Grade 5

Overview of Topics

Grade 5

Language Arts
I. Writing, Grammar, and Usage
  A. Writing and Research
  B. Grammar and Usage
  C. Vocabulary
II. Poetry
  A. Poems
  B. Terms
III. Fiction and Drama
  A. Stories
  B. Drama
  C. Myths and Legends
  D. Literary Terms
IV. Speeches
V. Sayings and Phrases

History and Geography
World:
I. World Geography
  A. Spatial Sense
  B. Great Lakes of the World
II. Early American Civilizations
  A. Geography
  B. Maya, Aztec and Inca Civilizations
  C. Spanish Conquerors
III. European Exploration, Trade, and the Clash of Cultures
  A. Background
  B. European Exploration, Trade, and Colonization
  C. Trade and Slavery
IV. The Renaissance and the Reformation
  A. The Renaissance
  B. The Reformation
V. England from the Golden Age to the Glorious Revolution
  A. England in the Golden Age
  B. From the English Revolution to the Glorious Revolution
VI. Russia: Early Growth and Expansion
  A. Geography
  B. History and Culture
VII. Feudal Japan
  A. Geography
  B. History and Culture

American:
I. Westward Expansion
  A. Westward Expansion before the Civil War
  B. Westward Expansion after the Civil War
II. The Civil War: Causes, Conflicts, Consequences
  A. Toward the Civil War
  B. The Civil War
  C. Reconstruction
III. Native Americans: Cultures and Conflicts
  A. Culture and Life
  B. American Government Policies
  C. Conflicts
IV. U. S. Geography

Visual Arts
I. Art of the Renaissance
II. American Art: Nineteenth-Century United States
III. Art of Japan

Music
I. Elements of Music
II. Listening and Understanding
  A. Composers and Their Music
  B. Musical Connections
III. American Musical Traditions (Spirituals)
IV. Songs

Mathematics
I. Numbers and Number Sense
II. Ratio and Percent
  A. Ratio
  B. Percent
III. Fractions and Decimals
  A. Fractions
  B. Decimals
IV. Computation
  A. Addition
  B. Multiplication
  C. Division
  D. Solving Problems and Equations
V. Measurement
VI. Geometry
VII. Probability and Statistics
VIII. Pre-Algebra

Science
I. Classifying Living Things
II. Cells: Structures and Processes
III. Plant Structures and Processes
  A. Structure: Non-Vascular and Vascular Plants
  B. Photosynthesis
  C. Reproduction
IV. Life Cycles and Reproduction
  A. The Life Cycle and Reproduction
  B. Sexual Reproduction in Animals
V. The Human Body
  A. Changes in Human Adolescence
  B. The Endocrine System
  C. The Reproductive System
VI. Chemistry: Matter and Change
  A. Atoms, Molecules, and Compounds
  B. Elements
  C. Chemical and Physical Change
VII. Science Biographies

Language Arts: Grade 5

The *Common Core State Standards for English Language Arts* emphasize the critical importance of building nonfiction background knowledge in a coherent and sequenced way within and across grades. This can be accomplished most effectively, at each grade level, by integrating the topics from history, geography, science, and the arts in the *Core Knowledge Sequence* into the language arts block. Note that in the *Sequence*, there are many cross-curricular connections to history and science topics within Language Arts (e.g., poems, stories, and sayings), as well as to visual arts and music, which can and should be integrated into the applicable domain of study.

For Grade 5, domains include: Early American Civilizations; European Exploration, Trade, and the Clash of Cultures; The Renaissance and the Reformation; England from the Golden Age to the Glorious Revolution; Russia: Early Growth and Expansion; Feudal Japan; Westward Expansion; The Civil War: Causes, Conflicts, Consequences; Native Americans: Cultures and Conflicts; Classifying Living Things; Cells: Structures and Processes; Plant Structures and Processes; Life Cycles and Reproduction; The Human Body.

NOTE: The objectives listed in I. Writing, Grammar, and Usage are currently under revision, as part of the *Core Knowledge Language Arts* program development for Grades 3–5. The revised Grade 5 goals and objectives will be conceptually consistent with the K–2 language arts sections of the 2010 edition of the *Sequence* and will be posted at www.coreknowledge.org as part of the online *Sequence* as soon as they are available.

