitation, words, numbers, tables, and graphs of patterns, functions and algebraic relations. A pupil must demonstrate the ability to:

(a) Identify, describe and explain number patterns and relationships, including, without limitation, triangular numbers, perfect squares, and arithmetic and geometric sequences, using paper and pencil, concrete materials and calculators;

(b) Use variables in open sentences to describe simple functions and relationships;

(c) Solve simple whole numbers equations and inequalities using a variety of methods; and

(d) Generate number sequences given the first term of the sequence and any simple computation rule.

3. For the area of measurement, to solve problems, communicate, reason and make connections within and beyond the field of mathematics, a pupil must use appropriate tools and techniques of measurement to determine, estimate, record and verify direct and indirect measurements. A pupil must demonstrate the ability to:

(a) Measure, compare and convert units of length, within the same system of measurement, to the nearest fractional or decimal part;

(b) Estimate and directly measure length, volume, capacity and quantity;

(c) Select and justify the use of estimation or direct measurement and weight in a given situation;

(d) Determine the total cost of purchases and the amount of change in practical situations;

(e) Describe the difference between perimeter and area and determine the perimeter of any polygon and the area of right triangles and rectangles, including squares; and

(f) Identify equivalent periods of time using relationships between and among seconds, minutes, hours, days, months and years.

4. For the areas of spatial relationships and geometry, to solve problems, communicate and make connections within and beyond the field of mathematics, a pupil must identify, represent, verify and apply spatial relationships and geometric properties. A pupil must demonstrate the ability to:

(a) Draw and classify angles and triangles as right, acute or obtuse;

(b) Identify and draw circles and elements of circles and describe the relationships between the various elements;

(c) Identify a transformation as translation, rotation, reflection, enlargement or reduction;

(d) Identify shapes that have congruence, similarity or symmetry using a variety of methods, including, without limitation, transformational motions and models, drawings and tools of measurement;

(e) Graph ordered pairs and identify coordinates for a given point in the first quadrant;

(f) Identify, describe, compare and classify two-dimensional and three-dimensional figures by their properties, including the number of vertices and edges and the number and shape of the faces; and

(g) Identify, describe, classify and draw one-dimensional and two-dimensional geometric figures, including lines that are intersecting, perpendicular and parallel, line segments, rays, and angles with given measurements.

5. For the area of data analysis, to solve problems, communicate, reason and make connections within and beyond the field of mathematics, a pupil must collect, organize, display, interpret and analyze data to determine statistical relationships and probability projections. A pupil must demonstrate the ability to:

(a) Collect, organize, read and interpret data using graphic representations, including tables, line plots, stem and leaf plots, scatter plots and histograms;

(b) Use data and graphs to formulate and explain conclusions and predictions, with and without the assistance of technology;

(c) Conduct simple probability experiments using concrete materials and represent the results in fractional form;

(d) Solve probability problems using a variety of methods, including constructing sample spaces and tree diagrams;

(e) Model and compute measures of central tendency, including mean, median and mode; and

(f) Describe the limitations of various formats of graphs, select a type of graph to accurately represent the given data and justify the selection.

6. For the area of problem solving, to develop the ability to solve problems, a pupil must engage in developmentally appropriate opportunities for problem solving in which there is a need to use various approaches to investigate and understand mathematical concepts to formulate problems, find solutions to problems, develop and apply strategies to solve problems,

and integrate mathematical reasoning, communication and connections. A pupil must demonstrate the ability to:

(a) Use efficient approaches to investigate and understand mathematical concepts;

(b) Find solutions to problems that occur in everyday situations;

(c) Select, modify, develop and apply strategies to solve a wide variety of problems;

(d) Apply previous experience to new problem-solving situations;

(e) Demonstrate persistence in problem solving;

(f) Explain and verify results; and

(g) Use technology as a tool in problem solving.

7. For the area of mathematical communication, to develop the ability to communicate mathematically, a pupil must solve problems in which there is a need to obtain information, translate the information into mathematical language and symbols, process the information mathematically and present the results in written, oral and visual formats. A pupil must demonstrate the ability to:

(a) Obtain information by reading, listening, observing and inquiring and use this information to solve mathematical problems;

(b) Use mathematical language and symbols to explain thinking and processes and translate those ideas into everyday language;

(c) Present mathematical ideas and solutions in written, oral and visual forms;

(d) Discuss, explain, justify and evaluate mathematical ideas and solutions;

(e) Use physical, pictorial and symbolic forms to represent mathematical ideas and relationships; and

(f) Make conjectures, present arguments and evaluate discussions concerning mathematical ideas presented in various written and oral forms.

8. For the area of mathematical reasoning, to develop the ability to reason mathematically, a pupil must solve problems in which there is a need to investigate significant mathematical ideas and construct his own learning in all content areas to justify and enhance his ability to think and reason logically. A pupil must demonstrate the ability to:

(a) Construct meaning and justify thinking by investigating mathematical ideas, patterns and relationships;

(b) Reinforce and extend abilities for logical reasoning;

(c) Ask questions to reflect on, clarify and extend thinking;

(d) Review, refine, explain and justify mathematical processes, arguments and solutions by using manipulatives, physical models and abstract ideas;

(e) Determine the relevancy and sufficiency of information to solve mathematical problems;

(f) Follow, create and defend valid logical mathematical arguments; and

(g) Recognize and apply inductive and deductive reasoning in concrete and abstract contexts.

9. For the area of mathematical connections, to develop the ability to make mathematical connections, a pupil must solve problems in which there is a need to view mathematics as an integrated whole, including identifying relationships between content strands and integrating mathematics with other disciplines, thereby allowing the flexibility to approach problems in a variety of ways within and beyond the field of mathematics. A pupil must demonstrate the ability to:

(a) View mathematics as an integrated whole and identify relationships between content strands;

(b) Identify practical applications of mathematical principles that can be applied to other disciplines;

(c) Use and analyze the connections within and beyond the field of mathematics in a variety of ways to solve problems;

(d) Link new concepts to prior knowledge;

(e) Explain the relationship of concepts to procedures using models; and

(f) Apply mathematical thinking and modeling to solve problems that arise in other disciplines and in everyday life.

Sec. 10. *By the end of the eighth grade, pupils must know and be able to do everything required in the previous grades for courses in mathematics offered in public schools. Instruction in the eighth grade in mathematics must be designed so that pupils meet the following performance standards by the completion of the eighth grade:*

1. For the areas of numbers, number sense and computation, to solve problems, communicate, reason and make connections within and beyond the field of mathematics, a pupil must accurately calculate and use estimation techniques, number relationships, operation rules and algorithms, and determine the reasonableness of answers and the accuracy of solutions. A pupil must demonstrate the ability to:

(a) Read, write, apply and compute with real numbers in various forms, including, without limitation, radicals, exponentials and scientific notations;

(b) Determine, write and use ratios and proportions to solve problems;

(c) Estimate in problem-solving situations and practical applications to determine the reasonableness of answers and verify the results;

(d) Explain the relationship among fractions, decimals and percents and translate among representations; and

(e) Explain and use concepts of:

(1) Number theory such as factors and multiples;

(2) Properties of real numbers such as the commutative, associative and distributive; and

(3) Order of operations,

FLUSH

to solve problems.

2. For the areas of patterns, functions and algebra, to solve problems, communicate, reason and make connections within and beyond the field of mathematics, a pupil must use various algebraic methods to analyze, illustrate, extend and create numerous representations, including, without limitation, words, numbers, tables, and graphs of patterns, functions and algebraic relations. A pupil must demonstrate the ability to:

(a) Use inductive reasoning to find a missing term in numeric, arithmetic and geometric sequences and generalize basic patterns to the nth term, with and without the assistance of calculators;

(b) Identify, describe, model and evaluate relationships, including, without limitation, patterns, sequences and functions using oral, written and symbolic language, with and without the assistance of technology;

(c) Solve an equation or a formula for any variable;

(d) Describe how a change in one variable of a mathematical relationship affects the remaining variables by using various tools and methods;

(e) Model, identify and solve simple linear equations and inequalities and relate that process to the order of operations by using formal and informal methods; and

(f) Add and subtract binomials and describe the connection between the algebraic process and the arithmetic process.

3. For the area of measurement, to solve problems, communicate, reason and make connections within and beyond the field of mathematics, a pupil must use appropriate tools and techniques of measurement to determine, estimate, record and verify direct and indirect measurements. A pupil must demonstrate the ability to:

(a) Compare and convert units of measure for length, weight, mass and volume within the same system of measurement, either customary or metric, and estimate conversions between like units of the two systems to solve problems;

(b) Identify the range of precision, error of measure and tolerance in measurement when using the appropriate tool of measurement and measure to the required degree of accuracy;

(c) Estimate and measure length, weight, mass and volume to the required degree of accuracy;

(d) Derive and apply formulas to find:

(1) The perimeter, circumference and area of plane figures; and

(2) Volume and surface area of solid figures;

(e) Identify the relationship between changes in area and volume and changes in linear measures of figures;

(f) Evaluate formulas and algebraic expressions for given values of a variable; and

(g) Apply ratio and proportion to calculate rates and as a method of indirect measure.

4. For the areas of spatial relationships and geometry, to solve problems, communicate and make connections within and beyond the field of mathematics, a pupil must identify, represent, verify and apply spatial relationships and geometric properties. A pupil must demonstrate the ability to:

(a) Identify, classify, compare and draw regular and irregular polygons, if given specifications;

(b) Determine the sum of the interior angles of convex polygons;

(c) Apply the properties of equality and proportionally to solve problems that involve congruent or similar shapes;

(d) Use coordinate geometry and models to illustrate change in scale and other geometric transformations;

(e) Create a model of a three-dimensional figure from two-dimensional drawings and make a two-dimensional drawing of a three-dimensional object;

(f) Represent and interpret relationships defined by equations and formulas, including distance, midpoint and slope, on a coordinate plane, with and without the assistance of technology;

(g) Form generalizations and validate conclusions about properties of geometric shapes including those associated with parallel lines, perpendicular lines, bisectors, triangles and quadrilaterals;

(h) Verify, explain and use the Pythagorean Theorem and the Triangle Sum Theorem to determine missing sides and angles of triangles; and

(i) Construct, draw and sketch geometric figures, bisected angles and lines and line segments with given specifications by using hand tools and technology.

5. For the area of data analysis, to solve problems, communicate, reason and make connections within and beyond the field of mathematics, a pupil must collect, organize, display, interpret and analyze data to determine statistical relationships and probability projections. A pupil must demonstrate the ability to:

(a) Organize, display, read and analyze data, with and without the assistance of technology by using a variety of displays, including circle graphs, frequency distributions, and box and whisker plots;

(b) Determine the theoretical probability of a simple or independent event using different counting methods, including tree diagrams, sample spaces and organized lists and compare those results with the results of conducting an experiment;

(c) Differentiate between the probability of an event and the odds of an event;

(d) Identify the number of combinations possible in given situations by using a variety of counting methods;

(e) Evaluate the accuracy and validity of arguments based on data analysis and analyze the effect that a change of scale or a change of format has on statistical charts and graphs; and

(f) Formulate inferences and projections based on interpolations and extrapolations of data to solve problems.

6. For the area of problem solving, to develop the ability to solve problems, a pupil must engage in developmentally appropriate opportunities for problem solving in which there is a need to use various approaches to investigate and understand mathematical concepts to formulate problems, find solutions to problems, develop and apply strategies to solve problems,

and integrate mathematical reasoning, communication and connections. A pupil must demonstrate the ability to:

(a) Use efficient approaches to investigate and understand mathematical concepts;

(b) Find solutions to problems that occur in everyday situations;

(c) Select, modify, develop and apply strategies to solve a wide variety of problems;

(d) Transfer and generalize previous experience to new problem-solving situations;

(e) Demonstrate persistence in problem solving;

(f) Explain and verify results; and

(g) Use technology as a tool in problem solving.

