Pass the TExES Core Subjects EC-6

FOR TEXAS TEACHERS
A test prep program for the TExES Core Subjects exam #291 for grades EC-6.

Second Edition

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EXCELLENT STUDY CONTENT,
WORKSHEETS, EXERCISES, AND
INTERACTIVE STUDY MODULE!

Also available from
Ed Publishing:
Pass the TExES Core Subjects 4-8
Subject Test I (801):
English Language Arts and Reading and the Science of Teaching Reading

Competencies 1-13

28% of the test
1. Oral Language

Key Descriptors

- Knows and teachers basic linguistic concepts, and the developmental stages in the acquisition of oral language, and recognizes that individual variations occur within and across languages, in accordance with the Science of Teaching Reading (STR).
- Plans and implements systematic oral language instruction based on student assessments.
- Recognized when speech or language delays or differences require evaluations, help, or interventions.
- Designs a variety of one-on-one and group activities to build on students’ current oral language skills.
- Selects and uses instructional materials and strategies that promote students’ oral language development in accordance with the STR.
- Understands relationships between oral language and literacy development.
- Uses instructional strategies, materials, activities and models to strengthen students’ oral vocabulary and narrative skills in spoken language for a variety of contexts.
- Teaches students how to evaluate the content and effectiveness of their own spoken messages and the messages of others.
- Recognizes the interrelationships between oral language and the other components of reading, in accordance with the STR.
- Uses appropriate technologies to develop students’ oral communication skills.

Key Words:

- Phonology
- Morphology
- Syntax
- Lexicon
- Semantics
- Discourse
- Pragmatics

English Language Proficiency Standards (ELPS) relating to listening and speaking

ELA Texas Essential Knowledge and Skills (TEKS) relating to listening and speaking

Linguistic Environment
1. Oral Language

Competency 1:
The teacher understands the importance of oral language, knows the developmental processes of oral language, and provides children with varied opportunities to develop listening and speaking skills.

A. LANGUAGE CONCEPTS

Phonology – Phonology (root word “phon” = sound) is the study of sounds.

Phonemes – The smallest part of spoken language that makes a difference in the meaning of words (Examples: Mop – Top, Cat – Hat)

Phonological Awareness is the ability to hear and manipulate sounds and sound chunks (the overarching category). Phonemic Awareness is the ability to hear and manipulate INDIVIDUAL sounds (a sub-category of phonological awareness).

Phonological and Phonemic Awareness of English phonemes are CRITICAL to reading and language success.

Example: Student: I don’t know this word.
Teacher: Sound it out…

Meaning – Use what you know about sounds and the letters that make the sounds to figure out the new word.

If the student lacks the ability to hear the sounds, the student will NOT be able to decode the new word.

Some sounds are not present in all languages, and some sounds are represented differently in different languages. (For example, some children may not be able to distinguish between the sounds in “lice” and “rice”.) Awareness of these differences and the struggles they cause for learners will help teachers plan instruction that builds students’ knowledge of English phonemes.

Phonological Awareness involves several categories and, in English, develops in a specific order, distinguishing and manipulating sounds from chunks of sound to individual sounds.

1. When children first learn to hear sounds, they begin by hearing “chunks” of sounds.
2. This progresses as they learn to take apart words into beginning sound (onset) and “word family” (rime). (See additional explanation below.)
3. Finally, children learn to hear individual sounds (phonemes) and to play with these sounds, or manipulate them.

IMPORTANT:
Teachers must understand the developmental stages of phonological awareness (what they are) as well as their progression (the order in which they develop), so they can:
• Determine where a child is in their phonological development
• Plan activities that help them build to the next level

1. Working with Words and Word “Chunks”

• Segmenting Words in Sentences - breaking sentences into individual words, usually using claps or stomps. Example: “Clifford” (one clap) “ate” (one clap) “pizza” (one clap)

• Segmenting Words into Syllables - clapping and breaking words into smaller parts that include a vowel.

• Segmenting Compound Words - breaking compound words into the smaller words from which they are built.

continued
1. Oral Language, cont’d.

2. Working with Onsets and Rimes
   - Distinguishing onsets and rimes - onsets are the sounds in a syllable that come before the vowel; rimes are the vowels and everything else
   **Example:**
   - Mop – Onset /m/, Rime /op/
   - Flop – Onset /fl/, Rime /op/
   - Stick – Onset /st/, Rime /ick/
   - Creating rhymes using onsets and rimes

   **NOTE** – These activities must be relevant and developmentally appropriate. Older students will not engage with nursery rhymes; instead creating poetry, word sorts, and raps using rhyming words will encourage participation from students in grades 4-8.

3. Working with Individual Phonemes
   Phonemic awareness - the ability to hear AND manipulate the sound that is spoken

According to the National Reading Panel, there are eight types of phonemic awareness activities. Teachers should only introduce and practice two or three activities at the same time. For each activity, start with initial consonant sounds, then work with ending consonant sounds, and finish with medial vowel sounds. Allow students to master beginning sounds before moving to ending sounds, etc.

- These activities should be a **planned** part of your everyday instruction.
- They do not take much time, and should be practiced in the form of discussion, collaboration, or games.
- In the upper grades, phonemic activities fit well into word study, vocabulary lessons, and spelling.
- Teachers should assess students’ phonemic skills regularly, and plan instruction that meets students’ individual needs.
- Assessment must be done 1:1 (because in a group, it is difficult to determine each child’s ability and needs).

### The Eight Phonemic Awareness Activities

1. **Isolation** - Students hear individual sounds in words.
   - Teacher: What’s the first sound you hear in “top”?
   - Students: The first sound is /t/.
   - Teacher: What is the last sound you hear?
   - Students: The last sound is /p/.

2. **Identity** - Students hear and identify the same sound in different words.
   - Teacher: What sound is the same in teacher, table, and tree?
   - Students: The beginning sound, /t/.

3. **Categorization** - Students identify which word is different in a list of words, based on sounds.
   - Teacher: Which word doesn’t belong – cat, king or face?
   - Students: Face doesn’t belong because it doesn’t start with /k/.

The two activities that help the kids the most are **BLENDING** and **SEGMENTING**. These should be practiced and reviewed regularly.
1. Oral Language, cont’d.

4. **Blending** – Students put sounds together to make a word.
   Teacher: What words is /k/ /a/ /t/?
   Students: /k/ /a/ /t/ is cat!

5. **Segmentation** – Students break words into their individual sounds and/or count the number of sounds in a word. It is the opposite of blending.
   Teacher: How many sounds are in “fan”?
   Students: /f/ /a/ /n/, three sounds.

6. **Deletion** – Students remove a sound from a word and identify what remains.
   Teacher: What word is clap without /k/?
   Students: Clap without /k/ is “lap”.

7. **Addition** – Students create a new word by adding a sound.
   Teacher: What word do you have when you add /s/ to the beginning of “top”?
   Students: Stop!

8. **Substitution** – Students change one sound in a word to a different sound and identify the new word.
   Teacher: I’m thinking of a word that sounds like man but starts with /r/. What’s my word?
   Students: Ran!

**Semantics** - Relating to the meaning of words, groups of words, signs, symbols and phrases.

Semantics is critical to language acquisition. Semantics studies how meaning is built, understood, deciphered and explained, and includes topics such as:

- how word meanings change over time
- how meaning is changed by the addition or deletion of morphemes
- how words may work together to form a single idea (“drop off”, “turn into”) the connotations, or variation of meanings attached to similar words (tired, sleepy; angry, furious)
- similes and metaphors (sings like a bird, sharp as a tack)
- idioms (raining cats and dogs, hungry as a horse)

**Morphology** – Morphology (root word “morph” = change) is the study of how the meaning of a word is changed when a morpheme (in English, root words, prefixes and suffixes) is added.

**Morpheme** – Morphemes are the smallest unit of meaning in a language; a part that changes the meaning.

**Examples:**
- **-ed** happened in the past, such as talk
  - > talked
- **-ing** is happening now, such as fly
  - > flying
- **re-** again, such as visit -> revisit
- **pre-** before, such as view -> preview
- **spect** to look (root word)

**Discourse** - Discourse is a conversation or dialogue between two people. It can also relate to the jargon and vocabulary of a specific group of people such as doctors or teachers.

**Pragmatics** - Pragmatics is the way meaning is implied by context and expressions. For example, “She’s a real genius!” may mean “She’s extremely smart”, or “She’s not very smart”, continued
1. Oral Language, cont’d.

depending on the conversation or writing that surrounds the sentence.

B. TEKS FOR ORAL LANGUAGE

Texas Essential Knowledge and Skills (TEKS)

Listening
- Determine reasons for listening (such as to get information or solve problems)
- Listen critically to interpret and evaluate
- Listen responsively to stories and texts
- Identify musical elements of language (such as rhymes and repeated sounds)
- Listen and speak to share and experience culture
- Learn and use new vocabulary
- Listen to enjoy spoken language

Speaking
- Respond appropriately and courteously
- Participate in rhymes, songs, conversations, and discussions
- Distinguish and produce sounds in English
- Infer meaning using visuals and actions
- Adapt spoken language to audience and setting
- Gain increasing control of grammar when speaking

C. TYPES OF VOCABULARY AND RELATIONSHIPS

There are four types of interrelated vocabularies that we all use when we communicate. They typically develop in the listed order, and build upon each other.

<table>
<thead>
<tr>
<th>Listening vocabulary</th>
<th>Speaking vocabulary</th>
<th>Reading vocabulary</th>
<th>Writing vocabulary</th>
</tr>
</thead>
</table>

Gaps or weaknesses in one area yield gaps and weaknesses in other areas.

Listening vocabulary - the words we need to know to understand what we hear

Speaking vocabulary - the words we use when we speak

Reading vocabulary - the words we need to know to understand what we read

Writing vocabulary - the words we use in writing

Types of Vocabulary

Gaps in any area affect those that build on it.