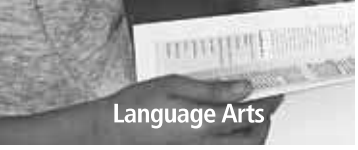
I. Writing, Grammar, and Usage

Teachers: Students should be given many opportunities for writing with teacher guidance that strikes a balance between encouraging creativity and requiring correct use of conventions. Continue imaginative writing but place a stronger emphasis than in previous grades on expository writing, including, for example, summaries, book reports, essays that explain a process, and descriptive essays. In fifth grade, it is appropriate to place a greater emphasis on revision, with the expectation that students will revise and edit to produce (in some cases) a finished product that is thoughtful, well-organized, and reasonably correct in grammar, mechanics, and spelling. In fifth grade, students should be reasonably competent spellers, and in the habit of using a dictionary to check and correct words that present difficulty. They should receive regular practice in vocabulary enrichment.

Note: Review from grade 4: how to use a topic sentence; how to develop a paragraph with examples and details.

A. WRITING AND RESEARCH

- Produce a variety of types of writing—including reports, summaries, letters, descriptions, research essays, essays that explain a process, stories, poems—with a coherent structure or story line.
- Know how to gather information from different sources (such as an encyclopedia, magazines, interviews, observations, atlas, on-line), and write short reports synthesizing information from at least three different sources, presenting the information in his or her own words, with attention to the following:
  - understanding the purpose and audience of the writing
  - defining a main idea and sticking to it
  - providing an introduction and conclusion
  - organizing material in coherent paragraphs
  - illustrating points with relevant examples
  - documenting sources in a rudimentary bibliography



Note: Punctuation studied in earlier grades includes: end punctuation (period, question mark, or exclamation point); comma (between day and year when writing a date, between city and state in an address, in a series, after yes and no, before conjunctions that combine sentences, inside quotation marks in dialogue); apostrophe (in contractions, in singular and plural possessive nouns); and quotation marks (in dialogue, and for titles of poems, songs, short stories, magazine articles).

Note: A brief review of prefixes and suffixes introduced in earlier grades is recommended. Prefixes: *re, un, dis, im (in), non, mis, en, pre.* Suffixes: *er and or, less, ly, ily, y, ful, able, ible, ment.*

B. GRAMMAR AND USAGE

- Understand what a complete sentence is, and
  identify subject and predicate
  correct fragments and run-ons
- Identify subject and verb in a sentence and understand that they must agree.
- Know the following parts of speech and how they are used: nouns, verbs (action verbs and auxiliary verbs), adjectives (including articles), adverbs, conjunctions, interjections.
- Understand that pronouns must agree with their antecedents in case (nominative, objective, possessive), number, and gender.
- Correctly use punctuation studied in earlier grades, as well as
  the colon before a list
  commas with an appositive
- Use underlining or italics for titles of books.

C. VOCABULARY

- Know how the following prefixes and suffixes affect word meaning:

Prefixes:

anti (as in antisocial, antibacterial)
co (as in coeducation, co-captain)
fore (as in forefather, foresee)
il, ir (as in illegal, irregular)
inter (as in interstate)
mid (as in midnight, Midwest)
post (as in postseason, postwar)
semi (as in semicircle, semiprecious)

Suffixes:

ist (as in artist, pianist)
ish (as in stylish, foolish)
ness (as in forgiveness, happiness)
tion, sion (as in relation, extension)

II. Poetry

Teachers: The poems listed here constitute a selected core of poetry for this grade. Expose children to more poetry, old and new, and have children write their own poems. To bring children into the spirit of poetry, read it aloud and encourage them to read it aloud so they can experience the music in the words. At this grade, poetry should be primarily a source of delight. This is also an appropriate grade at which to begin looking at poems in more detail, asking questions about the poet's use of language, noting the use of devices such as simile, metaphor, alliteration, etc.