7. For the area of mathematical communication, to develop the ability to communicate mathematically, a pupil must solve problems in which there is a need to obtain information, translate the information into mathematical language and symbols, process the information mathematically and present the results in written, oral and visual formats. A pupil must demonstrate the ability to:

(a) Obtain information by reading, listening, observing and inquiring and use that information to solve mathematical problems;

(b) Use mathematical language and symbols to explain thinking and processes and translate those ideas into everyday language;

(c) Present mathematical ideas and solutions in written, oral and visual forms;

(d) Discuss, explain, justify and evaluate mathematical ideas and solutions;

(e) Use physical, pictorial and symbolic forms to represent mathematical ideas and relationships; and

(f) Make conjectures, present arguments and evaluate discussions concerning mathematical ideas presented in various written and oral forms.

8. For the area of mathematical reasoning, to develop the ability to reason mathematically, a pupil must solve problems in which there is a need to investigate significant mathematical ideas and construct his own learning in all content areas to justify and enhance his ability to think and reason logically. A pupil must demonstrate the ability to:

(a) Construct meaning and justify thinking by investigating mathematical ideas, patterns and relationships;

(b) Reinforce and extend abilities for logical reasoning;

(c) Ask questions to reflect on, clarify and extend thinking;

(d) Review, refine, explain and justify mathematical processes, arguments and solutions using manipulatives, physical models and abstract ideas;

(e) Determine the relevancy and sufficiency of information to solve mathematical problems;

(f) Follow, create and defend valid logical mathematical arguments; and

(g) Recognize and apply inductive and deductive reasoning in both concrete and abstract contexts.

9. For the area of mathematical connections, to develop the ability to make mathematical connections, a pupil must solve problems in which there is a need to view mathematics as an integrated whole, including identifying relationships between content strands and integrating mathematics with other disciplines, thereby allowing the flexibility to approach problems in a variety of ways within and beyond the field of mathematics. A pupil must demonstrate the ability to:

(a) View mathematics as an integrated whole and identify relationships between content strands;

(b) Identify practical applications of mathematical principles that can be applied to other disciplines;

(c) Use and analyze the connections within and beyond the field of mathematics in a variety of ways to solve problems;

(d) Link new concepts to prior knowledge;

(e) Explain the relationship of concepts to procedures by using models; and

(f) Apply mathematical thinking and modeling to solve problems that arise in other disciplines and in everyday life.

Sec. 11. *By the end of the 12th grade, pupils must know and be able to do everything required in the previous grades for courses in mathematics offered in public schools. Instruction in the 12th grade in mathematics must be designed so that pupils meet the following performance standards by the completion of the 12th grade:*

1. For the areas of numbers, number sense and computation, to solve problems, communicate, reason and make connections within and beyond the field of mathematics, a pupil must accurately calculate and use estimation techniques, number relationships, operation rules and algorithms, and determine the reasonableness of answers and the accuracy of solutions. A pupil must demonstrate the ability to:

(a) Determine the reasonableness of answers and the accuracy of solutions;

(b) Calculate and estimate sums, differences, products, quotients, powers and roots, and apply formulas and algorithms;

(c) Apply the laws of exponents to perform operations on expressions with integral exponents and scientific notation;

(d) Apply properties and theories of the real number system to practical situations; and

(e) Add, subtract and scalar multiplying matrices.

2. For the areas of patterns, functions and algebra, to solve problems, communicate, reason and make connections within and beyond the field of mathematics, a pupil must use various algebraic methods to analyze, illustrate, extend and create numerous representations, including, without limitation, words, numbers, tables, and graphs of patterns, functions and algebraic relations. A pupil must demonstrate the ability to:

(a) Represent, analyze and solve problem situations using discrete models, including, without limitation, graphs and matrices, with and without the assistance of technology;

(b) Create and use different forms of a variety of equations, proportions and formulas, solving for the needed variable as necessary in given situations;

(c) Add, subtract and multiply polynomials, factor 1st and 2nd degree polynomials and describe the process and connection between the algebraic process and arithmetic process;

(d) Use simple quadratic equations with integer roots to solve practical and mathematical problems;

(e) Model practical situations mathematically and translate a practical problem into a variety of mathematical forms, including, without limitation, matrices, tabular, symbolic and graphical representations of functions, with and without the assistance of technology;

(f) Determine the domain and the range of linear relations given a graph or a set of ordered pairs and explain the importance of the domain and range in problem-solving situations; and

(g) Solve systems of two linear equations algebraically and graphically, using graphing calculators as a primary tool to solve problems and verify solutions found by other methods.

3. For the area of measurement, to solve problems, communicate, reason and make connections within and beyond the field of mathematics, a pupil must use appropriate tools and techniques of measurement to determine, estimate, record and verify direct and indirect measurements. A pupil must demonstrate the ability to:

(a) Distinguish, differentiate and convert units of measure among and between customary and metric systems and between monetary systems;

(b) Select and use tools of measurement, techniques and formulas to calculate and compare rates, costs, distances, interests, temperatures, weights and masses;

(c) Justify and communicate the differences between accuracy, precision, error of measure and tolerance in measurement and describe how each of these can affect solutions found in problem situations;

(d) Use and interpret consumer data such as amortization tables, tax tables and compound interest charts to make informed financial decisions related to practical applications; and

(e) Use relationships and formulas to determine the measurement of unknown dimensions, angles, areas and volumes to solve problems.

4. For the areas of spatial relationships and geometry, to solve problems, communicate and make connections within and beyond the field of mathematics, a pupil must identify, represent, verify and apply spatial relationships and geometric properties. A pupil must demonstrate the ability to:

(a) Identify and use the properties of polygons, determine measures of interior and exterior angles and elements of circles to solve practical problems;

(b) Use coordinate geometry to graph linear equations, determine slopes of lines, identify parallel and perpendicular lines and find possible solutions to sets of linear equations;

(c) Use algebraic techniques to solve problems involving geometric relationships;

(d) Use complementary and supplementary angles, congruent angles, vertical angles, angles formed when parallel lines are cut by a transversal and angles in polygons to solve practical problems;

(e) Apply the Pythagorean Theorem and its converse, properties of special right triangles, and right triangle trigonometry, sine, cosine and tangent to solve practical problems;

(f) Use tools, technology and models to sketch, draw and construct geometric figures to solve problems and to demonstrate the properties of geometric figures; and

(g) Construct, justify and defend mathematical conclusions using logical, sequential and deductive reasoning supported by established mathematical principles.

5. For the area of data analysis, to solve problems, communicate, reason and make connections within and beyond the field of mathematics, a pupil must collect, organize, display, interpret and analyze data to determine statistical relationships and probability projections. A pupil must demonstrate the ability to:

(a) Use calculators and computers to create and manipulate tables, graphs and matrices to communicate statistical information;

(b) Use the shape of graphs of normal distributions to compare and analyze information;

(c) Design, conduct, analyze and communicate the results of multi-stage probability and statistical experiments;

(d) Identify a probability situation as a permutation or a combination and find the number of possible outcomes, with and without the assistance of graphing calculators;

(e) Select and use the measures of central tendency such as mean, median and mode that are appropriate for given situations;

(f) Select and use measures of dispersion including range, distribution and possible outliers that are appropriate for given situations; and

(g) Analyze the validity of statistical conclusions and note various sources of bias and misuse and abuse of data caused by a variety of factors.

6. For the area of problem solving, to develop the ability to solve problems, a pupil must engage in developmentally appropriate opportunities for problem solving in which there is a need to use various approaches to investigate and understand mathematical concepts to formulate problems, find solutions to problems, develop and apply strategies to solve problems, and integrate mathematical reasoning, communication and connections. A pupil must demonstrate the ability to:

(a) Use efficient approaches to investigate and understand mathematical concepts;

(b) Find solutions to problems that occur in everyday situations;

(c) Select, modify, develop and apply strategies to solve a wide variety of problems;

(d) Transfer and generalize previous experience to new problem-solving situations;

(e) Demonstrate persistence in problem solving;

(f) Explain and verify results; and

(g) Use technology as a tool in problem solving.

7. For the area of mathematical communication, to develop the ability to communicate mathematically, a pupil must solve problems in which there is a need to obtain information, translate the information into mathematical language and symbols, process the information

mathematically and present the results in written, oral and visual formats. A pupil must demonstrate the ability to:

(a) Obtain information by reading, listening, observing and inquiring and using that information to solve mathematical problems;

(b) Use mathematical language and symbols to explain thinking and processes and translate those ideas into everyday language;

(c) Present mathematical ideas and solutions in written, oral and visual forms;

(d) Discuss, explain, justify and evaluate mathematical ideas and solutions;

(e) Use physical, pictorial and symbolic forms to represent mathematical ideas and relationships; and

(f) Make conjectures, present arguments and evaluate discussions concerning mathematical ideas presented in various written and oral forms.

8. For the area of mathematical reasoning, to develop the ability to reason mathematically, a pupil must solve problems in which there is a need to investigate significant mathematical ideas and construct his own learning in all content areas to justify and enhance his ability to think and reason logically. A pupil must demonstrate the ability to:

(a) Construct meaning and justify thinking by investigating mathematical ideas, patterns and relationships;

(b) Reinforce and extend abilities for logical reasoning;

(c) Ask questions to reflect on, clarify and extend thinking;

(d) Review, refine, explain and justify mathematical processes, arguments and solutions by using manipulatives, physical models and abstract ideas;

(e) Determine the relevancy and sufficiency of information to solve mathematical problems;

(f) Follow, create and defend valid logical mathematical arguments; and

(g) Recognize and apply inductive and deductive reasoning in both concrete and abstract contexts.

9. For the area of mathematical connections, to develop the ability to make mathematical connections, a pupil must solve problems in which there is a need to view mathematics as an integrated whole, including identifying relationships between content strands and integrating mathematics with other disciplines, thereby allowing the flexibility to approach problems in a variety of ways within and beyond the field of mathematics. A pupil must demonstrate the ability to:

(a) View mathematics as an integrated whole and identify relationships between content strands;

(b) Identify practical applications of mathematical principles that can be applied to other disciplines;

(c) Use and analyze the connections within and beyond the field of mathematics in a variety of ways to solve problems;

(d) Link new concepts to prior knowledge;

(e) Explain the relationship of concepts to procedures by using models; and

(f) Apply mathematical thinking and modeling to solve problems that arise in other disciplines and in everyday life.

Sec. 12. *By the end of the second grade, pupils must know and be able to do everything required in the previous grades for courses in science offered in public schools. Instruction in*

the second grade in science must be designed so that pupils meet the following performance standards by the completion of the second grade:

1. For the area of physical science:

(a) Understand that gravitational, electrical and magnetic forces have an effect on the motion of objects, as demonstrated by the pupil's ability to:

(1) Show that objects move at different speeds, for example, a car speeds up or slows down or one person runs faster than another; and

(2) Use a model or pattern to demonstrate how to assemble or disassemble a structure, for example, by using an interlocking block tower, erector set crane or pattern block picture.

(b) Understand that materials have distinct properties which depend on the amount of matter present, its chemical composition and structure, as demonstrated by the pupil's ability to:

(1) Sort and describe objects in terms of some observable properties, for example, color, shape, size or texture; and

(2) Independently form large objects from smaller objects, for example, by putting together a puzzle or quilt.