- Teaching ELA requires use and development of all four areas. Encourage students to BUILD and USE their vocabularies.
- Students may need lesson adaptations (such as bilingual books, reduced writing assignments, etc.) to serve their individual needs.

D. DEVELOPING ORAL LANGUAGE PROFICIENCY

Language Acquisition – the process of “picking up” or acquiring a new language

- Develops similarly for both first language and second
- Language is built by a desire to communicate
- Differs from language that is taught

To develop oral language proficiency, learners should have:

• opportunities to acquire and use language (let students talk, teach students to listen)
• a desire to learn and use language
2. **Phonological and Phonemic Awareness**

Key Descriptors

Key Words:

Onsets and Rimes
Phonemes
Isolation
Identity
Categorization
Blending
Segmenting
Addition
Deletion
Substitution

**NOTE:** Refer to the lettered descriptors under each Competency in the ETS/SBEC study material (in the back of this manual). Analyze each descriptor, and synthesize it down to a paraphrase that is meaningful to you, using no more than 5 words. List those phrases in order on the lines above. It will help to letter the lines above. When complete, record them again on Worksheet 4 in Appendix I.

<table>
<thead>
<tr>
<th><strong>DESCRIPTOR HIGHLIGHTS</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>- Understands phonological and phonemic awareness and typical patterns of development.</td>
</tr>
<tr>
<td>- Understands differences in developmental pattern and adjusts instruction meet students’ needs, particularly the needs of English Language Learners (ELLs).</td>
</tr>
<tr>
<td>- Plans instruction based on formal and informal assessment.</td>
</tr>
<tr>
<td>- Uses learning games and materials to build phonological awareness.</td>
</tr>
<tr>
<td>- Builds teamwork to help each child grow, connecting with families and other school professionals</td>
</tr>
<tr>
<td>- Recognized the interrelationships between phonological and phonemic awareness and the other components of reading in accordance with the STR (Science of Teaching Reading).</td>
</tr>
</tbody>
</table>
2. **Phonological and Phonemic Awareness**

**Competency 2:**
The teacher understands phonological and phonemic awareness and employs a variety of approaches to help students develop phonological and phonemic awareness.

**A. LANGUAGE CONCEPTS**

**Phonology** – Phonology (root word “phon” = sound) is the study of sounds.

**Phonemes** – The smallest part of spoken language that makes a difference in the meaning of words (Examples: Mop – Top, Cat – Hat)

These two terms are often used interchangeably, but they are not the same thing. Phonological Awareness is the ability to hear and manipulate sounds and sound chunks (the over arching category). Phonemic Awareness is the ability to hear and manipulate individual sounds (a sub-category of phonological awareness).

**Phonological and Phonemic Awareness** of English phonemes are critical to reading and language success.

*Student: I don't know this word.*
*Teacher: Sound it out…*

**Meaning** – Use what you know about sounds and the letters that make the sounds to figure out the new word.

If the student lacks the ability to hear the sounds, the student will NOT be able to decode the new word.

Since phonological awareness is necessary for spelling, students who lack phonological skills will also have challenges with spelling.

If a student has trouble spelling, the teacher must revisit phonological awareness.

Teachers must examine spelling tests to determine not only whether the child knows the specific tested words, but also to assess the child’s phonological skills.

Some sounds are not present in all languages, and some sounds are represented differently in different languages. (For example, some children may not be able to distinguish between the sounds in “lice” and “rice”.) Awareness of these differences and the struggles they cause for learners will help teachers plan instruction that builds students’ knowledge of English phonemes.

**Graphemes** – Written letter(s) that represent a spoken sound. For example, a student writes the letter “B” when they hear the sound /b/.

There is no writing in phonological or Phonemic Awareness. Graphemes come next, during phonics (where letters and sounds connect). If a question asks about phonemic or phonological awareness, the correct answer will relate to sounds, not writing.

**Phonics** - Phonics is the understanding that there is a predictable relationship between phonemes (the sounds of spoken language) and graphemes (the letters and spellings that continued
represent those sounds in written language). When letters and sounds come together, the student is developing phonics skills.

**B. DEVELOPMENTAL ORDER OF PHONOLOGICAL AWARENESS**

Phonological Awareness involves several categories and, in English, develops in a specific order, distinguishing and manipulating sounds from chunks of sound to individual sounds.

**Phonological Awareness**

<table>
<thead>
<tr>
<th></th>
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</thead>
<tbody>
<tr>
<td>Words in a sentence</td>
<td>Dividing words into onsets and rimes</td>
<td>Isolation</td>
</tr>
<tr>
<td>Syllables</td>
<td>Creating rhymes using onsets and rimes</td>
<td>Identity</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Blending and Segmenting</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Addition and Deletion</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Substitution</td>
</tr>
</tbody>
</table>

**IMPORTANT:**
Test questions will require you to identify where a child is on the chart above, and either determine what they have already mastered, or determine what they need to work on next.

Teachers must understand the developmental stages of phonological awareness (what they are) as well as their progression (the order in which they develop), so they can:

- Determine where a child is in their phonological development.
- Plan activities that help them build to the next level.

**1. Working with Words and Word “Chunks”**

- Segmenting Words in Sentences – breaking sentences into individual words, usually using claps or stomps.  
  **Example** – “Clifford” (one clap) “ate” (one clap) “pizza” (one clap)
- Segmenting Words into Syllables – clapping and breaking words into smaller parts that include a vowel
- Segmenting Compound Words – breaking compound words into the smaller words from which they are built

**2. Working with Onsets and Rimes**

- Distinguishing onsets and rimes – onsets are the sounds in a syllable that come before the vowel; rimes are the vowel and everything else
2. Phonological and Phonemic Awareness, cont'd.

**Example:** Mop – Onset /m/, Rime /op/
Flop – Onset /fl/, Rime /op/
Stick – Onset /st/, Rime /ick/

If a teacher is playing a game with her children in which they change beginning sounds in words, she is working with onsets and rimes.

**Example:** “The farmer in the dell…” becomes “The farmer in the bell…” then “The farmer in the pell…” (nonsense words are fine for this purpose)

Also, if a teacher wants to create an onset and rime activity, he should select words that have many rhyming possibilities.

**Example:** “Stamp” would be a better word choice than “six”.

- Creating rhymes using onsets and rimes

**NOTE** – These activities must be relevant and developmentally appropriate. Older students will not engage with nursery rhymes; instead creating poetry, word sorts, and raps using rhyming words will encourage participation from students in grades 4-8.

3. Working with Individual Phonemes

Phonemic awareness - the ability to hear and manipulate the sound that is spoken

According to the National Reading Panel, there are eight types of phonemic awareness activities. Teachers should only introduce and practice two or three activities at the same time. For each activity, start with initial consonant sounds, then work with ending consonant sounds, and finish with medial vowel sounds. Allow students to master beginning sounds before moving to ending sounds, etc.

- These activities should be a planned part of your everyday instruction.
- They do not take much time, and should be practiced in the form of discussion, collaboration, or games.
- In the upper grades, phonemic activities fit well into word study, vocabulary lessons, and spelling.
- Teachers should assess students’ phonemic skills regularly, and plan instruction that meets students’ individual needs.
- Assessment must be done 1:1 (because in a group, it is difficult to determine each child’s ability and needs)

**IMPORTANT NOTE:** To be successful on this test, you must know the order in which each activity develops and what each activity looks like. You will have to identify where a child is from a set of evidence, test results, or observations, and decide what they already know or what they need to work on. Many questions focus on these skills.

The Eight Phonemic Awareness Activities

- **Isolation** - Students hear individual sounds in words.
  Teacher: What’s the first sound you hear in “top”?
  Students: The first sound is /t/.
  Teacher: What is the last sound you hear?
  Students: The last sound is /p/.

- **Identity** - Students hear and identify the same sound in different words.
  Teacher: What sound is the same in teacher, table, and tree?
  Students: The beginning sound, /t/.

- **Categorization** - Students identify which word is different in a list of words, based on sounds.

continued
8. Vocabulary Development

Competency 8:
The teacher knows the importance of vocabulary development and applies that knowledge to teach reading, listening, speaking and writing.

VOCABULARY DEFINED
Vocabulary, words we must know orally and read in print to communicate effectively, plays an important role in learning to read:

- As beginning readers, children use the words they have heard to make sense of the words they see in print.
- Beginning readers have a much more difficult time reading words that are not already part of their oral vocabulary.
- Readers cannot understand what they are reading without knowing what most of the words mean.
- Readers must know what most of the words mean before they can understand what they reading.
- Readers use their oral vocabulary to make sense of the words they see in print.
- As children learn to read more advanced texts, they must learn the meaning of new words that are not part of their oral vocabulary.

A. EXPLICIT, SYSTEMATIC INSTRUCTION
Vocabulary is learned systematically (explicit) and must be taught simple-to-complex, or in stages so that knowledge builds upon and relates to prior knowledge. There are four interrelated types of vocabulary that develop and build upon each other:

1. Listening vocabulary—words we need to know in order to understand what we hear
2. Speaking vocabulary—words we use when we speak
3. Reading vocabulary—words we need to know to understand what we read
4. Writing vocabulary—words we use when writing

A well-written blueprint for teaching vocabulary includes students’ oral and reading vocabularies. First, for new learners, it introduces letters of the alphabet in random order:

- 4-6 frequently used consonants (M, S, L, N, R)
- 2 short vowels (in this order: a, o, u)
- Then, the remaining consonants and vowels

As students grow, their vocabulary abilities should match levels on the Phonological Awareness chart. Students’ skills develop in predictable orders and are needed to increase their vocabularies. These skills should be assessed by mid-point in kindergarten and in a 1:1 setting. Any gaps between areas affect students’ learning during skill levels.

continued
Finally, use differentiated, explicit activities to target and build students’ vocabularies so that they may learn to communicate effectively:

- Language and sound games (Bingo, Charades, Jeopardy, Memory)
- Informal interactions
- Onsets
- Rhymes and rhyming books
- Plays
- Skits
- Sponge (short) activities

Use vocabulary across-curriculum so students hear and use new words. Most importantly, involve community and family members in helping students practice vocabulary skills!