A. POEMS

The Arrow And The Song (Henry Wadsworth Longfellow)
Barbara Frietchie (John Greenleaf Whittier)
Battle Hymn of the Republic (Julia Ward Howe)
A bird came down the walk (Emily Dickinson)
Casey at the Bat (Ernest Lawrence Thayer)
The Eagle (Alfred Lord Tennyson)
I Hear America Singing (Walt Whitman)
I like to see it lap the miles (Emily Dickinson)
I, too, sing America (Langston Hughes)
Jabberwocky (Lewis Carroll)
Narcissa (Gwendolyn Brooks)
O Captain! My Captain! (Walt Whitman)
A Poison Tree (William Blake)
The Road Not Taken (Robert Frost)
The Snowstorm (Ralph Waldo Emerson)
Some Opposites (Richard Wilbur)
The Tiger (William Blake)
A Wise Old Owl (Edward Hersey Richards)

Note: See also below, III. D, Literary Terms: Literal and figurative language.

B. TERMS
onomatopoeia
alliteration

III. Fiction and Drama

Teachers: In fifth grade, students should be fluent, competent readers of appropriate materials. Regular independent silent reading should continue. Students should read outside of school at least 25 minutes daily.

The titles below constitute a selected core of stories for this grade. Expose children to many more stories, and encourage children to write their own stories. Children should also be exposed to nonfiction prose: biographies, books about science and history, books on art and music, etc.

Some of the works below, such as *Don Quixote*, *Narrative of the Life of Frederick Douglass*, or *A Midsummer Night's Dream* are available in editions adapted for young readers.

A. STORIES
The Adventures of Tom Sawyer (Mark Twain)
episodes from *Don Quixote* (Miguel de Cervantes)
Little Women (Part First) (Louisa May Alcott)
Narrative of the Life of Frederick Douglass (Frederick Douglass)
The Secret Garden (Frances Hodgson Burnett)
Tales of Sherlock Holmes, including "The Red-Headed League" (Arthur Conan Doyle)

See also World History 5: The Renaissance, *re Don Quixote.*

B. DRAMA
- *A Midsummer Night's Dream* (William Shakespeare)
- Terms:
  tragedy and comedy
  act, scene
  Globe Theater

See also World History 5: The Renaissance, *re A Midsummer Night's Dream.*

C. MYTHS AND LEGENDS
- A Tale of the Oki Islands (a legend from Japan, also known as "The Samurai's Daughter")
- Morning Star and Scarface: the Sun Dance (a Plains Native American legend, also known as "The Legend of Scarface")
- Native American trickster stories (for example, tales of Coyote, Raven, or Grandmother Spider)

See also World History 5: Feudal Japan, *re* "A Tale of the Oki Islands."

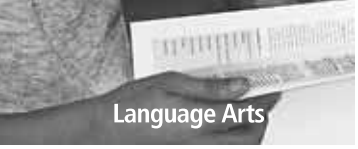
See also American History 5: Native American Cultures, *re* "Morning Star and Scarface" and Native American trickster stories.

D. LITERARY TERMS
- Pen name (pseudonym)
- Literal and figurative language
  imagery
  metaphor and simile
  symbol
  personification

IV. Speeches

- Abraham Lincoln: The Gettysburg Address
- Chief Joseph (Highh'moot Tooyalakekt): "I will fight no more forever"

See also American History 5: Civil War; and, Native Americans: Cultures and Conflicts.



V. Sayings and Phrases

Teachers: Every culture has phrases and proverbs that make no sense when carried over literally into another culture. For many children, this section may not be needed; they will have picked up these sayings by hearing them at home and among friends. But the sayings have been one of the categories most appreciated by teachers who work with children from home cultures that differ from the standard culture of literate American English.

Birthday suit
Bite the hand that feeds you.
Chip on your shoulder
Count your blessings.
Eat crow
Eleventh hour
Eureka!
Every cloud has a silver lining.
Few and far between
Forty winks
The grass is always greener on the other side (of the hill).
To kill two birds with one stone
Lock, stock and barrel
Make a mountain out of a molehill
A miss is as good as a mile.
It's never too late to mend.
Out of the frying pan and into the fire.
A penny saved is a penny earned.
Read between the lines.
Sit on the fence
Steal his/her thunder
Take the bull by the horns.
Till the cows come home
Time heals all wounds.
Tom, Dick and Harry
Vice versa
A watched pot never boils.
Well begun is half done.
What will be will be.