(c) Understand that changes in temperature and pressure can alter states of matter and that energy exists in many forms and one form can change into another, as demonstrated by the pupil's ability to:

(1) Describe a variety of objects as being cold, cool, warm or hot;

(2) Describe the temperatures of similar objects in different outdoor locations and explain that heat from the sun warms the objects;

(3) Describe an object before and after a change in the state of the object occurs by using terms of observable properties; and

(4) Independently manipulate appropriate objects to produce various sounds by vibrating the objects and classify the sounds produced in terms of properties of pitch and tone.

(d) Understand that chemical reactions change substances into different substances.

(e) Understand that nuclear energy and electromagnetic energy are produced in many forms from natural and man-made sources.

2. For the area of life science:

(a) Understand that all life forms, at all levels of organization, use specialized structures and similar processes to meet the basic needs of life, as demonstrated by the pupil's ability to:

(1) Provide examples of how living things grow and change, with some minor errors in detail; and

(2) Classify living and non-living things according to established criteria, with few errors.

(b) Understand that organisms respond to internal and external influences, as demonstrated by the pupil's ability to:

(1) Explain that germs cause some diseases and may be spread by people who have them; and

(2) Explain that washing hands thoroughly with soap and water reduces the number of germs and the spread of germs.

(c) Understand that life forms are diverse and that, through heredity, they pass some characteristics to their offspring, as demonstrated by the pupil's ability to:

(1) Describe, using common examples, that animals produce offspring that are like themselves, for example, dogs produce puppies and not kittens; and

(2) Sort a group of living things and describe how some living things have similar observable characteristics.

(d) Understand that life forms change over time through evolution and the process of biological change.

3. For the areas of earth and space sciences:

(a) Understand the structures of the Earth and that the Earth is composed of interrelated systems of rocks, water, air and life, as demonstrated by the pupil's ability to:

(1) Group rock samples according to a single attribute of shape, size, color, texture, or patterns of color or shading; and

(2) Provide justification for their grouping.

(b) Understand that the Earth may be represented by a variety of maps and models.

(c) Understand the history of the Earth and that the systems of the Earth such as weather and the formation of mountains change or vary.

(d) Observe and describe changes that take place in nature, for example, weather, seasons, day and night.

(e) Understand that the systems of the Earth have a variety of cycles through which energy and matter continually flow, as demonstrated by the pupil's ability to:

(1) Observe and describe the way the ground, water and air feel in the shade versus the sunlight; and

(2) Observe and describe how weather such as temperature, cloudiness and precipitation change from day to day and throughout the year.

(f) Understand the solar system and the universe and that the Earth is part of a planetary system within the Milky Way Galaxy, which is part of the known universe, as demonstrated by the pupil's ability to:

(1) Identify from drawings or photographs the sun, moon and stars;

(2) Identify from drawings, photographs or verbal prompts that the Earth is a planet; and

(3) Describe the movement of the sun across the sky and explain that the moon appears in different places at different times.

4. For the area of environmental sciences:

(a) Understand that ecosystems display patterns of organization, change and stability as a result of the interactions and interdependencies among the life forms and the physical components of the Earth, as demonstrated by the pupil's ability to:

(1) Investigate, observe and discuss the interactions between plants as producers and animals as consumers; and

(2) Provide examples of interdependence between plants and animals.

(b) Understand that natural resources include renewable and non-renewable materials and energy, that all organisms, including humans, use resources to maintain and improve their existence, and that the use of resources can have positive and negative consequences, as demonstrated by the pupil's ability to:

(1) Demonstrate how some resources can be used and reused, for example, waste paper and glass are recyclable; and

(2) Describe the various resources that provide the basic necessities used by people in their daily lives.

(c) Understand conservation and that humans have the unique ability to change personal and societal behavior based on ethical considerations regarding other organisms, the planet as a whole and future generations, as demonstrated by the pupil's ability to:

(1) Illustrate how people live in different places in different ways; and

(2) Illustrate how some things change in daily life and some things stay the same.

5. For the area of the nature and history of science:

(a) Understand that humans have the unique ability to change personal and societal behavior based on ethical considerations regarding other organisms, the planet as a whole and future generations, as demonstrated by the pupil's ability to:

(1) Generate an idea or invention with the assistance from the teacher; and

(2) Provide examples of thinkers and inventors from around the world.

(b) Understand skills of reasoning and critical response and that many decisions require critical consideration of scientific evidence.

(c) Understand systems, models, risk and predictions and that a variety of models can be used to describe or predict occurrences and events.

(d) Understand scientific values and attitudes and that science is an active process of systematically examining the natural world, as demonstrated by the pupil's ability to:

(1) Make qualitative observations and provide pictorial or word descriptions of objects or phenomena; and

(2) Record in a notebook or journal, with minimal assistance from the teacher, observations of investigations over a period of time, for example, the growth of a plant, changes in weather or the growth and development of insects.

(e) Understand that a variety of methods of communication may be used to share scientific information, as demonstrated by the pupil's ability to:

(1) Generally follow verbal and written instructions accurately;

(2) Generally produce simple pictographs to describe observations; and

(3) Cooperate and contribute ideas within a group.

6. For the area of scientific inquiry, processes and skills:

(a) Understand that scientific inquiry is enhanced and often communicated through mathematics, as demonstrated by the pupil's ability to:

(1) Generally use mental computation to make rough estimates, for example, simple addition and subtraction problems; and

(2) Adequately identify unexpected or unusual results when counting or measuring using units of measurement that are not standard.

(b) Demonstrate laboratory skills and the appropriate and safe application of the tools and techniques of scientific inquiry by generally keeping accurate records of observations and measurements taken over time, such as plant growth, metamorphosis, evaporation and weather conditions.

Sec. 13. *By the end of the third grade, pupils must know and be able to do everything required in the previous grades for courses in science offered in public schools. Instruction in the third grade must be designed so that pupils meet the following performance standards by the completion of the third grade:*

1. For the area of physical science:

(a) Understand that gravitational, electrical and magnetic forces have an effect on the motion of objects, as demonstrated by the pupil's ability to:

(1) Demonstrate that a given push or pull, whether hard or soft, causes an object to change its speed or direction, or both;

(2) Predict whether or not an object will topple or balance; and

(3) Effectively manipulate simple tools such as hammer and nails, screwdriver and screws, and nuts and bolts, and demonstrate when to use specific tools.

(b) Understand that materials have distinct properties which depend on the amount of matter present, its chemical composition and structure, as demonstrated by the pupil's ability to:

(1) Describe objects in terms of observable properties such as color, texture, size, state of matter and symmetry;

(2) Sort objects on the basis of two or more observable characteristics or attributes such as dimensions, coloration, symmetry, parts and state of matter by using Venn diagrams or other schemes; and

(3) Identify or create a system of classification by observing objects that are grouped.

(c) Understand that changes in temperature and pressure can alter states of matter and that energy exists in many forms and one form can change into another, as demonstrated by the pupil's ability to:

(1) Use a thermometer to measure and record a range of temperatures and label each as hot, warm, cool or cold; and

(2) Investigate, using direct observations, and describe in detail how a solid changes into a liquid and water evaporates in an open container.

(d) Understand that chemical reactions change substances into different substances.

(e) Understand that nuclear energy and electromagnetic energy are produced in many forms from both natural and man-made sources.

2. For the area of life science:

(a) Understand that all life forms, at all levels of organization, use specialized structures and similar processes to meet the basic needs of life, as demonstrated by the pupil's ability to:

(1) Observe and describe the growth of a plant, such as a bean plant, over time and identify growth patterns, for example, the sprouting of seeds, the formation of roots, leaves and stems, and the development of flowers and seeds;

(2) Observe and describe the life cycle of a domestic animal and an animal that undergoes metamorphosis, such as a frog, butterfly or mealworm, and describe the needs of living organisms; and

(3) Classify, with few errors, plants and animals representative of major groups such as the evergreen versus deciduous trees, or animals with an external or internal skeleton or no skeleton.

(b) Understand that organisms respond to internal and external influences, as demonstrated by the pupil's ability to:

(1) Describe, using examples with minimal errors, how various living things behave differently under differing conditions such as migration, coloration and hibernation; and

(2) Explain that germs affect the functions of the body and identify the defenses that the human body has against germs, such as saliva, skin and special blood cells.

(c) Understand that life forms are diverse and that through heredity they pass some characteristics to their offspring, as demonstrated by the pupil's ability to:

(1) Give examples of how offspring may resemble parents and other siblings; and

(2) With minimal assistance from the teacher, sort a group of living things by appearance and behavior and give rational justification for the sorting.

(d) Understand evolution and that life forms change over time, as demonstrated by the pupil's ability to:

(1) Illustrate with diverse examples the many different kinds of living things that exist on the Earth; and

(2) Provide general examples of how particular features of plants and animals help them live in different kinds of environments, for example, the thickened stems of cacti enable them to store water and live in the desert.

3. For the areas of earth and space sciences:

(a) Understand that the Earth is composed of interrelated systems of rocks, water, air and life, as demonstrated by the pupil's ability to:

(1) Identify, with few or no errors, various samples of the materials of the Earth, such as rocks, minerals, soil, sand, gravel, water, ice and air;

(2) Identify landforms such as mountains and valleys;

(3) Describe the shape of the Earth as "round like a ball" or as a sphere; and

(4) Compare, using maps and models, relative areas of ocean and land on the surface of the Earth.

(b) Understand that the Earth may be represented by a variety of maps and models, as demonstrated by the pupil's ability to:

(1) Indicate any one of three directions on a map, as requested by the teacher, when given the fourth direction by the teacher; and

(2) Locate the State of Nevada on a national map and the city or town in which the pupil resides on a map of the State of Nevada.

(c) Understand that the systems of the Earth such as weather and the formation of mountains change or vary, as demonstrated by the pupil's ability to observe and describe, with examples, how some changes are hard to see while they happen because they are:

(1) Slow, such as the growth of a plant and the movement of an hour hand on a clock; or

(2) Fast, such as lightning strikes, eye blinks and the change from dark to light when a light is turned on.

(d) Understand that the systems of the Earth have a variety of cycles through which energy and matter continually flow, as demonstrated by the pupil's ability to:

(1) Observe and describe that some objects that give off light, such as light bulbs or the sun, also give off heat;

(2) With minimal assistance from the teacher, observe, record and describe by using words, numbers and drawings, the seasonal differences, for example, changes in the weather and the leaves of deciduous trees; and

(3) Observe and describe that water can be a liquid or a solid, and explain that changes in temperature can cause water to go back and forth from one form to the other.

(e) Understand that the Earth is part of a planetary system within the Milky Way Galaxy, which is part of the known universe, as demonstrated by the pupil's ability to:

(1) Identify the sun, the moon and the Earth as components of our solar system; and

(2) Explain that there are more stars in the sky than anyone could easily count.

4. For the area of environmental sciences:

(a) Understand that ecosystems display patterns of organization, change and stability as a result of the interactions and interdependencies among the life forms and the physical components of the Earth, as demonstrated by the pupil's ability to:

(1) Identify, with appropriate examples, similarities and differences found in animals and plants that help them live in their unique habitats; and

(2) Describe, with the use of diagrams or illustrations, ways in which organisms interact with each other.

(b) Understand that natural resources include renewable and non-renewable materials and energy, and that all organisms, including humans, use resources to maintain and improve their existence, and the use of resources can have positive and negative consequences, as demonstrated by the pupil's ability to:

(1) Explain, with multiple examples, that natural resources are used for many purposes, for example, trees are used for construction, paper and fuel; and

(2) Describe how humans have obtained natural resources for thousands of years through farming, mining, hunting and gathering.