B. DIRECT AND INDIRECT METHODS OF TEACHING

<table>
<thead>
<tr>
<th>Direct</th>
<th>Indirect</th>
</tr>
</thead>
<tbody>
<tr>
<td>Explicitly, systematically taught</td>
<td>Daily engagement in oral language</td>
</tr>
<tr>
<td>Teacher led</td>
<td>Student led</td>
</tr>
<tr>
<td>Individual words learned; word analysis/decoding/phonics</td>
<td>Listen to adults read to them</td>
</tr>
<tr>
<td>Word Study: Phonics, word structure, meaning, usage, tenses, morphology</td>
<td>Read extensively on their own</td>
</tr>
<tr>
<td>Examples: bubble/graphic/semantic maps, connotation/denotation, demonstrations, illustrations, word sorts, word walls, Thesaurus, dictionary, glossary, Internet</td>
<td>Examples: discussions, dramatic play, language play, show and tell, storytelling, puppet show, pair interview, presentations, projects, reading forms of literary works</td>
</tr>
</tbody>
</table>

Never have students write words or word parts repetitiously, or over and over, or require them to memorize a list of words or words’ parts. Vocabulary, or word learning, should be fun!

C. USE A WIDE RANGE OF INSTRUCTIONAL MATERIALS

Present vocabulary development through various instructional materials, and provide strong contextual support for vocabulary development. Students should read varieties of instructional materials in search of vocabulary words:

- Content specific texts
- Expository texts
- Literature
- Magazines
- Newspapers
- Trade books
- Technology
Subject Test II (802): Mathematics

Competencies 1-6 (14-19)*

18% of the test

*NOTE: The numbering of these Competencies is based upon how we number them for the comprehensive Core Subjects EC-6 test prep program, and also how the SBEC numbers them for the separate Subject Tests. They are noted as such due to the design of our worksheets in the Appendices.
2 (15). Number Concepts and Operations

Key Descriptors:

- Understands relationships between number properties, operations, and algorithms for the four basic operations.
- Understands equivalency among representations of rational numbers.
- Selects appropriate representations of real numbers.
- Understands number theory.
- Understands a variety of models for representing numbers.

Key Words:
- Odd and Even Numbers
- Prime Numbers
- Composite Numbers
- Rational Numbers
- Algorithm
- Whole Numbers
- Natural Numbers
- Place Value
- Real Numbers
- Irrational Numbers
- Fractional Numbers

NOTE: Refer to the lettered descriptors under each Competency in the ETSSBEC study material (in the back of this manual). Analyze each descriptor, and synthesize it down to a paraphrase that is meaningful to you, using no more than 5 words. List those phrases in order on the lines above. It will help to letter the lines above. When complete, record them again on Worksheet 4 in Appendix I.
1. Number Concepts

• **Whole Numbers** are the counting numbers and 0 (0,1,2,3,4,5, and so on).

• **Place Value** - The location of a digit within a number determines its value. The following number shows 8 in the

<table>
<thead>
<tr>
<th>Ones place</th>
<th>8</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tens place</td>
<td>80</td>
</tr>
<tr>
<td>Hundreds place</td>
<td>800</td>
</tr>
<tr>
<td>Thousands place</td>
<td>8000</td>
</tr>
<tr>
<td>Ten Thousands place</td>
<td>80,000</td>
</tr>
<tr>
<td>Hundred Thousands place</td>
<td>800,000</td>
</tr>
<tr>
<td>Millions Place</td>
<td>8,000,000</td>
</tr>
</tbody>
</table>

• **Expanded Form** is the sum of a number's place values: \(1,729 = 1000 + 700 + 20 + 9\).

• **Rounding** means estimating the closest number to a given whole number, with all zeros to the right of the desired place value. **Examples:**
  
  17 rounded to the nearest ten is 20
  212 rounded to the nearest hundred is 200
  7895 rounded to the nearest thousand is 8000

2. Number Properties

• **Commutative Property** - Changing the order of numbers being added or multiplied gives the same answer (\(12 + 7\) gives the same answer as \(7 + 12\), and \(3 \times 9\) gives the same answer as \(9 \times 3\)).

• **Associative Property** - The grouping of the numbers in addition or multiplication does not change the answer, such as \((2 \times 4) \times 3 = 2 \times (4 \times 3)\).

• **Distributive Property** - Multiplication and division may be distributed over addition or subtraction. \(10 \times (50 + 3) = (10 \times 50) + (10 \times 3)\) and \((30-18) / 3 = 30/3 - 18/3\).
2 (15). Number Concepts and Operations, cont’d.

- **Zero Property of Addition** - Adding 0 to a number equals the original number \((43 + 0 = 43)\) and \((0 + 43 = 0)\).
- **Zero Property of Multiplication** - Multiplying a number by 0 equals 0 \((43 \times 0 = 0)\) and \((0 \times 43 = 0)\).

**B. DEMONSTRATING EQUIVALENCY**

Using concrete models means having objects, pictures, or diagrams to show how numbers are added, subtracted, multiplied, or divided can help young learners to visualize equivalency between numerical representations. A teacher who creates a hands-on activity where his students put 16 buttons into groups of 4 to show a division problem is using a concrete model. Tables and graphs are other ways to visually show relationships between math operations such as addition and subtraction or between number representations such as decimals to percents.
C. CLASSIFICATIONS OF REAL NUMBERS

Set of real numbers denoted by $\mathbb{R}$ contains all forms and structures of numbers used in mathematics. Real numbers can be classified in terms of accuracy, form, and value. A real number may be either rational or irrational; positive, negative or zero.

1. Classifications of Real Numbers in Terms of Accuracy

• Rational Numbers

A rational number is a real number that can be expressed as a ratio of integers $a/b$, where $a$ and $b$ are integers and $b \neq 0$. Decimals are either terminating or repeating for rational numbers.

$\frac{5}{2}$, $-10\frac{1}{4}$, $1.333...$, $4.234$ etc.

**Example.** Which of the numbers is rational?

a. $2.40$  b. $\frac{1}{7}$  c. $\pi$

**Answers:**

a. $2.40$ represents a fixed number of digits; therefore, this number is rational.

b. $\frac{1}{7} = 0.142857142857$. This number contains a repeating decimal part of $0.142857$, therefore it is a rational number.

c. $\pi = 3.14159265...$ The decimal does not begin to repeat from some point, so it is not a rational number.

• Irrational Numbers

Irrational numbers are not expressible as ratios of integers. Irrational numbers are always non-terminating and non-repeating.

Irrational numbers denoted by $\mathbb{I}$ contain numbers of the forms $\sqrt{5}$, $1.23476...$, $\sqrt{2}$, $e$, $\pi$, etc.

**Examples:** Classify each expression as rational or irrational. In order to proceed, convert each expression to decimal form.

a. $\sqrt{25}$

b. $\frac{4}{3}

c. $2.451451451$

d. $\frac{4}{5}$

e. $5.347658953...$

**Answers:**

a. $\sqrt{25} = 5.0$. 5.0 has a fixed repeating part of 0, thus $\sqrt{25}$ is a rational number.

b. $\frac{4}{3} = 1.3333...$. In this decimal expansion, there is not a part of the decimal that repeats; and it is non-terminating; thus, it is an irrational number.

**continued**
c. 2.451451451 contains a repeating part of 451; therefore it is a rational number. It can be written as the mixed fraction \( \frac{451}{999} \) or the improper fraction \( \frac{2449}{999} \), illustrating it is indeed a rational number.

d. \( \frac{4}{5} = 0.80 \). This value has a repeating part of 0, therefore, it is a rational number.

e. 5.347658953 has no repeating decimal part therefore, it is an irrational number.

2. Classification of Real Numbers in Terms of their Forms

Each real number can be expressed in either a decimal or fractional form.

- **Decimal Numbers** - Decimal numbers contain a decimal point that separates the place value of ones from tenths. They can also contain commas that underline other place values.
  
  **Examples:**
  
  a. 2,300.34  
  b. 0.4553  
  c. 444,456.09

  A decimal point is often used to indicate the number of significant figures. For example, 20g can be expressed as 20.00g. The magnitudes of both values are the same; they differ by the number of significant figures: the first has one; the second has four.

- **Fractional numbers** \( \frac{1}{5}, \frac{3}{4}, \frac{1}{5}, \frac{8}{2} \)

  Fractional numbers do not contain decimal points. They have a division bar either horizontal \( \frac{a}{b} \) or slashed \( a/b \). The number \( a \) is the numerator, and the number \( b \) is the denominator. A fraction is expressed as \( \frac{\text{Numerator}}{\text{Denominator}} \). A fractional form is not defined if the denominator is zero.

- **Converting a Decimal Number to a Fraction and a Fraction to a Decimal Number**

  To convert a decimal to a fraction identify the place value of each digit.

  a. 3.2   b. 2.004   c. 0.027

  **Answers:**

  a. \( 3.2 = 3 + \frac{2}{10} = \frac{32}{10} = \frac{16}{5} \)
  b. \( 2.004 = 2 + \frac{4}{1000} = \frac{2004}{1000} = \frac{501}{250} \)
  c. \( 0.027 = \frac{27}{1000} = \frac{27}{1000} \)

  **Examples:** Convert to decimal form and classify them as rational or irrational.

  a. \( 3\frac{1}{2} \)   b. \( \frac{23}{100} \)   c. \( -7\frac{34}{76} \)

  **Answers:** Using the algorithm for division we get:

  a. 3.5 Rational (5 is terminating and 0 repeats)  
  b. .230 Rational (0 repeats)  
  c. -7.447368421052632 Rational (terminating)

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Pass the TExES - Ed Publishing 128 Core Subjects - EC-6
2 (15). Number Concepts and Operations, cont’d.

- **Classification of Fractions**

Fractions can be classified as proper, improper, and a mixed number.