History and Geography: Grade 5

See also below, II.A: Geography of Early American Civilizations; III.C: Trade and Slavery; VI.B: Geography of Russia; VII.B: Geography of Japan.

World History and Geography

I. World Geography

Teachers: The study of geography embraces many topics throughout the *Core Knowledge Sequence*, including topics in history and science. Geographic knowledge includes a spatial sense of the world, an awareness of the physical processes that shape life, a sense of the interactions between humans and their environment, an understanding of the relations between place and culture, and an awareness of the characteristics of specific regions and cultures. Many geographic topics are listed below in connection with historical topics.

A. SPATIAL SENSE (Working with Maps, Globes, and Other Geographic Tools)
Teachers: Review as necessary map-reading skills and concepts, as well as geographic terms, from previous grades.
- Read maps and globes using longitude and latitude, coordinates, degrees.
- Tropic of Cancer and Tropic of Capricorn: relation to seasons and temperature
- Climate zones: Arctic, Tropical, Temperate
- Time zones (review from Grade 4): Prime Meridian (O degrees); Greenwich, England; 180° Line (International Date Line)
- Arctic Circle (imaginary lines and boundaries) and Antarctic Circle
- From a round globe to a flat map: Mercator projection, conic and plane projections

B. GREAT LAKES OF THE WORLD
- Eurasia: Caspian Sea
- Asia: Aral Sea
- Africa: Victoria, Tanganyika, Chad
- North America: Superior, Huron, Michigan
- South America: Maracaibo, Titicaca

II. Early American Civilizations

Teachers: Discuss with students: How do we know about these ancient civilizations? (Through archaeological findings; ancient artifacts and writings; writings by European missionaries and conquerors, etc.).

A. GEOGRAPHY
- Identify and locate Central America and South America on maps and globes.
  Largest countries in South America: Brazil and Argentina
- Amazon River
- Andes Mountains

B. MAYA, AZTEC, AND INCA CIVILIZATIONS
- The Mayas
  Ancient Mayas lived in what is now southern Mexico and parts of Central America; their descendants still live there today.
  Accomplishments as architects and artisans: pyramids and temples
  Development of a system of hieroglyphic writing
  Knowledge of astronomy and mathematics; development of a 365-day calendar; early use of concept of zero

- The Aztecs
  - A warrior culture, at its height in the 1400s and early 1500s, the Aztec empire covered much of what is now central Mexico.
  - The island city of Tenochtitlan: aqueducts, massive temples, etc.
  - Moctezuma (also spelled Montezuma)
  - Ruler-priests; practice of human sacrifice

- The Inca
  - Ruled an empire stretching along the Pacific coast of South America
  - Built great cities (Machu Picchu, Cuzco) high in the Andes, connected by a system of roads

C. SPANISH CONQUERORS

- Conquistadors: Cortés and Pizzaro
  - Advantage of Spanish weapons (guns, cannons)
  - Diseases devastate native peoples

III. European Exploration, Trade, and the Clash of Cultures

Teachers: It is recommended that you use timelines to place these people and events in the context of the students' previous studies (especially in grade 3) of the early exploration and settlement of North America. Fifth grade teachers should examine the third grade guidelines for American History in order to use the familiar topics as a foundation upon which to build knowledge of the new topics.

A. BACKGROUND

Note: Place the great wave of exploration by Europeans in the context of various peoples exploring beyond their own borders, including Islamic traders and (recall from Grade 4) Zheng He of China.