(c) Understand conservation and that humans have the unique ability to change personal and societal behavior based on ethical considerations regarding other organisms, the planet as a whole and future generations, as demonstrated by the pupil's ability to:

(1) Provide examples of materials that can be recycled and used again, including materials that may be used in different forms; and

(2) Make a reasonable prediction of the continuation of a pattern based on a given pattern of observable change.

5. For the area of the nature and history of science:

(a) Understand that humans have the unique ability to change personal and societal behavior based on ethical considerations regarding other organisms, the planet as a whole and future generations, as demonstrated by the pupil's ability to:

(1) With the assistance of the teacher, make observations, ask questions and seek answers;

(2) Generally observe and record accurately to compare findings with others;

(3) Identify women and men of different ages and backgrounds who have made contributions to science;

(4) Identify the benefits of working with a team and sharing findings; and

(5) Competently use tools such as hammers, screwdrivers, balances, hand lens, pencil sharpeners and levers to make a task easier.

(b) Understand that many decisions require critical consideration of scientific evidence.

(c) Understand that a variety of models can be used to describe or predict things and events, as demonstrated by the pupil's ability to:

(1) Compare and contrast a model with what it represents;

(2) Identify and represent observable patterns and correctly predict the next likely event based on the pattern, for example, life cycles, seasonal changes in the weather or phases of the moon; and

(3) Demonstrate, with an example, that when parts or substances are joined or mixed they can do things together they could not have done by themselves, such as bread and its ingredients or a model car and its parts.

(d) Understand that science is an active process of systematically examining the natural world, as demonstrated by the pupil's ability to:

(1) Observe and raise questions about the world, for example, about the actions of toys or the development and characteristics of schoolyard plants, and seek answers through investigations; and

(2) Record in a notebook or journal observations of investigations over time, such as changes in a terrarium or changes in a tadpole as it matures.

(e) Understand that a variety of methods of communication may be used to share scientific information, as demonstrated by the pupil's ability to:

(1) Follow verbal and written instructions to complete a procedure;

(2) Create adequate illustrations, graphs and charts that are easy to understand and that convey ideas and record observations; and

(3) Cooperate and contribute ideas within a group.

6. For the area of scientific inquiry, processes and skills:

(a) Understand that scientific inquiry is enhanced and often communicated through mathematics, as demonstrated by the pupil's ability to:

(1) Use mental computation to make rough estimates, such as using addition, subtraction, multiplication, division and measurement; and

(2) Determine whether measurements and descriptions are reasonably accurate, for example, comparing objects by measuring lengths, weights and capacities or verifying the reasonableness of results by checking the measurements against known values, such as the length of the classroom or the capacity of a quart of milk.

(b) Appropriately and safely apply the tools and techniques of scientific inquiry, as demonstrated by the pupil's ability to:

(1) Consistently use equipment properly and safely during all science activities; and

(2) Identify and gather tools and materials necessary for a scientific investigation.

Sec. 14. *By the end of the fifth grade, pupils must know and be able to do everything required in the previous grades for courses in science offered in public schools. Instruction in the fifth grade in science must be designed so that pupils meet the following performance standards by the completion of the fifth grade:*

1. For the areas of physical science:

(a) Understand that gravitational, electrical and magnetic forces have an effect on the motion of objects, as demonstrated by the pupil's ability to:

(1) Demonstrate and describe that the greater the push or pull on an object, the greater the change in motion of that object;

(2) Give examples of falling objects and explain that a gravitational force is pulling them down;

(3) Categorize objects that move in different directions, such as forward, back and sideways, in a variety of ways, for example, rotating, rolling or revolving, and with varying ease of movement and friction;

(4) Accurately predict which objects will sink or float in air or water and classify those objects accordingly; and

(5) Predict, sort and classify objects and materials that magnets attract and describe and demonstrate that like magnetic poles repel.

(b) Understand that materials have distinct properties which depend on the amount of matter present, its chemical composition and structure, as demonstrated by the pupil's ability to:

(1) Separate the components of a mixture based on their properties, for example, separating sand and sugar from a mixture of sand and sugar or separating sugar from a solution of water and sugar, and describe why the technique worked;

(2) Compare and contrast elements, compounds and mixtures and give common examples of elements, compounds and mixtures;

(3) Investigate and describe how patterns of crystals are formed after water has evaporated from a solution;

(4) Describe the properties of large and small pieces of a material and explain that the properties are the same, such as a sheet of paper versus pieces of paper, a chunk of rock and fragments of rock or a cinnamon stick and powdered cinnamon;

(5) Describe observable properties such as the state of matter, ductility, malleability, color, strength and shape of various materials and suggest uses for these materials based on their properties; and

(6) Compare and contrast the properties and composition of various materials.

(c) Understand that changes in temperature and pressure can alter states of matter and that energy exists in many forms, as demonstrated by the pupil's ability to:

(1) Gather data to describe the cooling of warm objects and the warming of cool objects when brought together and make accurate observations;

(2) Investigate how energy and matter interact when water changes phases from solid to liquid to gas and vice versa, explain these interactions and diagram the water cycle, indicating whether energy is absorbed or released in each change;

(3) Demonstrate how changes in sound can be made given appropriate supplies such as a uniform set of eight glasses or test tubes, a metal spoon, a chopstick and a container of water, and record and summarize the findings; and

(4) Follow instructions to build a simple series electrical circuit and describe the use of various components such as switches, wires, batteries, sockets, motor and lights.

(d) Understand that chemical reactions change substances into different substances, as demonstrated by the pupil's ability to:

(1) Observe and record the effects of common physical and chemical changes, for example, melting and burning candle wax, dissolving sugar in water and heating sugar and mixing baking soda with vinegar to bake a cake; and

(2) Distinguish between a phase and a chemical change.

(e) Understand that nuclear energy and electromagnetic energy are produced in many forms from both natural and man-made sources.

2. For the area of life science:

(a) Understand that all life forms, at all levels of organization, use specialized structures and similar processes to meet the basic needs of life, as demonstrated by the pupil's ability to:

(1) Observe, draw, label, compare and contrast, with minor errors or omissions, the essential features of the life cycles of representative plants and animals, including birth or germination, the development of plants such as seeds to roots, stems and leaves to flowers to seeds, and the development of animals such as the frog, silk moth or cricket;

(2) Classify, with minor errors, structures of various organisms according to their functions; and

(3) Give examples of specific features that enable a wide variety of plants and animals to live in their environments.

(b) Understand that organisms respond to internal and external influences, as demonstrated by the pupil's ability to:

(1) With reasonable assistance from the teacher, relate sensory input to behavioral response, for example, plants turn toward the sun and animals turn toward sound;

(2) Develop a reasonable plan to teach an organism a learned behavior; and

(3) Make reasonable predictions that some environmental conditions are more favorable than others to living things, for example, that there is a far greater diversity of life in a rain forest than in a desert or tundra.

(c) Understand that life forms are diverse and that they pass some characteristics to their offspring, as demonstrated by the pupil's ability to:

(1) Differentiate inherited traits from learned traits and illustrate with appropriate examples;

(2) Explain that living things are classified by similar features, behaviors and habits and provide some examples;

(3) Illustrate, by providing several examples, that there are variations among individuals within a population of certain species; and

(4) Relate reproduction to the continuation of a species.

(d) Understand that life forms change over time through evolution and the process of biological change, as demonstrated by the pupil's ability to:

(1) Classify animals and plants according to their physical characteristics;

(2) Identify examples of environmental changes that have allowed some species to survive and caused others to become extinct; and

(3) Identify examples of how differences in individual characteristics may give an advantage for survival.

3. For the areas of earth and space sciences:

(a) Understand that the Earth is composed of interrelated systems of rocks, water, air and life, as demonstrated by the pupil's ability to:

(1) Describe the mineral content of a rock sample in terms of easily observed properties of the minerals it contains, for example, the color and darkness of minerals and the size of crystals;

(2) Describe relationships, using models and first-hand observations, between:

(I) Increase in slope and increase in the rate of erosion;

(II) Increase in slope and decrease in the rate of deposition; and

(III) Ways in which the activities of humans can increase the rate of erosion, for example, through deforestation and removal of the soil, or decrease the rate of erosion, for example, through reforestation or construction that has a minimum impact on the environment;

(3) Describe, using models or maps, the flat, protruding and depressed features of the surface of the Earth, including features of the ocean floor; and

(4) Describe the composition of samples of soil in terms of constituents such as rock and mineral fragments, organic material, moisture content and organisms, and compare and contrast soil samples from different places.

(b) Understand that the Earth may be represented by a variety of maps and models, as demonstrated by the pupil's ability to:

(1) Identify, given a map, the directions northeast, northwest, southeast, and southwest;

(2) With minimal assistance from the teacher, use a road map of the State of Nevada to plan a route between various points of interest in this state, for example, from the residence of the pupil to a point of interest such as the Berlin Ichthyosaur or Lehman Caves; and

(3) With minimal assistance from the teacher, construct a map of a local or regional feature such as the classroom, school grounds or neighborhood.

(c) Understand that the systems of the Earth, such as weather and the formation of mountains change or vary, as demonstrated by the pupil's ability to:

(1) Compare and contrast, using various laboratory, print, multimedia and Internet resources, the amount of time required to cause various changes on the surface of the Earth, for example, weathering, erosion, earthquakes and volcanic eruptions; and

(2) With minimal assistance from the teacher, simulate and describe, by using hands-on materials, the various ways that fossils form, such as cast and mold formation and imprints.

(d) Understand that the systems of the Earth have a variety of cycles through which energy and matter continually flow, as demonstrated by the pupil's ability to:

(1) Investigate and explain, with examples, how the sun is the main source of energy for people;

(2) Analyze, using print, maps, models, multimedia resources and the Internet, various meteorological events, such as storms, flooding and drought, including their causes and effects;

(3) Conduct investigations that demonstrate relationships among temperature, relative humidity, air movement, and rates of evaporation and condensation; and

(4) Observe natural outdoor and artificial systems, for example, terraria, decomposition columns, aquariums, stream tables, gardens and school environments, and describe the physical changes, such as pH, temperature, relative humidity, changes in state of water, weathering and erosion, and biological changes, such as patterns of behavior and seasonal changes in form, that take place in those systems.

(e) Understand that the Earth is part of a planetary system within the Milky Way Galaxy, which is part of the known universe, as demonstrated by the pupil's ability to:

(1) Compare and contrast, citing print, multimedia or Internet resources, the general features of planets and their moons, asteroids, comets and the sun; and

(2) Describe, using daily and nightly observations or simulations, such as a classroom ceiling star projector or college planetarium, the:

(I) Motion of the sun, moon, stars and some planets across the sky; and

(II) Distribution, brightness and color of some major stars and constellations.

4. For the area of environmental sciences:

(a) Demonstrate an understanding that ecosystems display patterns of organization, change and stability as a result of the interactions and interdependencies among the life forms and physical components of the Earth, as demonstrated by the pupil's ability to:

(1) Describe, using examples, several ways organisms interact with each other and with their non-living habitat, including dead plants and animals;

(2) Match plants and animals that will survive well, less well, or will not survive in particular environments;

(3) Explain why energy is required in an ecosystem, identify the sun as the energy source and identify other requirements for life that are met by the environment; and

(4) List and describe unique characteristics of representative local ecosystems.