- \( \frac{a}{b} \) is called a **proper** fraction if \( a < b \).

**Examples:** \( \frac{1}{4}, \frac{5}{11} \)

Note: when converted to a decimal form, a proper fraction has zero as its place value for ones.

**Examples:** \( \frac{1}{4} = 0.25, \frac{5}{11} = 0.454 \)

- \( \frac{a}{b} \) is called an **improper** fraction if \( a > b \)

**Examples:** \( \frac{6}{4}, \frac{7}{2} \)

Note: Any whole number can be converted into an improper fraction.

**Example:** \( 2 = \frac{2}{1} \)

- \( \frac{a}{b} \) is called a **mixed number** because it contains a whole number and a proper fraction.

**Examples:** \( 2 \frac{2}{3}, -5 \frac{1}{7} \)

3. **Classification of Real Numbers in Terms of Their Values**

All real numbers can be placed on a number line and classified in terms of their values as: natural, whole, integers, rational, and irrational.
2 (15). Number Concepts and Operations, cont'd.

• Natural Numbers

Natural numbers, or counting numbers, are denoted by \( N \) where \( N = \{1, 2, 3, 4, \ldots \} \). The minimum value for a natural number is 1 and they increase in value by 1.

The set of natural numbers is infinite. Natural numbers are sometimes called positive or non-negative integers.

• Whole Numbers

Adding zero to the set of natural numbers produces a set of whole numbers denoted by \( W \) where \( W = \{0, 1, 2, 3, 4, \ldots \} \). The set of whole numbers is infinite.

• Integers

Whole numbers with their opposites generate a set of integers denoted by \( Z \) where \( Z = \{\ldots, -4, -3, -2, -1, 0, 1, 2, 3, 4, \ldots \} \). The set of integers is infinite and does not have maximum nor minimum values.

• Rational Numbers

Rational numbers, defined earlier in this section, contain numbers that can be converted into decimal forms that terminate or contain fixed repeated parts. Rational numbers are denoted by \( \mathbb{Q} \). Some examples of rational numbers in set \( \mathbb{Q} \) include: \(-10\), \(-1\), \(-1/2\), \(0\), \(3.4\), \(10\). Rational numbers can be placed on a number line and can be positive or negative.
Number Line Activities

- Irrational Numbers

If rational numbers are removed from the set of real numbers, irrational numbers will remain; \( \mathbb{I} = \mathbb{R} - \mathbb{Q} \). Irrational numbers were discussed earlier in this section.

4. Applications of Real Numbers: Decimals, Fractions, Percents, Roots, Power, Scientific Notation

a. Quantities Expressed in Decimal or Fractional Forms

Quantity can be expressed as a fraction or a decimal. A quantity properly described contains a magnitude and the unit.

**Examples:**
- Mass of 1/20 kilogram = 1/20 kg
- Speed of 60 miles per hour = 60 mi/h
- Time interval of 3.5 hours = 3.5 h

b. Percent and its Applications

Percent, or part out of 100, represents a ratio of part of a quantity with reference to the whole value.

**Example:** A class contains 25 students. If 20 students are present, express that in terms of percent.

**Answer:** Construct a ratio: \( \frac{\text{Part}}{\text{Whole Quantity}} = \frac{20}{25} \)

then multiply the ratio by 100: \( \frac{20}{25} \times 100 = 80 \), thus 80% of students are present.

*continued*
Subject Test III (803): Social Studies

Competencies 1-5 (20-24)*

16% of the test

*NOTE: The numbering of these Competencies is based upon how we number them for the comprehensive Core Subjects EC-6 test prep program, and also how the SBEC numbers them for the separate Subject Tests. They are noted as such due to the design of our worksheets in the Appendices.
2 (21). History

Competency 2 (21):
The teacher understands and applies knowledge of significant historical events and developments, multiple historical interpretations and ideas, and relationships between the past, the present, and the future as defined by the Texas Essential Knowledge and Skills (TEKS).

I. HISTORY
Texas teachers must be familiar with “historical points of reference,” which are briefly outlined below. Familiarize yourself with these points, paying careful attention to how each shaped our state and our government.

A. NATIVE AMERICANS
Texas teachers should be able to compare and contrast various Native American tribes throughout Texas and the Western Hemisphere. Below is a list of the prime attributes of each group.

a. Natives of the Western Hemisphere
The major Native American groups of the Western Hemisphere were the Incas, the Mayas, and the Aztecs. The Incan empire stretched from Ecuador to northern Chile. The Aztecs dominated northern Mexico, while the Mayans flourished in the rain forests of Guatemala. Their influence continues today; their positive achievements included the following:
• advanced agricultural methods
• tribute systems
• advanced communication systems
• skilled artisans
• highly specialized and stratified societies
• imperial administration
• schools

b. Natives of the United States
When the Europeans came to America, about 10 million Native Americans lived in all parts of the United States. All lived off the land and were
• hunters
• gatherers, or
• farmers.
They were resourceful in making tools and had advanced skills in
• horsemanship
• farming
• buffalo hunting, and
• the building of homes.

Many historians count the cooperative governing systems many nations had in place to be among their greatest contributions to modern society. In many parts of America, Native American tribes met on a regular basis to share news, methods, and culture, as well as to make cooperative governmental decisions. None had a system of writing nor did they have many scientific advances.

c. Texas Natives
Scientists believe that the earliest Texans arrived about 11,000 years ago, following herds of mammoth and mastodon. The earliest groups lived in the Gulf Coastal Plains (Caddo, Coahuiltecs, Karankawas) and were hunters, fishers, and farmers. The Plains nations (Tonkawa, Lipan Apache, Comanche, Kiowa) were mostly nomadic, skilled buffalo hunters. The most sedentary tribes (Pueblo, Jumano, Concho, Tigua) occupied the Mountains and Basins region. Contributions from these groups included:
• Caddo - built the first buildings in Texas - beehive shaped huts made
from wooden frames covered with grass or reeds; also known for advanced farming methods

- Karankawas - created dugout canoes, small ships carved from the trunks of trees to facilitate their nomadic lifestyle (dependent on fishing)
- Coahuiltecan - nomadic hunters and trappers, enslaved Cabeza de Vaca and other Spanish explorers
- Lipan Apaches and Comanche - buffalo hunters who tamed wild mustangs, becoming skilled horsemen
- Pueblo - built elaborate homes and cities using adobe (sun-dried mud) bricks

B. EUROPEAN EXPLORATION AND COLONIZATION

During the 15th and 16th centuries, Europe engaged in a strong push for exploration. England, Spain and France sent explorers to establish colonies in the Americas.

- The French claimed lands in Canada, around the Great Lakes, and all along the Mississippi River.
- Spain claimed territory that is now Texas, New Mexico, Arizona, California, Mexico, and Central and South America.
- England established colonies in the Caribbean, and thirteen colonies along the east coast of America.

Colonization had some clearly positive effects, creating communities and trade routes that facilitated cultural exchange. However, these were forged at the expense of the indigenous peoples of the area; their populations were ravaged by displacement, disease, warfare with the Europeans, and enslavement.

1. Reasons for European Exploration
- To locate a new passage to the Far East (for trade).
- To map uncharted areas.
- To find treasure (gold, silver, gems, artifacts).
- To claim new lands and set up colonies.
- To convert people to Christianity.

2. Significant Explorers

- Columbus (1492, 1493, 1498)
  - Led expeditions to South America for Spain.
  - Landed in South America.
  - Opened cultural exchange between the east and the west (Columbian exchange).

- De Pineda (1519)
  - Led first expedition into Texas.
  - Explored Gulf Coasts for Spain (Florida, Alabama, Louisiana, Texas, and Mexico).

- De Vaca (1527 -1535)
  - Part of a Spanish mission to claim land along the Gulf, he became stranded in Florida when his ships did not return from a supply run to Cuba.
  - Built rafts and skirted the coast, eventually wrecking near East Island, Louisiana; continued on foot with a slave called Esteban, eventually coming to Texas.
  - Encountered Caddo Indians near Houston; impressed with their sophistication and tales of wealth inland, he mapped and wrote about the area in detail, creating our first written record of America.
  - His tales of Cibola, a fabled city of gold, greatly influenced subsequent explorers including Coronado and De Soto.
Coronado (1540-1542)
- Sent by Spain to find fabled city of gold, reported by De Vaca.
- Traveled much of the Texas Panhandle.
- First Europeans to see Palo Duro Canyon.
- Went home empty handed.

La Salle (1682-1685) A French explorer
- Led expedition in 1682 from a French colony in Canada down the Mississippi River to the Gulf of Mexico, claiming land for France on both sides of the river.
- In 1684, led another expedition from France to start a colony at the mouth of the Mississippi River, sailed past the river and mistakenly landed in Texas.
- Built the first French colony in Texas, Fort St. Louis, near Galveston.

3. The Thirteen English Colonies
- In 1607, the first permanent English colony was established in Jamestown, Virginia. In less than six months, more than half of the settlers had died from disease, starvation, and attacks from Native Americans.
- In 1620, Pilgrims (religious dissidents) set up a strict, parochial colony of Puritans in Massachusetts, Plymouth colony.
- Roger Williams set up a colony in Rhode Island that advocated religious freedom for all, including Native Americans.
- William Penn established a colony for Quakers in Pennsylvania. The Quakers opposed violence, slavery, and war, and advocated religious tolerance for all people.

4. Important People
- William Bradford - Second governor of Plymouth colony. In 1621 he ordered the first Thanksgiving, sharing harvest with the Wampanoag Indians
- Roger Williams - Banished from Plymouth colony, advocated religious freedom, established Rhode Island colony.
- John Smith - Established trade relations with the Powhatan Indians; bargained for food for the starving Plymouth settlers.
- Pocahontas - Daughter of the Chief of the Powhatan Indians; convinced her father to spare John Smith and help the settlers.
- John Rolfe - Member of Jamestown, began tobacco industry in America; married Pocahontas and brought her to England ensuring peace with the Powhatan Indians.
- Squanto - A Pawtuxet Indian who taught the Plymouth Pilgrims how to hunt, fish, and grow crops, thereby saving the lives of many.