- Beginning in the 1400s Europeans set forth in a great wave of exploration and trade.
- European motivations
  - Muslims controlled many trade routes.
  - Profit through trade in goods such as gold, silver, silks, sugar, and spices
  - Spread of Christianity: missionaries
- Geography of the spice trade
  - The Moluccas, also called the "Spice Islands": part of present-day Indonesia
  - Locate: the region known as Indochina, the Malay Peninsula, the Philippines
  - Definition of "archipelago"
  - "Ring of Fire": earthquakes and volcanic activity

B. EUROPEAN EXPLORATION, TRADE, AND COLONIZATION

- Portugal
  - Prince Henry the Navigator, exploration of the West African coast
  - Bartolomeu Dias rounds the Cape of Good Hope
  - Vasco da Gama: spice trade with India, exploration of East Africa
  - Portuguese conquer East African Swahili city-states
  - Cabral claims Brazil
- Spain
  - Two worlds meet: Christopher Columbus and the Tainos
  - Bartolomé de las Casas speaks out against enslavement and mistreatment of native peoples
  - Treaty of Tordesillas between Portugal and Spain
  - Balboa reaches the Pacific
  - Magellan crosses the Pacific, one of his ships returns to Spain, making the first round-the-world voyage

Note: Briefly review from American History 3: "Early Spanish Exploration and Settlement." Also, see above, II.C, Spanish Conquerors.

Note: Briefly review from American History 3: search for Northwest Passage. You may also want to introduce other explorers, such as Verrazano and Cartier.

- England and France
  - Search for Northwest Passage (review from grade 3)
  - Colonies in North America and West Indies
  - Trading posts in India

- Holland (The Netherlands)
  - The Dutch take over Portuguese trade routes and colonies in Africa and the East Indies
  - The Dutch in South Africa, Cape Town
  - The Dutch in North America: New Netherland (review from grade 3), later lost to England

C. TRADE AND SLAVERY

- The sugar trade
  - African slaves on Portuguese sugar plantations on islands off West African coast, such as São Tomé
  - Sugar plantations on Caribbean islands
  - West Indies: Cuba, Puerto Rico, Bahamas, Dominican Republic, Haiti, Jamaica
- Transatlantic slave trade: the "triangular trade" from Europe to Africa to colonies in the Caribbean and the Americas
  - The "Slave Coast" in West Africa
  - The Middle Passage

IV. The Renaissance and the Reformation

A. THE RENAISSANCE

- Islamic scholars translate Greek works and so help preserve classical civilization.
- A "rebirth" of ideas from ancient Greece and Rome
- New trade and new wealth
- Italian city states: Venice, Florence, Rome
- Patrons of the arts and learning
  - The Medici Family and Florence
  - The Popes and Rome
- Leonardo da Vinci, Michelangelo
- Renaissance ideals and values as embodied in
  - *The Courtier* by Castiglione: the "Renaissance man"
  - *The Prince* by Machiavelli: real-world politics

See also Visual Arts 5: The Art of the Renaissance; and Language Arts 5: Shakespeare, *A Midsummer Night's Dream;* Cervantes, *Don Quixote.*

B. THE REFORMATION

- Gutenberg's printing press: the Bible made widely available
- The Protestant Reformation
  - Martin Luther and the 95 Theses
  - John Calvin
- The Counter-Reformation
- Copernicus and Galileo: Conflicts between science and the church
  - Ptolemaic (earth-centered) vs. sun-centered models of the universe

V. England from the Golden Age to the Glorious Revolution

A. ENGLAND IN THE GOLDEN AGE

- Henry VIII and the Church of England
- Elizabeth I
- British naval dominance
  - Defeat of the Spanish Armada
  - Sir Francis Drake
  - British exploration and North American settlements

See also Language Arts 5: Shakespeare.

B. FROM THE ENGLISH REVOLUTION TO THE GLORIOUS REVOLUTION

- The English Revolution
  - King Charles I, Puritans and Parliament
  - Civil War: Cavaliers and Roundheads
  - Execution of Charles I
  - Oliver Cromwell and the Puritan regime
  - The Restoration (1660): Charles II restored to the English throne, many Puritans leave England for America
- The "Glorious Revolution" (also called the Bloodless Revolution)
  - King James II replaced by William and Mary
  - Bill of Rights: Parliament limits the power of the monarchy

VI. Russia: Early Growth and Expansion

A. GEOGRAPHY

- Moscow and St. Petersburg
- Ural Mountains, Siberia, steppes
- Volga and Don Rivers
- Black, Caspian, and Baltic Seas
- Search for a warm-water port