(b) Understand that natural resources include renewable and non-renewable materials and energy, and that all organisms, including humans, use resources to maintain and improve their existence, and that the use of resources can have positive and negative consequences, as demonstrated by the pupil's ability to:

(1) Observe samples of various materials, such as wood, cloth, paper, metal, plastic and composites, and describe their properties, for example, how they respond to various stresses, how they react with other materials and chemicals, what happens in the presence of heat and fire, and their electrical and magnetic properties;

(2) Identify ways that observed properties of samples of materials make them useful for various activities of humans;

(3) Investigate and describe the extent to which samples of man-made items, such as objects made of cloth, glass, paper, metal, plastic, composites or ceramics, may be used over and over;

(4) Describe how a device can be made to operate with less energy, for example, reducing friction by applying a lubricant such as graphite or using more aerodynamic and lightweight materials;

(5) Describe, using information from state and federal agencies, the kinds and uses of natural resources found in the State of Nevada, for example, water, gold, gypsum, petroleum, wildlife and ranch, farm and recreation land;

(6) Describe, using print, multimedia or Internet resources, the kinds and uses of natural resources acquired nationally or globally, such as lumber, grain, fish and coal; and

(7) Contrast the basic needs of humans for resources, such as food, water, shelter and warmth, to the actual use of resources by humans and suggest ways in which personal use of limited resources may be reduced.

(c) Understand that through conservation humans have the unique ability to change personal and societal behavior based on ethical considerations regarding other organisms, the planet as a whole and future generations, as demonstrated by the pupil's ability to:

(1) Describe how the patterns of consumption of people living in the same period of time vary from place to place;

(2) Describe the components of an ecosystem that has changes which can be observed and the components of an ecosystem that do not change; and

(3) Identify changes in environments as being natural events or influenced by the activities of humans.

5. For the area of the nature and history of science:

(a) Understand that humans have the unique ability to change personal and societal behavior based on ethical considerations regarding other organisms, the planet as a whole and future generations, as demonstrated by the pupil's ability to:

(1) Develop a systematic approach to solving a problem;

(2) Use actual observations and results of scientific investigation to form a possible explanation;

(3) Research and use biographical information to make a written or oral report that describes past discoveries and inventions;

(4) Explain, with multiple examples, that working on a team brings greater results than working alone, for example, Apollo 13 and Thomas Edison's work on the light bulb;

(5) Use technological devices that may be used to determine motion, such as stop watches and radar guns; and

(6) Identify a question for further study while doing a scientific investigation, for example, factors affecting plant growth.

(b) Understand that many decisions require critical consideration of scientific evidence, as demonstrated by the pupil's ability to:

(1) Justify conclusions or explanations using data and logical argument; and

(2) Recognize the limits of generalizations, assumptions, analogies and models, for example, the solar system, evolution or model of atoms.

(c) Understand that a variety of models can be used to describe or predict things and events, as demonstrated by the pupil's ability to:

(1) Use a physical model to explain how something works or is constructed;

(2) Explain, with examples, that the probability of an event happening depends on how closely current conditions correspond with previous conditions, for example, weather and accidents; and

(3) Describe and compare the components and interrelationships of a simple system, for example, tracing the flow of water through an aquarium, a filter and a pump.

(d) Understand that science is an active process of systematically examining the natural world, as demonstrated by the pupil's ability to:

(1) Keep accurate records of investigations and observations without changing those records later so that the records will fit the norm;

(2) Make conscientious observations, test things more than once and use repeated observations or trials to verify results; and

(3) Offer reasons for the findings and consider the suggestions of others.

(e) Understand that a variety of methods of communication may be used to share scientific information, as demonstrated by the pupil's ability to:

(1) Provide written or oral instructions that others are able to follow;

(2) Organize information into charts, tables and graphs according to established criteria; and

(3) Collaborate on a group project.

6. For the area of scientific inquiry, processes and skills:

(a) Understand that scientific inquiry is enhanced and often communicated by using mathematics, as demonstrated by the pupil's ability to:

(1) Investigate the change in the result of a simple experiment when one of the experimental conditions is altered, for example, how the length of the string affects the swing of a pendulum;

(2) Explain the strategy and thinking used to solve a particular problem;

(3) Make acceptable quantitative estimates of familiar lengths, weights and intervals of time and check the estimates by accurate measurements;

(4) Select the appropriate types of units for a particular measurement, such as meters for length, seconds for time and kilograms for mass, and the appropriate magnitude of units for a particular measurement, such as meters, not centimeters, for measuring swimming pools; and

(5) Recognize that there may be inconsistent results if everyone in the class makes a particular measurement.

(b) Appropriately and safely apply the tools and techniques of scientific inquiry, as demonstrated by the pupil's ability to:

(1) Consistently use safety equipment and attire;

(2) Measure and mix dry and liquid materials safely in prescribed amounts;

(3) Properly use materials that are provided to construct objects for a particular task;

(4) Label measurements, graphs and diagrams correctly;

(5) Select and use a range of instruments to measure physical quantities, for example, length, volume, weight, time and temperature, and record data using traditional lab equipment as well as computers; and

(6) Given a set procedure, manipulate objects and observe events in an experiment.

Sec. 15. *By the end of the eighth grade, pupils must know and be able to do everything required in the previous grades for courses in science offered in public schools. Instruction in the eighth grade in science must be designed so that pupils meet the following performance standards by the completion of the eighth grade:*

1. For the area of physical science:

(a) Understand that gravitational, electrical and magnetic forces have an effect on the motion of objects, as demonstrated by the pupil's ability to:

(1) Explain how multiple forces acting on an object along a straight line will affect the motion of the object, for example, the forces may be acting in the same direction or in opposite directions, the forces may be of equal magnitude or different magnitudes, or the object may be in motion or at rest;

(2) Explain that every object in the universe is attracted to every other object in the universe and that the larger the masses, the greater the force of attraction, and that the greater the distance between the objects, the weaker the force of attraction;

(3) Use a simple machine to solve a problem, such as moving an object from one place to another, and describe how simple machines change force and distance to accomplish a task;

(4) Describe the relationship between buoyancy and the apparent weight of an object in liquid; and

(5) Investigate the use of direct observations, and describe that electric current produces magnetic forces and moving magnets produce electric forces in conductors.

(b) Understand that materials have distinct properties which depend on the amount of matter present, its chemical composition and structure, as demonstrated by the pupil's ability to:

(1) Use simple models, such as particle models, and measurements to explain observed properties of matter;

(2) Separate substances based on their physical and chemical properties, for example, color, solubility, chemical reactivity, melting point and boiling point;

(3) Use models or diagrams to describe how atoms form molecules;

(4) Explain that all atoms consist of protons, electrons and neutrons;

(5) Explain the three states of matter, solid, liquid and gas, as systems of particles of varying densities and degrees of organization; and

(6) Explain, with examples, how atoms of different elements can combine to form all known substances.

(c) Understand that changes in temperature and pressure can alter states of matter and that energy exists in many forms and one form can change into another, as demonstrated by the pupil's ability to:

(1) Describe the movement of heat from object to object and incorporate the concepts of composition and proximity of the objects;

(2) Identify in general terms which kinds of substances will conduct heat most readily;

(3) Describe, using such terms as melting point and boiling point, the specific changes in energy that must occur for a substance to change states, for example, by diagramming a heating or cooling curve that identifies the changes which are taking place;

(4) Investigate and describe the characteristics of waves using such things as ropes, water tables and springs;

(5) Describe that waves move at different speeds if traveling in different materials, for example, sound waves traveling in air as opposed to water;

(6) Describe:

(I) The electromagnetic spectrum and how wavelength changes from one end to the other; and

(II) That the energy of waves can be changed into other forms of energy;

(7) Create parallel, series and combination circuits and describe:

(I) Very simple properties of parallel and combination circuits, for example, current is distributed among the branches of the circuits; and

(II) More sophisticated properties of series circuits, for example, voltage, resistance and current;

(8) Describe various ways energy can be transferred between systems or objects and the different forms of energy, such as radiant, chemical, electrical, nuclear and mechanical; and

(9) Distinguish between potential and kinetic energy and give specific examples of each.

(d) Understand that chemical reactions change substances into different substances, as demonstrated by the pupil's ability to:

(1) Apply the concept of the conservation of mass to a given chemical reaction specifying the total mass of reactants and products and confirm that the same elements are present in the products as were present in the reactants;

(2) Carry out simple investigations and describe how the rate of a reaction can be changed when variables such as temperature, pH and light are changed, and give examples of applications of this concept such as storing certain substances in brown bottles, refrigeration or the effect of acid rain;

(3) Observe and describe, using commonplace examples, chemical reactions that either require or release energy; and

(4) Describe the basic organization of the periodic table, patterns, such as location of metals, nonmetals, metalloids and noble gases, and chemical reactivity.

(e) Understand that nuclear energy and electromagnetic energy are produced in many forms from both natural and man-made sources, as demonstrated by the pupil's ability to:

(1) Investigate and describe the interaction of light with matter, for example, the transmission, absorption and scattering of light;

(2) Explain radioactive isotopes and describe their application to medicine, age dating and nuclear power plants;

(3) Define high-level and low-level nuclear wastes and describe their associated hazards;

(4) Describe the electromagnetic spectrum and qualitatively identify the waves produced by the sun within the electromagnetic spectrum;

(5) Compare and contrast the nuclear processes that occur in the sun and other stars with fusion, nuclear reactors and fission; and

(6) Explain, with examples, how nuclear reactions convert small amounts of matter into a relatively large amount of energy.

2. For the area of life science:

(a) Understand that all life forms, at all levels of organization, use specialized structures and similar processes to meet the basic needs of life, as demonstrated by the pupil's ability to:

(1) With minimal assistance from the teacher, explain that diseases result from breakdowns in the structures or functions of an organism;

(2) Explain, with an example, that life functions may occur at different levels of organization through specialized tissues, organs and systems, for example, oxygen is exchanged at the lungs, transported in the blood and used by the cells of the body;

(3) Identify various plant structures and systems and give the function of each with minimal errors; and

(4) Explain, in general terms, that cellular functions are guided by information stored in DNA.

(b) Understand that organisms respond to internal and external influences, as demonstrated by the pupil's ability to:

(1) Identify a given behavior as innate or learned and provide multiple, accurate examples of innate and learned behavior;

(2) Explain that behavior may be based on experience and evolutionary history;

(3) Accurately relate a given behavior to the stimulus that prompted the behavior; and

(4) Explain that various viruses, bacteria, fungi and parasites may infect the human body and interfere with its functions and give an example of each.

(c) Understand that life forms are diverse and that through heredity they pass some characteristics to their offspring, as demonstrated by the pupil's ability to:

(1) Adequately explain how Mendel's model of heredity predicts the passage of genetic instructions from one generation to another;

(2) Classify living things on the basis of similar characteristics and explain why certain organisms are grouped together;

(3) Explain that selective breeding has resulted in new varieties of domestic animals and plants, giving examples of both plants and animals;

(4) Distinguish between processes involved in sexual and asexual reproduction;

(5) Demonstrate that pairs of genes may control patterns of inheritance, using, for example, Punnett squares;

(6) Describe species as organisms that can mate with each other and produce fertile offspring; and

(7) Explain that changes in the genes of sex cells may affect offspring.

(d) Understand that life forms change over time through evolution and the process of biological change, as demonstrated by the pupil's ability to:

(1) Investigate and provide an estimate of the number of species of animals, plants and microorganisms that are alive today;

(2) Explain differences and similarities between species in terms of biological evolution;

(3) Give multiple examples of how organisms have adaptive characteristics that have allowed them to survive and therefore reproduce;

(4) Explain that all organisms show general similarities of internal structures and chemical processes; and

(5) Outline by using drawings, diagrams or charts, major lines of evidence that support evolutionary relationships among species, for example, fossil record, DNA sequences or anatomical similarities.