5. The Mayflower Compact
- An agreement written on the Mayflower, a ship which carried the Pilgrims to America.
- This agreement established the governing laws of the new colonies.

6. Missions, Presidios, and Early Towns
After La Salle built a French colony in Texas, Spain became worried about protecting their claims in Texas. They brought Franciscan monks to build missions - religious settlements in Texas. By 1740, there were more than 20 missions in Texas. Later they added forts called Presidios to protect the missions (and Spain’s territorial claims). Missions were built to:
- Solidify Spain’s territorial claims (primary purpose).
- Open and protect trade routes.
- Spread the Christian faith to the Native Americans.
- Provide a safe center for working and learning.
continued
C. THE FRENCH AND INDIAN WAR
(1754-1763)
This conflict, between British and French colonies, instigated issues between the colonists and England, which eventually led to the American Revolution. During the war, most Native American tribes sided with the French, fearing the British would take their ancestral homelands. The British won.

Causes of the War
• Britain and France were at war, causing conflict between their colonies in America.
• The British colonies wanted land owned by the French colonists - for fur trading.

Results of the War
• France lost the majority of its territory and power in North America.
• England’s land expanded to include all of the French lands east of the Mississippi River, except New Orleans, which became Spanish territory.
• Spain’s holdings expanded to include all of the French territory west of the Mississippi River, and New Orleans.
• England tightened its hold on the colonies, restricting freedom and levying large taxes to help offset the costs of the war.

D. THE AMERICAN REVOLUTION
(1776-1785)
By 1775, tensions were high between England and their American colonists. England had passed laws that prevented colonists from being elected to Parliament; at the same time, Parliament passed many laws that levied taxes on the colonists. Angry colonists called this “taxation without representation,” which became an instigation and a battle-cry for the revolt. For nine years, colonists fought the British with the aid of France. In 1781, British general Cornwallis surrendered to Washington after the Battle of Yorktown. The war officially ended with the Treaty of Paris in 1783.

Causes of the Revolution
• Progressively direct, internal taxes were levied against the colonists in order to provide support to mother England. In order to keep peace with the Native Americans, Parliament passed The Proclamation of 1763, a bill that said colonists could not settle west of the Appalachian Mountains. Settlers felt this was a local decision and the government should not interfere.
• In 1765, the Stamp Act was passed, which levied taxes against the colonists on almost everything printed on paper - legal documents, almanacs, diplomas, and playing cards. This law united the colonists against British rule, and resulted in many bloody demonstrations and riots.
• Parliament passed the Townshend Acts in 1767, which taxed glass, lead, paper, paint, and tea. The colonists refused to buy these items, so the tax was finally repealed on everything except tea.
• In 1768, 4,000 British soldiers were moved into Boston and the colonists were required to provide room and board to the soldiers. On March 5, 1770, several townsmen got into an argument and threw snowballs at a group of soldiers. The soldiers opened fire on the unarmed crowd, killing five colonists. This became a highly publicized story known as the Boston Massacre; it fueled the fires for colonial independence.
Causes of the War
- England and France were capturing U.S. ships and interfering with trade.
- The U.S. believed England was still interfering with the colonies, as well as providing weapons to the natives (so they could attack the colonies).
- The U.S. wanted to take new territories - Canada (Britain) and Florida (Spain).

Results of the War
- England recognized U.S. boundaries.
- American industry flourished because Americans had to make their own goods as opposed to relying on imports from England.
- The United States became recognized by other countries.

G. Westward Expansion
- After the Revolution, American territory increased due to an American belief known as “Manifest Destiny.” This belief encompassed the idea that America was destined by God to encompass the land from the east coast to the Pacific Ocean.
- Louisiana Purchase (1803) - Jefferson purchased French lands west of the Mississippi.
- Lewis and Clark Expedition (1804-1806) - Explorers sent to find a water route from the source of the Missouri River to the Pacific Ocean; mapped much of the Continental U.S., made trade relations with the Native Americans living there, and paved the way for westward expansion.
- Sacajawea - (1805) Shoshone Indian woman who served as a guide and translator for Lewis and Clark.
- Florida Purchase (1819) - Florida was purchased from Spain.
- The Trail of Tears and Resettlement of Native Americans (1830-1832) - removed Native Americans from their ancestral homes onto government reservations. Due to harsh traveling conditions and lack of supplies, many died during the journey.
- Texas joined the Union (1845) - including parts of New Mexico, Colorado, and Wyoming.
- Oregon Territory (1846) - Washington, Oregon, Idaho and most of Montana.
- Transportation during westward expansion:
  - Wagon trains - Settlers moving to new lands traveled by covered wagon
  - Stagecoach
  - The Pony Express
  - Canals
  - Railroads
- Mexican land acquisition from Mexican-American War (1848) - California, Arizona, Utah, Nevada.
- Mexico land purchase (1853) - the southern parts of New Mexico and Arizona.
- Homestead Act of 1862 - gave land to any settler who lived and farmed it for five years; instrumental in the settlement of central and western regions of the U.S.
- Alaska (1867) - purchased from Russia.
- Hawaii (1898) - annexed by the U.S.

1. Immigration Patterns and Diffusion
People came to Texas for many reasons:
- to make a better life
- inexpensive land
- democracy
- religious freedom

Major cultural groups in Texas:
- Old-stock Anglo-Americans
- Upper South/Southerners
- Lower South/Southerners
- Direct European (groups)
- Hispanic / Mexican-Americans
- African-Americans
- Native-Americans
2. **Culture, Settlement, and Diffusion**

Diffusion is the process by which an idea or innovation is transmitted from one individual or group to another across space - the way innovations and ideas travel through society. Texas is composed of distinct culture groups, each with its own way of life. The exchanges of cultural ideas and practices, as well as the physical properties of the land, have greatly influenced Texas, both in the past and the present.

H. **TEXAS REVOLUTION (1820-1840)**

1. **Important Events**
   - 1821 - Stephen F. Austin, the “Father of Texas,” brought white, American settlers to Texas.
   - 1830 - Mexico refused to allow any more U.S. settlers into the territory, creating tension and a cry for independence.
   - 1835 - The Texas Revolution began with the Battle of Gonzalez.
   - 1836 - The Texas Declaration of Independence was created and issued.
   - 1836 - The Battle of the Alamo; 5,000 Mexican soldiers attacked and killed 186 Texans (almost everyone there), including William B. Travis, David Crockett, and Jim Bowie.
   - 1836 - The Massacre at Goliad; 300-400 Texas soldiers are taken prisoner by the Mexican army. Later, the prisoners were paraded through the streets and killed.
   - 1836 - General Sam Houston defeated Mexican General Santa Anna at the Battle of San Jacinto.
   - 1836 - The Republic of Texas, an independent country, was formed and the Texas Constitution was written.
   - 1839 - Texas joined the United States.
   - 1845 - The new Texas Constitution was written.

2. **Important People**
   - Stephen F. Austin, “The Father of Texas” (because he brought settlers to Texas).
   - Sam Houston, first general of the Texas army, first President of the Republic of Texas.
   - Antonio Lopez de Santa Anna, arrogant Mexican general who led the assault against the Texas army, and later President of Mexico (1833).
   - William B. Travis, commander of the Alamo.
   - James Bowie and David Crockett, important statesmen who fought and died at the Alamo.

I. **THE MEXICAN WAR (1846-1848)**

After Texas joined the Union, conflicts continued with Mexico and Santa Anna. President Polk pushed to buy more Mexican lands (because of his strong belief in the Manifest Destiny). The U.S. won the war after taking over Mexico City, Mexico’s capital.

**Causes of the War**

- Mexico was against Texas joining the Union.
- Disputes regarding the southern border of Texas (U.S. claimed it was the Rio Grande, Mexico claimed it was the Nueces River, farther to the north).
- The U.S. wanted to own more land, which Mexico refused to sell.

**Results of the War**

- Mexico agreed that the southern border was the Rio Grande.
- Mexico sold the U.S. California, Nevada, Utah, and parts of Arizona, New Mexico, Colorado, and Wyoming
- U.S. size and power increased

continued
**Subject Test IV (804): Science**

**Competencies 1-18 (25-42)**

19% of the test

*NOTE: The numbering of these Competencies is based upon how we number them for the comprehensive Core Subjects EC-6 test prep program, and also how the SBEC numbers them for the separate Subject Tests. They are noted as such due to the design of our worksheets in the Appendices.*
1 (25). Safe and Proper Laboratory Processes

Key Descriptors:

- Safety should be the primary concern of the science teacher, with special attention to injuries, especially to eyes, and cuts from glass
- Understand and be familiar with all substances/materials in the lab, field, or work area
- Understand the proper handling of organisms and specimens
- Teacher should be familiar with and know how to properly use all science tools and measurement standards
- Teacher should be aware of and communicate to students the importance of communication of results, theories, and hypotheses in science study
- Teacher should understand and communicate the international system of measurement

Key Words:
Lab Safety
Proper Disposal
Precision
Accuracy
Error
Bias
Metric System
Inquiry-based Instruction

NOTE: Refer to the lettered descriptors under each Competency in the ETS/SBEC study material (in the back of this manual). Analyze each descriptor, and synthesize it down to a paraphrase that is meaningful to you, using no more than 5 words. List those phrases in order on the lines above. It will help to letter the lines above. When complete, record them again on Worksheet 4 in Appendix I.
1 (25). Safe and Proper Laboratory Processes

Competency 1 (25):
The teacher understands how to manage learning activities, tools, materials, equipment, and technologies to ensure the safety of all students.