B. HISTORY AND CULTURE

- Russia as successor to Byzantine Empire: Moscow as new center of Eastern Orthodox Church and of Byzantine culture (after the fall of Constantinople in 1453)
- Ivan III (the Great), czar (from the Latin "Caesar")
- Ivan IV (the Terrible)
- Peter the Great: modernizing and "Westernizing" Russia
- Catherine the Great
  - Reforms of Peter and Catherine make life even harder for peasants

VII. Feudal Japan

A. GEOGRAPHY

- Pacific Ocean, Sea of Japan
- Four main islands: Hokkaido, Honshu (largest), Shikoku, Kyushu
- Tokyo
- Typhoons, earthquakes
- The Pacific Rim

B. HISTORY AND CULTURE

See also Language Arts 5: "A Tale of the Oki Islands."

- Emperor as nominal leader, but real power in the hands of shoguns
- Samurai, code of Bushido
- Rigid class system in feudal Japanese society
- Japan closed to outsiders
- Religion
  - Buddhism: the four Noble Truths and the Eightfold Path, Nirvana
  - Shintoism: reverence for ancestors, reverence for nature, *kami*

Note: Review from grade 2: Buddhism's origins in India, spread throughout Asia.

American History and Geography

Note: Fifth grade students who have been through earlier grades of the *Core Knowledge Sequence* have been introduced to exploration and pioneers in grades 1 and 2.

American History and Geography

I. Westward Expansion

Teachers: Guidelines for the study of Westward Expansion are divided into two parts, with part A focusing on the decades before the Civil War, and part B focusing on the years after the Civil War. You may wish to plan a single unit on Westward Expansion, or divide your studies with a unit on the Civil War (see II below).

A. WESTWARD EXPANSION BEFORE THE CIVIL WAR

- Geography
  - Rivers: James, Hudson, St. Lawrence, Mississippi, Missouri, Ohio, Columbia, Rio Grande
  - Erie Canal connecting the Hudson River and Lake Erie
  - Appalachian and Rocky Mountains
  - Continental Divide and the flow of rivers: east of Rockies to the Arctic or Atlantic Oceans, west of Rockies to the Pacific Ocean
  - Great Plains stretching from Canada to Mexico
- Early exploration of the west
  - Daniel Boone, Cumberland Gap, Wilderness Trail
  - Lewis and Clark, Sacagawea
  - "Mountain men," fur trade
  - Zebulon Pike, Pike's Peak
- Pioneers
  - Getting there in wagon trains, flatboats, steamboats
  - Many pioneers set out from St. Louis (where the Missouri and Mississippi Rivers meet).
  - Land routes: Santa Fe Trail and Oregon Trail
  - Mormons (Latter-day Saints) settle in Utah, Brigham Young, Great Salt Lake
  - Gold Rush, '49ers
- Native American resistance
  - More and more settlers move onto Native American lands, treaties made and broken
  - Tecumseh (Shawnee): attempted to unite tribes in defending their land
  - Battle of Tippecanoe
  - Osceola, Seminole leader
- "Manifest Destiny" and conflict with Mexico
  - The meaning of "manifest destiny"
  - Early settlement of Texas: Stephen Austin
  - General Antonio Lopez de Santa Anna
  - Battle of the Alamo ("Remember the Alamo"), Davy Crockett, Jim Bowie
- The Mexican-American War
  - General Zachary Taylor ("Old Rough and Ready")
  - Some Americans strongly oppose the war, Henry David Thoreau's "Civil Disobedience"
  - Mexican lands ceded to the United States (California, Nevada, Utah, parts of Colorado, New Mexico, Arizona)

B. WESTWARD EXPANSION AFTER THE CIVIL WAR

- Homestead Act (1862), many thousands of Americans and immigrants start farms in the West
- "Go west, young man" (Horace Greeley's advice)
- Railroads, Transcontinental Railroad links east and west, immigrant labor
- Cowboys, cattle drives
- The "wild west," reality versus legend: Billy the Kid, Jesse James, Annie Oakley, Buffalo Bill
- "Buffalo Soldiers," African American troops in the West
- U. S. purchases Alaska from Russia, "Seward's folly"
- 1890: the closing of the American frontier (as acknowledged in the U. S. Census), the symbolic significance of the frontier