3. For the areas of earth and space sciences:

(a) Understand that the Earth is composed of interrelated systems of rocks, water, air and life, as demonstrated by the pupil's ability to:

(1) Describe mineral samples on the basis of physical properties, such as hardness, luster, color, streak, cleavage and crystal shape;

(2) Describe rock samples on the basis of obvious physical features, for example, sedimentary structures such as ripple marks, metamorphic structures such as foliation and igneous structures such as interlocking crystals;

(3) Explain, using models such as stream tables and clay layers, how erosion, deposition, and pushing and pulling forces inside the Earth create landforms like mountains and valleys;

(4) Describe, using three-dimensional models or drawings, the internal layers of the Earth, for example:

(I) Continental and oceanic crust;

(II) A hot, convecting mantle; and

(III) A dense, metallic core;

(5) Compare and contrast the properties of various soil samples, such as color, texture and capacity to retain water;

(6) Explain by using observations of actual soil samples, that soil contains materials that are required for things that live in the soil;

(7) List the major components of the atmosphere at the surface of the Earth and their relative abundance, such as nitrogen is the largest component, followed by oxygen, with other gases like carbon dioxide and water vapor in smaller amounts;

(8) Describe how temperature, density, pressure and the composition of the atmosphere vary with elevation; and

(9) Describe the causes and effects of geologic events, such as earthquakes, landslides, volcanoes and floods.

(b) Understand that the Earth may be represented by a variety of maps and models, as demonstrated by the pupil's ability to:

(1) Locate positions on the surface of the Earth using degrees of latitude and longitude coordinates;

(2) Compare and contrast the kinds of features found on various kinds of maps, including, without limitation, contour, physical, political and geological maps;

(3) Find the State of Nevada or identifiable features of the State of Nevada, depending on the map scale, on various kinds of maps, including contour, physical, political and geological maps;

(4) Use a color-coded map to compare and contrast various features such as temperature, density of population, geology and precipitation; and

(5) Determine the time of day in various places throughout the world, but not across the International Date Line, given the local time of day.

(c) Understand that the systems of the Earth such as weather and formation of the mountains can change or vary, as demonstrated by the pupil's ability to:

(1) Identify the key processes and rates of change that occurred in the formation of a landform, for example, the slow processes of weathering, erosion and deposition, and the relatively fast processes of volcanism and mass wasting;

(2) Apply, using actual, replica or graphic reproductions of fossils, the following evidence to show that life forms and environmental conditions change over time:

(I) The fossil record reflects a pattern of change in organisms over time; and

(II) Many fossils are similar to organisms that are alive today, allowing logical comparisons of past and present environments;

(3) Describe reasons that fossil evidence may not form or may be destroyed, for example, scavenger and decomposer activity, and the effects of weathering and erosion; and

(4) Provide a reasonable description of how weathering, erosion, deposition, radioactive decay, volcanic activity, plate tectonics and many other natural processes that occur in the present day are the same as those that occurred in the past.

(d) Understand that the systems of the Earth have a variety of cycles through which energy and matter continually flow, as demonstrated by the pupil's ability to:

(1) Explain, using diagrams and words, that the sun is the ultimate source of energy for the major processes of the Earth, for example:

(I) From the sun to plant to fossil fuel; and

(II) From the sun to evaporation to precipitation to weathering and erosion caused by water;

(2) Explain, citing direct observations of the high specific heat of water, the moderating effect that large bodies of water have on the weather and climate because of the relatively high capacity of water to absorb heat and release heat slowly;

(3) Explain, using weather maps, the weather that occurs near boundaries between air masses;

(4) Describe the formation and types of clouds and how these types of clouds are associated with particular patterns of weather, for example, particular clouds often precede particular kinds of fronts between air masses, and that cumulonimbus clouds are typically associated with thunderstorms;

(5) Explain the relationship between temperature, moisture and origin of air masses, for example, air masses that form over land tend to be dry and air masses that form in polar regions tend to be cold;

(6) Explain, citing first-hand observations such as radiation striking a surface from a light bulb at various angles of incidence, the relationship between changes in the aspect of the Earth's axis relative to the sun and the incidence of solar radiation;

(7) Explain, using climate and weather data, diagrams, maps and models, how long-term patterns of air movement combined with regional topography affect regional climate, for example, rain-shadow deserts caused by coastal mountain ranges;

(8) Explain, using a model or a diagram, how water circulates through the Earth, oceans and atmosphere through interlinked cycles of evaporation, condensation, transpiration, runoff and groundwater percolation;

(9) Describe, using climate and weather data, drawings and maps, how climate is affected by proximity to large bodies of water, patterns of atmospheric movement, latitude and altitude;

(10) Observe and describe some processes that are reversible, such as pH indicator changes or stretching a spring within its elastic limit, and others that are practically irreversible, such as burning, stretching a spring beyond its elastic limit and extinction of a species;

(11) Explain, citing first-hand observations such as the conservation of energy in calorimeter experiments, that the energy the Earth receives over geologic time approximately equals the energy that the Earth loses; and

(12) Describe, using diagrams and models, the relationships among geothermal and tectonic processes, for example, geothermal processes occur near lithosphere plate boundaries or where lithosphere plates are fractured or relatively thin.

(e) Understand that the Earth is part of a planetary system within the Milky Way Galaxy, which is part of the known universe, as demonstrated by the pupil's ability to:

(1) Investigate and describe the principle characteristics of the planets in the solar system, using print, multimedia or Internet resources and drawings or models;

(2) Investigate, using print, multimedia or Internet resources, and describe, using drawings or models, how seasons, eclipses, moon phases and tides are caused by the effects of relative motion and positions of the sun, Earth and moon;

(3) Explain that billions of galaxies form most of the visible mass in the universe and compare the chemical composition of galaxies to that of the Earth;

(4) Explain how various tools, such as optical and radio telescopes and unmanned robotic spacecraft, allow us to investigate objects in the sky that are too distant, faint or bright to observe directly from the Earth; and

(5) Describe the historical development of some of the laws of motion, for example, the laws of Kepler and Newton, that apply to the motion of objects in the solar system.

4. For the area of environmental sciences:

(a) Understand that ecosystems display patterns of organization, change and stability as a result of the interactions and interdependencies among the life forms and the physical components of the Earth, as demonstrated by the pupil's ability to:

(1) Develop a presentation to represent visually and explain how organisms interact with the living and non-living components of their ecosystems, including food chains and food webs;

(2) Characterize organisms in a variety of ecosystems by their function, for example, producer, consumer, predator, prey, parasite, host, scavenger or decomposer;

(3) Analyze, citing specific examples, the role of predators as a stabilizing factor in an ecosystem and explain how they can prevent habitat destruction or extinction of a species;

(4) Trace the flow of energy in an ecosystem, noting the dissipation of heat at each energy transfer point, and describe the impact on the ecosystem, for example, by comparing the implications on resources of a vegetarian diet to one with high meat consumption; and

(5) Identify similarities and differences found in geographically distinct ecosystems.

(b) Understand that natural resources include renewable and non-renewable materials and energy and that all organisms, including humans, use resources to maintain and improve their existence, and that the use of resources can have positive and negative consequences, as demonstrated by the pupil's ability to:

(1) Observe and describe the identifying characteristics of renewable and non-renewable resources;

(2) Explain how some natural resources are limited in their abundance or accessible location, for example, water in the desert;

(3) Investigate and describe the location and distribution of non-renewable energy resources by using print, multimedia or Internet resources;

(4) Observe directly and use print, multimedia and Internet resources to describe how organisms alter their local environment through their use of natural resources;

(5) Describe how the unintended consequences of technology can cause:

(I) The depletion of resources, such as internal combustion engines burning fossil fuels that are non-renewable; and

(II) Environmental degradation, such as internal combustion engines causing air pollution; and

(6) Describe how technology can increase the availability of resources, for example:

(I) Internal combustion engines allow the harvest and transport of resources more efficiently and mitigate environmental degradation;

(II) Improvements in design and fuel of internal combustion engines can lower rates of air pollution; and

(III) Improvements in mining technology make it financially feasible to mine ores previously considered too low-grade to be profitable.

(c) Understand that through conservation humans have the unique ability to change personal and societal behavior based on ethical considerations regarding other organisms, the planet as a whole and future generations.

5. For the area of the nature and history of science:

(a) Understand that humans have the unique ability to change personal and societal behavior based on ethical considerations regarding other organisms, the planet as a whole and future generations, as demonstrated by the pupil's ability to:

(1) Demonstrate that scientific investigations involve:

(I) The use of logic, for example, step-by-step thinking;

(II) Respect for the rules of evidence, such as generally using a truthful, careful and accurate collection of evidence and information in a scientific investigation;

(III) Adherence to the standards for keeping a science notebook;

(IV) Openness to criticism, for example, respectfully considering constructive criticism and review by peers;

(V) Respectfully offering constructive criticism and review of peers; and

(VI) Public reporting of methods and procedures;

(2) Successfully carry out at least one of the following kinds of investigations:

(I) A controlled experiment;

(II) A field study; or

(III) A research report using multiple sources;

(3) Explain, using examples, that people from ancient times have provided knowledge about the natural world that is still regarded as valid today, even though that knowledge may not have originated by scientific methods;

(4) Understand that scientists may work in teams or scientists may work alone, but scientists should communicate extensively with each other, for example, by conducting investigations and sharing results with other scientists conducting similar work;

(5) Compare and contrast scientific inquiry and technological design using multiple and related examples of research and the application of the research to technology, for example, fish ladders, habitats and walkways for tortoises, access for the handicapped and pace makers for the heart;

(6) Critique the results, techniques and processes used in a scientific investigation; and

(7) Compare and contrast the strengths and limitations of science as related to other social and intellectual activities of humans.

(b) Understand that many decisions require critical consideration of scientific evidence, as demonstrated by the pupil's ability to:

(1) Identify and evaluate the use of statistics, data and graphs in a variety of scientific work;

(2) Give examples of human activities with their associated benefits, costs and risks, for example, cloning, electric automobiles and pest control;

(3) Analyze and describe a simple system, such as a pendulum, aquarium or toilet, in terms of its efficiency, optimal function and possible sources of malfunction; and

(4) Evaluate information to distinguish between fact and opinion when solving problems, for example, product advertising and early theories concerning flat earth versus round earth.

(c) Understand that a variety of models can be used to describe or predict things and events, as demonstrated by the pupil's ability to:

(1) Use two different models to demonstrate the same thing, such as a map and a globe;

(2) Use models to predict change, as in a stream table;

(3) Identify and illustrate natural cycles within systems, for example, water, planetary motion, climate and geological changes;

(4) Analyze data from two groups, comparing their means, medians, modes and ranges, and explain why these statistics are important; and

(5) Use a systematic approach to describe the risks and benefits of a situation.

(d) Understand that science is an active process of systematically examining the natural world, as demonstrated by the pupil's ability to:

(1) Clearly state reasons for keeping honest, clear and accurate records, for example, to maintain the integrity of the scientific process and to mitigate possible injury to persons, property or the environment;

(2) Explain that hypotheses are valuable even if they turn out to be incorrect; and

(3) Compare varying explanations given for a particular phenomenon, event or result.

(e) Understand that a variety of methods of communication may be used to share scientific information, as demonstrated by the pupil's ability to:

(1) Write clear, step-by-step instructions for a procedure;

(2) Organize information in tables and graphs and describe the relationships they reveal; and

(3) Discuss scientific topics by paraphrasing, asking for clarification or elaboration, and expressing alternative positions using print, Internet and multimedia resources.