A. KEEP A SAFE ENVIRONMENT
Because science involves hands-on activities with a variety of different substances both in and out of the classroom, safety rules must be taught and enforced. Again, developmental stages of children should be considered. Though students in grades EC through 6 should, as a general rule, avoid the use of harmful chemicals and open flames (such as Bunsen burners), injuries are still possible even while using common materials. Sand can get into eyes or students on a field investigation may be bitten by ants.

Students should know safety rules before any investigation begins. Though science investigations are fun, they can avoid injuries by making safety a priority in several areas. Here are some examples of science safety rules:

Injury Prevention for Students
• Work areas should be kept clean before, during and after an experiment is completed.
• Equipment must be returned to its proper place.
• Follow all directions exactly. If in doubt, ask your teacher for help!
• No running, pushing or horseplay in the lab.
• Immediately notify your teacher if you get cut or have another injury when performing an experiment.
• Wash your hands before and after each experiment.

Eye Protection
• Always wear safety goggles whenever you are working with anything that might get into your eyes.
• Never touch or rub your eyes or face during a science investigation.

Glassware
• Keep lids on bottles and containers when not in use.
• Never use broken or chipped glassware.

Additional Guidelines for the Teacher
• Students must never be left unsupervised with laboratory equipment.
• There should be no eating or drinking in the laboratory.
• The teacher must demand responsible behavior from all students.
• Very clear instructions must be given explaining any assignment using laboratory equipment or chemicals before students proceed with the assignment.
• Students should keep only what is necessary for the assignment on the bench top.
• Students must be told to inform the teacher if any problem arises during the assignment.
• Suitable clothing must be worn when completing a laboratory assignment.

B. UNDERSTAND APPROPRIATE HANDLING OF CHEMICALS, MATERIALS, SPECIMENS, AND EQUIPMENT
Chemicals
While noxious chemicals such as hydrochloric acid will not be used until middle and high school, elementary school students should still know and be familiar with procedures for using chemicals. Some EC-6 experiments may use substances such as vinegar or baking soda, which have the potential to cause injury or allergic reaction if not handled properly. Though common, these continued
substances should still be treated by the teacher and students as chemicals.

• Immediately notify your teacher if any chemical gets on your skin or clothing to find out what to do to clean it off.
• Never smell a chemical directly from the container. Wave your hand over the opening of the container and “waft” the fumes towards your nose.
• Never taste a chemical unless you are instructed by your teacher to do so.
• Never mix chemicals or perform tests without your teacher’s permission.

Animals

• Handle animals with care to avoid being bitten.
• If an animal bites you, report the bite to your teacher immediately.

In the Field

Some science activities can and should occur outside. Be sure you know of any students with allergies to ensure that proper precautions are taken against insect bites or any other irritants. Teachers should survey the area to be used ahead of time to check for dangers such as broken glass or dangerous tools left behind by workers.

• Be aware of your surroundings: avoid danger!
• Follow instructions carefully and stay on task.
• Stay in the assigned area and/or with your assigned partner.
• Report any injuries or stings immediately.

Materials

• Know the locations and operating procedures of all safety equipment; know where the fire alarm and the exits are located.
• Chemical waste must be disposed of properly. The teacher must be consulted before pouring any liquid down the drain. Insoluble materials are to be disposed of in the proper waste containers, not in the sink. Cracked or broken glass should be placed in the special container for “Broken Glass.”
• Students should never use broken glassware.
• The teacher should be in possession of MSDSs for chemicals used in the laboratory.
• Chemical containers should be carefully labeled and students instructed to read all labels carefully before handling material.
• Rules and regulations for the proper handling of material should be posted throughout the laboratory.

C. PROPER HANDLING OF ORGANISMS AND SPECIMENS

• The teacher should be familiar with safety guidelines such as NABT Guidelines for the Use of Live Animals, Working with DNA and Bacteria in Precollege Science Classrooms or other safety guidelines from organizations such as NIH, the American Chemical Society, Flinn Scientific, etc.
• The teacher should discuss safety procedures with students before the beginning of each laboratory assignment.

Teachers need a basic understanding of proper laboratory etiquette. Before beginning each laboratory assignment, instructors must discuss safety procedures with students; teachers must always be alert that students are following all safety rules and regulations.
D. TOOLS
Science is the study of the natural world, not by anyone in particular. It is important to realize that anyone can be a scientist, as long as there are questions that are being asked and a desire to learn about the world around you. Professional scientists can only make comments on what their senses can tell them about the world, but oftentimes human senses are limited. Therefore, scientists use tools to aid them in their research. There are some basic tools that all scientists should know about.

• Graduated Cylinder = This is a long container for measuring volume. Remember to always read the number which the bottom-most part of the meniscus is touching, while keeping your eye level with the meniscus.
• Balance or scale = This is used for measuring weight and determining mass. There are many different types of balances, such as mechanical balances, digital balances, and spring scales.
• Pipette = This is used to transfer a certain volume of liquid; again, there are different types of pipette.
• Microscope = A cornerstone of scientific laboratories. Used to view small objects; again, there are different types of microscopes, such as a compound light microscope, and a dissecting microscope.
• Bunsen burner = Creates a flame that is used for heating and sterilization.
• Test Tubes = Containers which hold liquid and in which chemicals can be mixed.
• Rulers

• Hot plates = Used to heat objects.
• Beakers and Flasks = Used to contain liquids.
• Computers
• Dissecting tools

E. MEASUREMENTS

• Precision = The ability to produce the same value or result; also can be thought of as the number of digits used to record a measurement or which a measuring device is capable of providing
• Accuracy = A measure of how close a measured value is to the true value.
• The bulls-eye analogy = To distinguish between precision and accuracy. Imagine a target in which the bulls-eye is our true value. If you shoot a few arrows and they land relatively close to the bulls-eye, but far apart from each other, then this is an illustration of accuracy (your arrows, or measurements, were close to the true value); if instead, your arrows land far from the bulls-eye, but all in a bunch, where they are all close to one another, then this is an illustration of precision (you produced relatively the same result with all your throws). A good scientific measurement is both precise and accurate.
• Error = The difference between a computed, estimated, or measured value and the true value that is caused by random, and inherently unpredictable fluctuations in the measurement instruments. The deviation can be small and inherent in the structure and functioning of the system and be within acceptable limits or can be due to lack of care or mistakes made by the investigator. A related term is standard deviation, which is a measure of the dispersion of random errors about the mean value.
• Bias = A prejudice, usually of the investigator, continued
SCIENTISTS AND INVENTORS

Alexander Graham Bell - Invented the telephone.
Rachel Carson - Founder of environmental science.
George Washington Carver - Botanist who was called the "farmers best friend."
Francis Crick and James Watson - Discovered the structure of the DNA molecule.
Marie Curie - Physicist who discovered radioactivity.
Leonardo da Vinci - Inventor and artist from the Renaissance.
Thomas Edison - Invented the light bulb, phonograph, and the motion picture.
Albert Einstein - Developed the Theory of Relativity and the equation E=mc^2.
Henry Ford - Invented the Model T Ford, the first mass produced car.
Ben Franklin - Inventor and Founding Father of the United States.
Galileo - First used the telescope to view the planets and stars.
Jane Goodall - Studied chimpanzees in the wild for many years.
Johannes Gutenberg - Invented the printing press.
Stephen Hawking - Discovered Hawking Radiation and wrote A Brief History in Time.
Antoine Lavoisier - Father of modern chemistry.
Isaac Newton - Discovered the theory of gravity and the three laws of motion.
Louis Pasteur - Discovered pasteurization, vaccines, and founded the science of germ theory.
The Wright Brothers - Invented the first airplane.

TYPES OF SCIENTISTS

While we often talk about a person being a "scientist", there are actually many different types of scientists. This is because most scientists study and become experts in a specific field of science.
Astronomer - Studies the planets, stars, and galaxies.
Botanist - Studies plant life.
Chemist - Studies chemistry and the behavior, properties, and composition of matter.
Cytologist - Studies cells.
Ecologist - Studies the relationship between living organisms and the environment.
Entomologist - Studies insects.
Geneticist - Studies genes, DNA, and the hereditary characteristics of living organisms.
Geologist - Studies the properties of matter that makes up Earth as well as the forces that shaped it.
Marine biologist - Studies the living organisms that live in the ocean and other bodies of water.
Microbiologist - Studies microscopic life forms such as bacteria and protists.
Meteorologist - Studies the Earth’s atmosphere including the weather.
Nuclear physicist - Studies the interactions and make up of the atom.
Ornithologist - Studies birds.
Paleontologist - Studies prehistoric life and fossils including dinosaurs.
Pathologist - Studies diseases caused by pathogens such as bacteria and viruses.
Seismologist - Studies earthquakes and the movements of the Earth’s crust.
Zoologist - Studies animals.
and tools should be used to collect, record, and process data. Science fair projects are a good example of the process of scientific investigation in action.

- Students would begin with a question: Will different colors of crayons lose mass if heat is applied? Students would form a hypothesis, explaining whether or not they believe the crayons would lose mass, or have less wax, if they were heated.
- To find out, they would need materials (crayons of different colors) and several tools: a digital camera, a scale to measure the mass of the crayons, a hot plate, a non-stick pan, and a plastic utensil for scraping the pan. As the crayons were being melted, students could use the camera to document the melting and weighing of each crayon both before and after heating.
- To better be able to share their data, the teacher might guide them in using a computer to create a bar graph showing the mass of each colored crayon before and after melting.
- Finally, after gathering their data, the students would draw a conclusion about what happened and why, comparing their data to their hypotheses and answering the original question. To complete the project, students could type up each part of the investigation and attach it to a display board along with the pictures, data collection, and graph, and share their results with their fellow student scientists.

C. Motion
Scientists use the term motion to refer to a continuous change in the position of a body relative to a reference point, as measured by a particular observer in a particular frame of reference. There are many ways of measuring, graphing, and describing changes in motion; most of these ways involve analyzing the displacement, acceleration, and velocity of an object.

- **Displacement.** A vector quantity that describes the position of a particle in reference to an origin, or that particle's change in position. An object can cover a large distance, but if it ends up in the same place where it started, its displacement is 0.
- **Velocity.** The speed of an object in a particular direction. Since speed (a scalar quantity) and direction are both important in determining velocity, it is a vector quantity. Graphs 1 and 2 below have constant velocity because the slope of

![Graphs 1, 2, and 3]

- **Graph 1:**
  - x(t) vs. t
  - Constant velocity

- **Graph 2:**
  - x(t) vs. t
  - Constant velocity

- **Graph 3:**
  - x(t) vs. t
  - Non-constant velocity
the line is unchanging, while Graph 3 illustrates a particle with changing velocity.

- **Acceleration.** This is a vector quantity defined as the rate of change of velocity. It is measured in meters/second$^2$. Graph 2 above shows a particle with 0 acceleration, because there is no change in velocity, while graphs 1 and 3 both show particles which are accelerating.

### D. FORCE AND MOTION

Sir Isaac Newton was most probably the first to give a mathematical definition of force; more importantly, Newton came up with three laws which defined motion in relation to forces acting upon objects and the reaction of objects to those forces.

- **Newton's First Law of Motion.** This law states that an object at rest will remain at rest, while an object in motion at constant velocity will remain in motion at constant velocity, unless there is a net force acting on it. This law is also called The Law of Inertia.

- **Newton's Second Law of Motion.** When the net force acting on an object is not zero, then the object will move in the direction of the force; in this case, the acceleration is directly proportional to the net force and inversely proportional to the mass of the object. From this relationship, we can derive a very important equation:

  $$F = \text{net force (measured in N)}$$
  $$m = \text{mass of the object (measured in kilograms)}$$
  $$a = \text{acceleration m/s}^2$$

  $$a = \frac{F}{m} \quad \text{or} \quad F = ma$$

- **Newton's Third Law of Motion.** When one object exerts a force on another object, the second object will exert a force on the first object that is equal in magnitude but opposite in direction. From this law, we get the famous phrase, "For every action, there is an equal and opposite reaction." This is an example of action-reaction forces.

Data about the physical properties of objects can be compiled by putting them into a graphic form such as a table to help explore how they are related to one another. Given the table, students can then discuss and record how objects compare to one another with respect to various physical properties. Early elementary students can complete the table as a whole-class activity, while students in second grade and up can likely complete the grid independently. To the right is an example that could be used in a fourth grade classroom.

<table>
<thead>
<tr>
<th>Object</th>
<th>Size</th>
<th>Shape</th>
<th>Temperature</th>
<th>Hardness</th>
<th>Mass</th>
<th>Conduction</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ice cube</td>
<td>2 cm</td>
<td>Rectangular prism</td>
<td>32°F</td>
<td>Hard</td>
<td>5g</td>
<td>No</td>
</tr>
<tr>
<td>Cotton ball</td>
<td>3 cm</td>
<td>Sphere</td>
<td>70°F</td>
<td>Soft</td>
<td>1g</td>
<td>No</td>
</tr>
<tr>
<td>Metal spoon</td>
<td>12 cm</td>
<td>Bowl on one end with handle</td>
<td>90°F (in cocoa)</td>
<td>Very hard</td>
<td>45g</td>
<td>Yes</td>
</tr>
<tr>
<td>Hot Cocoa (prepared)</td>
<td>50cm$^3$</td>
<td>Liquid (shape of container)</td>
<td>100°F</td>
<td>Liquid</td>
<td>150g</td>
<td>No</td>
</tr>
<tr>
<td>Crayon</td>
<td>6 cm</td>
<td>Cylindrical with point</td>
<td>70°F</td>
<td>Soft (easily scratched)</td>
<td>7g</td>
<td>No</td>
</tr>
</tbody>
</table>

*continued*
Muscular system. Muscles are responsible for your body's every move; they are also responsible for the physical actions of your internal organs such as the pounding of your lungs and the movement of food through your digestive system. Muscles can also generate heat to keep you warm.

Nervous system. This system is responsible for sending messages throughout your body. It is divided into the central nervous system (CNS) and the peripheral nervous system (PNS). The first is made up of the brain and spinal cord and has the job of receiving information from the body and sending out instructions; the latter is made up of all the nerves and has the job of transmitting the messages to and from the CNS.

Digestive system. This system has the job of breaking down food into chemicals that the body can use for fuel.

Respiratory system. This is the system that is responsible for taking oxygen into the body and releasing carbon dioxide out of the body. Our cells need oxygen in order to perform cellular respiration.

Circulatory system. This system is made of the heart and all the vessels that transport blood around the body. Circulation is necessary to transport oxygen and nutrients to all the cells of the body.

Urinary system. This system controls the amount of water and salts that are found in the body and what is taken out as waste; it also acts as a filtering mechanism for the blood.

Endocrine system. This system regulates, coordinates, and controls a number of bodily functions by the release of chemicals called hormones.

Integumentary system. This is composed of skin, hair, nails, oil and sweat glands. This system not only covers the body, but it acts as a protective wrapping, it insulates against wear and tear, it keeps germs and excess water out, it keeps the body's fluids and salts in, and it acts as a temperature regulator.

Immune system. This system defends against millions of bacteria, microbes, viruses, toxins, and parasites that come into contact with the body on a regular basis.

Reproductive. This system is responsible for ensuring the survival of the species by production of offspring.
1 (43). Visual Arts

Competency 1 (43):
The teacher understands the concepts, processes, and skills involved in the creation, appreciation, and evaluation of art and uses that knowledge to plan and implement effective and engaging visual arts instruction.

A. THE VALUE OF ART
All children need a variety of experiences to assist them in exploring their environment. Through art, children learn to value their own uniqueness and to appreciate the individuality of others. Art allows us to communicate powerful ideas creatively, on many levels. Art promotes
- Personal Development - creative expression, self-discovery, self-esteem and self-concept
- Social Development - children learn to cooperate during group art projects
- Physical Development - small muscles, eye-hand coordination, dexterity, and a sense of rhythm are developed as children engage in art activities
- Language Development - vocabulary is increased as the children talk about their art projects; drawing contributes to the development of writing
- Cognitive Development - art contributes to thinking skills in many areas, including classification, symbolic representation, and spatial relationships

B. FOSTERING CREATIVITY
Students should be allowed to explore and create with as few limits as possible! Genuine creative thinking consists of flights of fancy tempered by practical limitations, and is a requirement for success in modern society. In a world that is becoming increasingly technological, creativity is tantamount to success. Students will develop their creative skills in an environment that fosters mental flexibility. Respect for the individual and his ideas are more than a democratic principle; it is a cardinal code of conduct for the teacher who expects genuine, sustained interest from students. Simply put, students should be allowed to explore and create with as few limits as possible. Students should be allowed choice of topic, choice of design, and choice of tools as much as possible. Use of patterns and examples limits creativity.

C. DEVELOPING PERCEPTION AND VISUAL LITERACY
Visual literacy refers to the way we use our senses and perceive the world. It is the ability to identify the visual and tactile qualities of the environment. The development of visual literacy is fundamental to learning. Visual literacy allows students to:
- interpret symbols and understand symbolism
- communicate ideas more effectively
- comprehend artworks
- visually analyze their environment

Students with weak visual perception struggle in many areas. Visual Arts education provides unique opportunities for students to build visual perception skills. Students can build visual perception skills by:
- drawing and creating images from observation
- cooperative discussion prior to activities that continued
stimulates students’ prior knowledge
• creating artworks and images from their imagination
• creating artworks that demonstrate the student’s thoughts and beliefs - works that include symbolism and contain a message
• multi-sensory experiences - activities in which artworks are based on things they see, feel, taste, smell, or hear.

D. CRITICAL THINKING AND THE VISUAL ARTS
Few venues offer finer opportunities for critical thinking and problem solving. In the study of art, students must constantly seek innovative ways to express their thoughts and ideas. They must consider the world around them from many perspectives. They must focus on minute detail, while still considering the overall composition. To capitalize on these opportunities, teachers should include elements of critical thinking in every art lesson with methods such as:
• cooperative discussion prior to activities that examines projects and issues from many angles
• allowing students to make informed choices about how they will create their artworks, including choices about tools and techniques they will use
• lead student discussions on the merits and shortfalls of various tools and techniques as related to the work at hand
• question students regarding their choices and the choices of other (professional and peer) artists and artworks; use higher order questioning from Bloom’s Taxonomy (What if? Is it effective? How can it be improved? Predict...)
• teach students to apply Bloom’s Taxonomy to their own works and to create effective questions for themselves—to evaluate their own works
• include self-reflection activities as a routine part of every lesson by having students explain or justify their choices and the messages of their works, creating an artist’s statement, and by displaying the works
• teach students to respectfully evaluate their own works, the works of their peers, and the works of professional artists.

E. THE ELEMENTS OF ART
The elements of art are apparent in all living systems. They have practical applications in mathematics, assist readers with comprehension and inference, and provide a myriad of opportunities for written expression.

1. Line
Lines are the most basic element of art. They take on many forms including horizontal, straight, diagonal, vertical, zigzag, curved and wavy. Lines create the underlying concepts and boundaries for works of art.

2. Texture
Texture brings clarity and depth to art. Textures may be soft, smooth, rough, bumpy or silky.

3. Shape
Basic shapes create the form for objects in art. Shapes include circles, triangles, organic shapes, geometric shapes, rectangles, symbols and letters, ovals, squares and diamonds.

4. Form
Art moves from basic shapes to three dimensional forms with the addition of geometric figures. These add depth and perspective to art. Form includes geometric shapes, cones,
spheres, pyramids and triangular prisms, rectangular prisms, cubes, cylinders, and organic forms (forms found in nature).

5. Color
Color is used in three ways: to describe things, as a symbol, and to convey feelings or set the mood. Primary colors blend to create secondary colors, which in turn blend to create intermediate colors. Complementary colors—those that oppose each other on the color wheel—affect each other, causing the colors to be more vibrant. When complementary colors are together, they create contrast. Analogous colors—colors that are positioned next to each other on the color wheel—create a sense of harmony. Colors can be complementary, cool, warm, primary, secondary, or intermediate.