6. For the area of scientific inquiry, processes and skills:

(a) Understand that scientific inquiry is enhanced and often communicated through the use of mathematics, as demonstrated by the pupil's ability to:

(1) Explain that quantities can vary in proportion to one another, such as the mass of a substance is directly proportional to its volume or the time it takes for a vehicle to travel is directly proportional to the distance that it travels;

(2) Explain in general terms the steps required to solve a given problem and why the steps are necessary;

(3) Explain, using examples, that probabilities are ratios and can be expressed as fractions, percentages or odds;

(4) Make reasonable estimates of outcomes in familiar situations, for example, the probability of being born a boy or girl, of being struck by lightening or of being involved in an automobile accident;

(5) Explain that, with very few exceptions, numbers in science are expressed with units;

(6) Consistently select and use the appropriate Systeme International unit for a particular measurement, such as meters for length, seconds for time or kilograms for mass;

(7) Define accuracy and precision and determine if repeated measurements and computations of quantities are reasonably precise and accurate; and

(8) Make reasonable predictions on the basis of all known data from related studies carried out under similar conditions.

(b) Appropriately and safely apply the tools and techniques of scientific inquiry, as demonstrated by the pupil's ability to:

(1) Consistently use instruments and laboratory safety equipment properly;

(2) Consistently handle and dispose of chemicals according to established standards;

(3) Choose appropriate, available materials for making or repairing simple mechanical constructions, for example, designing an apparatus using simple machines;

(4) Keep accurate and organized records of scientific investigations;

(5) Use appropriate technology in laboratory procedures for measuring, recording, storing and analyzing data, such as computers, graphing calculators and probes; and

(6) Design and carry out a controlled experiment working in a small group.

Sec. 16. *By the end of the 12th grade, pupils must know and be able to do everything required in the previous grades for courses in science offered in public schools. Instruction in the 12th grade must be designed so that pupils meet the following performance standards by the completion of the 12th grade:*

1. For the area of physical science:

(a) Understand that gravitational, electrical and magnetic forces have an effect on the motion of objects, as demonstrated by the pupil's ability to:

(1) Use the laws of motion to correctly predict the motion of an object;

(2) Describe changes in the force of gravity based on different masses and distances and apply the principle of gravity to the motion of falling objects, for example, objects accelerate as they fall;

(3) Determine the mechanical advantage and efficiency of various simple machines, such as a screw, lever, pulley, wheel, axle and wedge, and evaluate the usefulness of various machines according to their function, efficiency and mechanical advantage;

(4) Explain and apply the relationship between force, pressure and area, P=F÷A, to common phenomena, for example, the change in gas pressure in an expanding container or the differences in pressure between sharp and dull objects;

(5) Investigate and describe the relationship between pressure and depth in a liquid;

(6) Describe or explain the relationship between electromagnetic forces and electromagnetic systems, such as generators, circuits and electric motors;

(7) Calculate variables for simple electromagnetic systems, such as current, resistance, wattage and voltage; and

(8) Investigate and describe that the electromagnetic spectrum, including radio waves, light and infrared, is a form of energy consisting of both electrical and magnetic energy.

(b) Understand that materials have distinct properties which depend on the amount of matter present, its chemical composition and structure, as demonstrated by the pupil's ability to:

(1) Investigate and describe the intrinsic physical properties of matter, such as color, odor and density, and the extrinsic physical properties of matter, such as mass and volume;

(2) Apply techniques of spectral analysis, such as flame tests and colorimetry, to the identification of elements and compounds;

(3) Distinguish among and describe various types of chemical bonds, such as covalent, ionic and metallic;

(4) Describe the major features of the quantum-mechanical model of atomic structure including the concepts of the probable locations of electrons, discrete energy levels, quantum numbers and electron configurations;

(5) Apply the Kinetic Molecular Theory and the concept of forces between particles to explain phase changes and the properties of the states of matter; and

(6) Explain how carbon atoms uniquely bond to one another to form a large variety of molecules including those necessary for life.

(c) Understand that changes in temperature and pressure can alter states of matter and that energy exists in many forms and one form can change into another, as demonstrated by the pupil's ability to:

(1) Explain, using multiple examples, that any transfer or transformation of energy results in some "loss" of energy in the form of heat which may spread by radiation, conduction or convection;

(2) Investigate, using first-hand observations, and explain that pressure may affect changes of state;

(3) Investigate, using first-hand observations, and describe how waves can superimpose on one another, bend around corners, reflect off surfaces, be absorbed by materials they enter and change directions when entering a new material;

(4) Investigate and describe, using first-hand observations, the properties of electrical circuits in terms of moving electrons, conductivity, resistance and electrical potential energy;

(5) Investigate how matter and energy may be changed and energy may be transferred in many ways by using first-hand observations such as data on conservation of momentum, predictions of projectile motion, careful measurements and calculations of transfer between potential and kinetic energy;

(6) Describe the conservation of mass-energy as it applies to a closed system, such as $E=mc^2$; and

(7) Describe the concept of entropy as it applies to a closed system, identify the tendency for disorder to increase, and, if given examples of chemical and physical changes, state which is favored by entropy.

(d) Understand that chemical reactions change substances into different substances, as demonstrated by the pupil's ability to:

(1) Write a balanced equation to describe a given chemical reaction and describe the information it conveys;

(2) Describe qualitatively the way in which various factors affect the rate of a chemical reaction, such as the temperature, particle size, pressure, presence of a catalyst, pH and concentration of reactants;

(3) Distinguish between endothermic and exothermic reactions, for example, redox reactions, burning fuel, photosynthesis, respiration and electrochemical reactions in batteries; and

(4) Relate the chemical reactivity of an element to its electron configuration and illustrate it with appropriate diagrams and examples.

(e) Understand that nuclear energy and electromagnetic energy are produced from both natural and man-made sources in many forms, as demonstrated by the pupil's ability to:

(1) Use lenses to demonstrate the interaction of light with matter, such as reflection and refraction;

(2) Diagram the converging and diverging lenses and describe their major applications;

(3) Estimate the age of some materials using predictable rates of nuclear reaction, for example, half-lives;

(4) Describe the differences in disposal techniques that are required for high-level and low-level nuclear wastes;

(5) Describe electromagnetic spectrum labeling, such as gamma rays, x-rays, visible light, ultraviolet, infrared and radio waves;

(6) Communicate that the strong nuclear force that holds the nucleus together is greater than the weak forces that would tend to break it apart;

(7) Describe the release of energy during the nuclear processes of fission and fusion and give examples of elements that undergo fission and fusion respectively; and

(8) Compare the amount of energy in fission and fusion with that in chemical and phase changes.

2. For the area of life science:

(a) Understand that all life forms, at all levels of organization, use specialized structures and similar processes to meet the basic needs of life, as demonstrated by the pupil's ability to:

(1) Explain, with minor errors, the concept of equilibrium in organisms as related to disease processes;

(2) With minimal assistance from the teacher, distinguish among the systems of the human body, for example, the skeletal, nervous and digestive systems, and describe the different cells of each;

(3) With assistance from the teacher, trace the digestion, absorption and use of a food or group of foods through an organism; and

(4) Reasonably explain the process of photosynthesis.

(b) Understand that organisms respond to internal and external influences, as demonstrated by the pupil's ability to:

(1) Relate patterns of behavior to survival of a species and provide some examples;

(2) Give examples of a response in a plant and an animal to an environmental change that enhances its chance of survival;

(3) Describe the role of the nervous system in receiving input and generating responses in multicellular animals; and

(4) Develop a presentation suitable for pupils who are enrolled in junior high school and middle school that explains how the immune system works and how acquired immune deficiency syndrome (AIDS), a viral disease, destroys critical cells, thereby making the body vulnerable to infectious agents and cancerous cells.

(c) Understand that life forms are diverse and that through heredity they pass some characteristics to their offspring, as demonstrated by the pupil's ability to:

(1) Explain, in general terms, that all cells in the body of an organism are developed from a single set of genetic information and that different parts of the information are used in different kinds of cells;

(2) Explain, using diagrams or charts, how similarity among sequences of DNA may be used to estimate the degree of relatedness among organisms;

(3) Relate the great variety of possible gene combinations to sexual reproduction;

(4) Explain how DNA provides instructions for assembling proteins;

(5) Demonstrate, with minor errors, how multiple pairs of genes may control patterns of inheritance;

(6) Point out, with examples, how the diversity and variation of organisms increases the chance of survival when changes in the conditions of the environment occur; and

(7) Describe how a variety of influences may cause mutations of genes.

(d) Understand that life forms change over time through evolution and the process of biological change, as demonstrated by the pupil's ability to:

(1) Explain the basic concepts underlying the theory of evolution;

(2) Investigate and apply the concept of natural selection to explain incremental changes in the fossil record, using an example such as Eohippus;

(3) Relate adaptations of a species to the unique characteristics that favor an organism in a particular environment and use Kettlewell's study of England's peppered moths as an example of natural selection;

(4) Recognize that there are various lines of evidence which are used to establish an evolutionary relationship among species;

(5) Explain why most species that ever lived are extinct and why many human beings are concerned that endangered species be preserved;

(6) Provide examples of genetic and environmental influences that drive the process of evolution; and

(7) Cite evidence that cells with nuclei existed over 1 billion years ago and that these cells were the precursors to increasingly more complex organisms.

3. For the areas of earth and space sciences:

(a) Understand that the Earth is composed of interrelated systems of rocks, water, air and life, as demonstrated by the pupil's ability to:

(1) Describe the general processes of formation of a given sample of rock, such as weathering, erosion, deposition, melting, heat and pressure;

(2) List uses for at least five common materials of the Earth, such as gypsum in drywall and metals in electrical devices;

(3) Explain the formation of some topographical features, for example, volcanoes, rift valleys, ocean trenches and fault-block mountains, in terms of moving lithosphere plates;

(4) Explain how the Earth is generally layered from the most dense material, such as solids like rocks, outward to less dense materials, such as liquids like oceans, lakes, and streams, with the outermost layer being the least dense with gases such as the atmosphere;

(5) Describe the origin of constituents in various samples of soil, for example, organic materials that come from decomposed plants and animals and mineral materials that come from weathered rock;

(6) Compare and contrast the composition and properties of different soil horizons;

(7) Describe, citing print, multimedia or Internet resources, some historical changes in the atmosphere of the Earth, such as the change from a predominantly methane and ammonia atmosphere to its composition today;

(8) Describe, citing print, multimedia or Internet resources, present-day changes in the atmosphere of the Earth, for example, the increase in carbon dioxide, ozone depletion and air pollution;

(9) Compare and contrast, using maps, models, photographs or field observations, large geologic features throughout the State of Nevada, such as basin and range fault-block mountains and Sierra batholiths; and

(10) Compare and contrast, using maps, models, photographs or field observations, specific local geologic features, such as the glacial features in Lamoille Canyon, the local beach benchmarks from ancient lakes and the thrust faults in the Spring Mountains.

(b) Understand that the Earth may be represented by a variety of maps and models, as demonstrated by the pupil's ability to:

(1) Construct a contour map of a simple model landform and then build a model landform from a simple contour map;

(2) Define a location on the Earth in terms of latitude and longitude to the precision of degrees, minutes and seconds; and

(3) Determine the time in any time zone given the time of day.

(c) Understand that the systems of the Earth, such as weather and the formation of mountains, change or vary, as demonstrated by the pupil's ability to:

(1) Describe two ancient and two recent examples of catastrophic geologic events and analyze the causes of those events by using Internet, print or audio-visual materials;

(2) Create a representation of a stratigraphic column based on actual or photographic data that represent rock sequences and non-conformities, such as erosion surfaces; and

(3) Compare and contrast the variety of methods by which geologic time is determined, for example, radioactive dating, dendrochronology, stratigraphy and faunal succession.

(d) Understand that the systems of the Earth have a variety of cycles through which energy and matter continually flow, as demonstrated by the pupil's ability to:

(1) Explain that the systems of the Earth have two major internal sources of energy, decay of radioactive isotopes and gravitational energy, and one major external source, the sun, all of which create heat, and link these respectively to their major effect;

(2) Observe and describe convection currents formed by heating water in a container;

(3) Explain, using diagrams and citing first-hand observations, how uneven heating of the surface of the Earth from the sun forms convection currents within the atmosphere and ocean, producing wind and ocean currents that are modified by the rotation of the Earth;

(4) Investigate the unusual ability of water to dissolve a wide range of substances and explain, using diagrams and citing first-hand observations, how water dissolves minerals and gases as it passes through the water cycle and carries them to oceans and lakes;

(5) Describe, using diagrams or multimedia presentations, how global climate is determined primarily by the conversion of light and ultraviolet energy to infrared radiation at and near the surface of the Earth;

(6) Describe how relatively small changes in solar output may have contributed to large changes in the climate of the Earth in the past, for example, ice ages and interglacial periods;

(7) Explain how large-scale, long-term equilibrium can accommodate small-scale changes, for example:

(I) A relatively small disruption such as a fire, landslide or flood of a large ecosystem may disturb patterns such as food webs and cycles of matter found in that ecosystem, but over time new patterns may form or old patterns may re-establish; and

(II) A regional disruption of climate, for example, El Niño, may cause global changes in weather, but it may not have a significant impact on climate over long periods of time;

(8) Explain, using diagrams or animated multimedia presentations, the global system of the cycles of rocks, carbon and nitrogen, including living and nonliving components of these cycles as appropriate;

(9) Describe the model of the greenhouse effect, including a list of the various gases, which impede the transfer of long-wave radiation from the Earth into space;

(10) Explain that the theory of global warming is based on observations subject to multiple interpretations and predictions and that the theory is less certain than the model of the greenhouse effect, which is one component of the theory of global warming, but which is based on reproducible laboratory data; and

(11) Model, using multimedia software or other methods, and explain how the energy that propels the lithosphere plates of the Earth is predominantly a result of nuclear processes deep in the Earth.

(e) Understand that the Earth is part of a planetary system within the Milky Way Galaxy, which is part of the known universe, as demonstrated by the pupil's ability to:

(1) Investigate, using print, multimedia or Internet resources, and compare and contrast the Earth's atmosphere, water, temperature and composition with those conditions on other planets;

(2) Explain, using print or multimedia software, how most objects in the solar system are in regular and predictable motion, and relate that motion to such phenomena as the day, the year, phases of the moon and eclipses;

(3) Explain that stars produce energy and elements heavier than hydrogen from nuclear reactions;

(4) Estimate the age of the universe as ten billion years and cite supporting scientific evidence;

(5) Describe how increasingly sophisticated technology, such as mathematical models and computer simulations, is used to learn about the universe; and

(6) Explain that the physical laws, such as the laws of Newton, Kepler, thermodynamics, relativity and quantum physics, appear to apply to all bodies in the universe.

4. For the area of environmental sciences:

(a) Understand that ecosystems display patterns of organization, change and stability as a result of the interactions and interdependencies among the life forms and the physical components of the Earth, as demonstrated by the pupil's ability to:

(1) Investigate and describe, using specific examples, how changes in an ecosystem may affect biodiversity and contribute to an ecosystem's stability or instability;

(2) Explain how an ecosystem may change or remain the same in response to different kinds of influences;

(3) Contrast the immediate and long-term effects of a disaster, such as a flood or fire, with those produced by a change in climate or introduction of a new species;

(4) Interpret a food web showing how materials and energy are cycled through ecosystems; and

(5) Compare and contrast the geologic, hydrologic, climatic and biological characteristics of the principal bioregions of the State of Nevada, for example, northern Nevada's cold desert and southern Nevada's warm desert.

(b) Understand that natural resources include renewable and non-renewable materials and energy, that all organisms, including humans, use resources to maintain and improve their

existence and that the use of resources can have positive and negative consequences, as demonstrated by the pupil's ability to:

(1) Investigate, using print, multimedia or the Internet, the positive and negative consequences of changing the way in which the nation as a whole and individuals use a natural resource, for example:

(I) Switching from the use of fossil fuels to the use of solar power may reduce air pollution, but would likely involve the extraction and use of materials from the Earth to make solar apparatus; and

(II) Recycling aluminum cans reduces the energy involved in extracting aluminum ore, but requires changing personal habits and creating new systems for recycling;

(2) Investigate and describe the various processes involved in obtaining, using and recycling a specific class of materials such as wood products, minerals or plastics and explain the environmental implications;

(3) Investigate, using print, multimedia or Internet resources, and describe the career opportunities associated with the study, exploration, extraction, use, protection and restoration of natural resources;

(4) Analyze and describe the limitations of the ability of the Earth to respond to several different kinds of stresses produced by human or natural activities, for example:

(I) Excessive rates of removal of groundwater may destroy an aquifer's ability to recharge;

(II) Channelization of mature rivers can change capacity for bioremediation by reducing the amount of wetland or marsh area the water normally passes through; and

(III) Forest fires in marginally arable areas can, over the short or long term, reduce soil stability and increase erosion; and

(5) Analyze and evaluate, with specific examples, the effects that changes in human populations have caused, such as:

(I) The depletion of resources and environmental degradation when a population increases; and

(II) The positive and negative changes in ecosystems when populations migrate.

(c) Understand that humans have the unique ability to change personal and societal behavior based on ethical considerations regarding other organisms, the planet as a whole and future generations, as demonstrated by the pupil's ability to:

(1) Analyze the energy condition, conservation efforts and societal behavior patterns of the United States;

(2) Discuss how human actions may impact the equilibrium of global systems;

(3) Select a representative example and show how there can be scientific uncertainty regarding an environmental issue due to its complexity or the length of time required to ascertain effects; and

(4) Provide examples of global actions that may affect the environment or economy of the State of Nevada and the impact of related trade-offs.

5. For the area of the nature and history of science:

(a) Understand that humans have the unique ability to change personal and societal behavior based on ethical considerations regarding other organisms, the planet as a whole and future generations, as demonstrated by the pupil's ability to:

(1) Demonstrate that scientific knowledge uses a process of critique and consensus, for example, communicating methods and procedures used in scientific investigations to peers and teachers;

(2) Investigate and explain that public policy impacts the allocation of money available for research, for example, nuclear research, cancer research and acquired immune deficiency syndrome (AIDS) research;

(3) Research and explain how a scientific innovation that was originally challenged is now widely accepted, such as the sun-centered model of the solar system;

(4) Explain, with an appropriate example, that scientists work with others to resolve differences in interpretation of observations;

(5) Provide examples of technological problems that create a demand for new scientific knowledge and new technologies which make it possible for scientists to extend their research in new ways or to undertake entirely new lines;

(6) Provide examples of scientific knowledge that is built on previous information to explain that entire theories are rarely completely discarded in favor of new ones, for example, the Greek view of the atom versus the quantum mechanical view; and

(7) Provide examples of ethical scientific policies and the reasons for those policies.

(b) Understand that many decisions require reasoning and critical consideration of scientific evidence, as demonstrated by the pupil's ability to:

(1) Evaluate how the validity of the scientific techniques used, for example, sampling procedures, affect the credibility of the information obtained in a

specific kind of scientific investigation such as a controlled experiment, field work or secondary research;

(2) Develop and present an analysis of costs, benefits and risks that includes all major factors in a decision-making situation, for example, creating a man-made lake to enhance a new subdivision;

(3) Identify and accurately describe examples of systems that are quantitatively different from the components which comprise them, such as:

(I) How populations differ from individuals;

(II) How a cardiac system differs from its individual cells;

(III) How the features of a carburetor are unique yet the carburetor functions in an engine system; or

(IV) The role of a raindrop in the water cycle; and

(4) Compare and contrast a scientific law, theory, rule and hypothesis and explain the limits of generalizations, assumptions, analogies and models by relating and applying each term to a specific concept in science.

(c) Understand that a variety of models can be used to describe or predict things and events, as demonstrated by the pupil's ability to:

(1) Use mathematical symbols and formulas for expression, for example, the universal gas law or Newton's Laws of Motion;

(2) Use models to identify and predict relationships of cause and effect, for example, the effect of temperature on the volume of a gas or the effect of the level of carbon dioxide on the greenhouse effect;

(3) Identify and describe how systems are often different from their components, using an example such as an aquarium or automobiles;

(4) Compare groups of data, taking into account both percentages and actual numbers;

(5) Identify types of hazards, such as transportation of chemicals on highways or railways, earthquakes or drought, and choose one example to estimate impacts such as fire or explosion or to estimate consequences of exposure to a hazard such as illness, death, economic loss of property, or loss of livelihood; and

(6) Provide examples of ways to reduce or eliminate risks, such as laws, planning and zoning, or safety precautions.

(d) Understand that science is an active process of systematically examining the natural world, as demonstrated by the pupil's ability to:

(1) Clearly demonstrate, through written or oral work, curiosity, honesty and skepticism by asking questions, not changing data, reasonably accounting for discrepant data and critically evaluating false or controversial findings;

(2) Repeat experiments for statistical analysis to produce conclusions that are well-supported; and

(3) Given a common phenomenon, generate multiple explanations and describe which explanation is the most logical.

(e) Understand that a variety of methods of communication may be used to share scientific information, as demonstrated by the pupil's ability to:

(1) Analyze experimental procedures and suggest appropriate revisions for improvement;

(2) Incorporate the use of tables, charts and graphs to effectively make arguments and claims in oral and written presentations; and

(3) Discuss scientific topics by restating or summarizing accurately what others have said, asking for clarification or elaboration, expressing alternative positions and making use of available print, Internet and multimedia resources.

6. For the area of scientific inquiry, processes and skills:

(a) Understand that scientific inquiry is enhanced by and often communicated through the use of mathematics, as demonstrated by the pupil's ability to:

(1) Determine the relationship between variables in an investigation, for example, direct, inverse or square;

(2) Use a pre-selected algebraic relationship to calculate the answer to a problem, for example, given density = mass ÷ volume, calculate one of the three variables given the values of the other two;

(3) Identify what the correct order of magnitude would be for an answer to a specific problem;

(4) Use derived quantities, ratios, proportions and constants to solve appropriate problems;

(5) Provide an explanation or analysis of why a calculation does not agree with the expected result, such as the calculation of percent accuracy and class precision; and

(6) Select samples by a random system to avoid bias.

(b) Appropriately and safely apply the tools and techniques of scientific inquiry, as demonstrated by the pupil's ability to:

(1) Consistently demonstrate personal responsibility for using safety equipment and observing all safety standards;

(2) Consistently follow the instructions given by the teacher on the proper handling, storage and disposal of chemicals;

(3) Inspect, manipulate and describe the functions of various parts of technical and scientific equipment;

(4) Maintain a satisfactory record of procedures, data analyses, decisions and conclusions drawn from scientific investigations;

(5) Write procedures for the investigation of delegated or original scientific problems that are comprehensible; and

(6) Design, carry out and report on a scientific investigation.