6. Value
Value is created through the blending of colors, and is used to enhance art and create specific effects. Colors mixed with white are lighter, and create highlights in art, giving depth and dimension. Colors mixed with black are darker, and create shadows and contrasts. Shadows and highlights are used to create focal points, or centers of attention. Values include shadows, tints (colors mixed with white), shades (colors mixed with black), and light to dark effects.

7. Space
Space is a critical element of art, as it allows the artist to create works with perspective. Perspective allows art viewers to see depictions from different angles. It is created with overlapping shapes, proportion (the size of one object in comparison to another object), and shadows. By drawing items in the foreground of the artwork larger than those in the background, the artist gives their work depth. Space elements include background, middle...
ground, foreground, proportion, positive and negative spaces, point of view, eye level view, worm’s eye view and bird’s eye view.

F. THE PRINCIPLES OF ART

1. Unity
Unity is creating a bond between all the parts of a work, giving the work a balanced sense of wholeness. Unity is created using repeated lines, textures, colors, shapes and forms.

2. Variety
Variety allows artists to give their work contrast, to create depth, and to engender emotion. Variety is formed by the use of different lines, textures, colors, shapes and forms.

3. Emphasis
Emphasis is the process whereby an artist makes one element of a piece of art capture the viewer’s attention. Artists create emphasis by adjusting the size of the objects in their works, and with shading and highlighting techniques.

4. Pattern
Patterns create movement and rhythm. To create harmony in artworks, patterns should match each other and not clash. Artists create unity through patterns of repeated lines and shapes. Patterns of curved lines and complimentary colors can create a sense of movement. Pattern is used to show proportion and to create balance—symmetrical, asymmetrical, and physical.

5. Harmony
Harmony is created when elements of a work blend and flow together into a cohesive statement. Harmony is created by the use of analogous colors (colors that are beside each other on the color wheel), tints (colors mixed with white) and shades (colors mixed with black).

6. Conflict
Conflict is created when complementary colors meet and create a contrast. Conflict is also created using arbitrary colors, colors that do not normally occur in nature (e.g., a green dog).

G. A VARIETY OF MEDIA
Elementary students should be exposed to and use a variety of media, including
- Crayon, pencil, colored pencil, pen
- Paint - acrylic paint, oil paint, tempera, Water color
- Pastel, oil pastel
- Collage and paper crafts
- Clay and fresco
- Print-making (lithography)
- Fabric crafts including yarn and beads

Teachers should be familiar with these tools and the methods for clean-up and storage of them.

H. A VARIETY OF ART TECHNIQUES
Elementary students should be exposed to and use a variety of art methods, including
- Drawing
- Painting
- Printmaking
- Construction (assembling artworks from found objects, cutting and pasting, collage, etc.)
Competency Definitions

1. Oral Language
   The teacher understands the importance of oral language, knows the developmental processes of oral language, and provides children with varied opportunities to develop listening and speaking skills.

2. Phonological and Phonemic Awareness
   The teacher understands phonological and phonemic awareness and employs a variety of approaches to help students develop phonological and phonemic awareness.

3. Alphabetic Principle
   The teacher understands the importance of the alphabetic principle for reading English and provides instruction that helps students understand the relationship between spoken language and printed words.

4. Literacy Development
   The teacher understands that literacy develops over time, progressing from emergent to proficient stages, and uses a variety of approaches to support the development of students' literacy.

5. Word Analysis and Identification Skills
   The teacher understands the importance of word identification skills (including decoding, blending, structural analysis, sight word vocabulary, and contextual analysis) and provides many opportunities for students to practice and improve word identification skills.

6. Fluency Reading
   The teacher understands the importance of fluency for reading comprehension and provides many opportunities for students to improve their reading fluency.

7. Reading Comprehension and Applications
   The teacher understands the importance of reading for understanding, knows the components and processes of reading comprehension, and teaches students strategies for improving their comprehension, including using a variety of texts and contexts.

8. Vocabulary Development
   The teacher knows the importance of vocabulary development and applies that knowledge to teach reading, listening, speaking and writing.

9. Reading, Inquiry, Research
   The teacher understands the importance of research and inquiry skills to students' academic success and provides students with instruction that promotes their acquisition and effective use of those study skills in the content areas.

10. Writing Conventions
    The teacher understands the conventions of writing in English and provides instruction that helps students develop proficiency in applying writing conventions.

11. Written Communication
    The teacher understands that writing to communicate is a developmental process and provides instruction that promotes students' competence in written communication.

12. Viewing and Representing
    The teacher understands skills for interpreting, analyzing, evaluating, and producing visual images and messages in various media and provides students with opportunities to develop skills in this area.

13. Assessment of Developing Literacy
    The teacher understands the basic principles of literacy assessment and uses a variety of assessments to guide literacy instruction.

1(14). Mathematics Instruction
   Competency 1(14)
   The teacher understands how students learn mathematical skills and uses that knowledge to plan, organize, and implement instruction and assess learning.

2(15). Number Concepts and Operations
   Competency 2(15)
   The teacher understands concepts related to numbers, operations and algorithms, and the properties of numbers.
# Competency Definitions

<table>
<thead>
<tr>
<th>Subject Test II (802): Mathematics</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Competency 3(16)</td>
<td><strong>Patterns and Algebra</strong></td>
</tr>
<tr>
<td>The teacher understands concepts related to patterns, relations, functions, and algebraic reasoning.</td>
<td></td>
</tr>
<tr>
<td>Competency 4(17)</td>
<td><strong>Geometry and Measurement</strong></td>
</tr>
<tr>
<td>The teacher understands concepts and principles of geometry and measurement.</td>
<td></td>
</tr>
<tr>
<td>Competency 5(18)</td>
<td><strong>Probability and Statistics</strong></td>
</tr>
<tr>
<td>The teacher understands concepts related to probability and statistics and their applications.</td>
<td></td>
</tr>
<tr>
<td>Competency 6(19)</td>
<td><strong>Mathematical Processes</strong></td>
</tr>
<tr>
<td>The teacher understands mathematical processes and knows how to reason mathematically, solve mathematical problems, and make mathematical connections within and outside of mathematics.</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Subject Test III (803): Social Studies</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Competency 1(20)</td>
<td><strong>Social Science Instruction</strong></td>
</tr>
<tr>
<td>The teacher understands and applies social science knowledge and skills to plan, organize, and implement instruction and assess learning.</td>
<td></td>
</tr>
<tr>
<td>Competency 2(21)</td>
<td><strong>History</strong></td>
</tr>
<tr>
<td>The teacher understands and applies knowledge of significant historical events and developments, multiple historical interpretations and ideas, and relationships between the past, the present, and the future as defined by the Texas Essential Knowledge and Skills (TEKS).</td>
<td></td>
</tr>
<tr>
<td>Competency 3(22)</td>
<td><strong>Geography and Culture</strong></td>
</tr>
<tr>
<td>The teacher understands and applies knowledge of geographic relationships involving people, places, and environments in Texas, the United States, and the world; and also understands and applies knowledge of cultural development, adaptation, diversity, and interactions among science, technology, and society as defined by the Texas Essential Knowledge and Skills (TEKS).</td>
<td></td>
</tr>
<tr>
<td>Competency 4(23)</td>
<td><strong>Economics</strong></td>
</tr>
<tr>
<td>The teacher understands and applies knowledge of economic systems and how people organize economic systems to produce, distribute, and consume goods and services.</td>
<td></td>
</tr>
<tr>
<td>Competency 5(24)</td>
<td><strong>Government and Citizenship</strong></td>
</tr>
<tr>
<td>The teacher understands and applies knowledge of concepts of government, democracy, and citizenship, including ways that individuals and groups achieve their goals through political systems.</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Subject Test IV (804): Science</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Competency 1(25)</td>
<td><strong>Safe and Proper Laboratory Processes</strong></td>
</tr>
<tr>
<td>The teacher understands how to manage learning activities, tools, materials, equipment, and technologies to ensure the safety of all students.</td>
<td></td>
</tr>
<tr>
<td>Competency 2(26)</td>
<td><strong>History and Nature of Science</strong></td>
</tr>
<tr>
<td>The teacher understands the history and nature of science, the process and role of scientific inquiry, and the role of inquiry in science instruction.</td>
<td></td>
</tr>
<tr>
<td>Competency 3(27)</td>
<td><strong>Impact of Science on Daily Life</strong></td>
</tr>
<tr>
<td>The teacher understands how science impacts the daily lives of students and interacts with and influences personal and societal decisions.</td>
<td></td>
</tr>
<tr>
<td>Competency 4(28)</td>
<td><strong>Concepts and Processes in Science</strong></td>
</tr>
<tr>
<td>The teacher knows and understands the unifying concepts and processes that are common to all sciences.</td>
<td></td>
</tr>
<tr>
<td>Competency 5(29)</td>
<td><strong>Students as Learners and Science Instruction</strong></td>
</tr>
<tr>
<td>The teacher has theoretical and practical knowledge about teaching science and about how students learn science.</td>
<td></td>
</tr>
<tr>
<td>Competency 6(30)</td>
<td><strong>Science Assessments</strong></td>
</tr>
<tr>
<td>The teacher knows the varied and appropriate assessments and assessment practices for monitoring science learning in laboratory, field, and classroom settings.</td>
<td></td>
</tr>
<tr>
<td>Competency 7(31)</td>
<td><strong>Forces and Motion</strong></td>
</tr>
<tr>
<td>The teacher understands forces and motion and their relationships.</td>
<td></td>
</tr>
<tr>
<td>Competency 8(32)</td>
<td><strong>Physical and Chemical Properties of Matter</strong></td>
</tr>
<tr>
<td>The teacher understands the physical and chemical properties of and changes in matter.</td>
<td></td>
</tr>
</tbody>
</table>