II. The Civil War: Causes, Conflicts, Consequences

A. TOWARD THE CIVIL WAR

- Abolitionists: William Lloyd Garrison and *The Liberator*, Frederick Douglass
- Slave life and rebellions
- Industrial North versus agricultural South
- Mason-Dixon Line
- Controversy over whether to allow slavery in territories and new states
  - Missouri Compromise of 1820
  - Dred Scott decision allows slavery in the territories
- Importance of Harriet Beecher Stowe's *Uncle Tom's Cabin*
- John Brown, Harper's Ferry
- Lincoln: "A house divided against itself cannot stand."
  - Lincoln-Douglas debates
  - Lincoln elected president, Southern states secede

See also Language Arts 5: *Narrative of the Life of Frederick Douglass.*

B. THE CIVIL WAR

- Fort Sumter
- Confederacy, Jefferson Davis
- Yankees and Rebels, Blue and Gray
- First Battle of Bull Run
- Robert E. Lee and Ulysses S. Grant
- General Stonewall Jackson
- Ironclad ships, battle of the USS *Monitor* and the CSS *Virginia* (formerly the USS *Merrimack)*
- Battle of Antietam Creek
- The Emancipation Proclamation
- Gettysburg and the Gettysburg Address
- African-American troops, Massachusetts Regiment led by Colonel Shaw
- Sherman's march to the sea, burning of Atlanta
- Lincoln re-elected, concluding words of the Second Inaugural Address ("With malice toward none, with charity for all. . . .")
- Richmond (Confederate capital) falls to Union forces
- Surrender at Appomattox
- Assassination of Lincoln by John Wilkes Booth

See also Language Arts / Music 5: "The Battle Hymn of the Republic"; and Language Arts 5: Gettysburg Address.

Note: Those who wish to examine other battles may want to include Vicksburg (and Lincoln's famous words, "The Father of Waters again goes unvexed to the sea") and the Battle of Mobile Bay (with Admiral David Farragut's famous words, "Damn the torpedoes, full speed ahead!").

See also Language Arts 5: Walt Whitman's poem "O Captain! My Captain!" *re* the assassination of Lincoln.

C. RECONSTRUCTION

- The South in ruins
- Struggle for control of the South, Radical Republicans vs. Andrew Johnson, impeachment
- Carpetbaggers and scalawags
- Freedmen's Bureau, "40 acres and a mule"
- 13th, 14th, and 15th Amendments to the Constitution
- Black Codes, the Ku Klux Klan and "vigilante justice"
- End of Reconstruction, Compromise of 1877, all federal troops removed from the South

III. Native Americans: Cultures and Conflicts

A. CULTURE AND LIFE

- Great Basin (for example, Nez Perce)
- Plateau (for example, Shoshone and Ute)
- Plains (for example, Arapaho, Cheyenne, Lakota [Sioux], Blackfeet, Crow)
  - Extermination of buffalo (review from grade 2)
- Pacific Northwest (for example, Chinook, Kwakiutl, Yakima)

See also Language Arts 5: American Indian trickster myths; and, Chief Joseph, "I will fight no more forever."

B. AMERICAN GOVERNMENT POLICIES

- Bureau of Indian Affairs
- Forced removal to reservations
- Attempts to break down tribal life, assimilation policies, Carlisle School

C. CONFLICTS

- Sand Creek Massacre
- Little Big Horn: Crazy Horse, Sitting Bull, Custer's Last Stand
- Wounded Knee
  Ghost Dance

IV. U. S. Geography

- Locate: Western Hemisphere, North America, Caribbean Sea, Gulf of Mexico
- The Gulf Stream, how it affects climate
- Regions and their characteristics: New England, Mid-Atlantic, South, Midwest, Great Plains, Southwest, West, Pacific Northwest
- Fifty states and capitals

Visual Arts: Grade 5

SEE INTRODUCTION, "The Arts in the Curriculum."

Teachers: In schools, lessons on the visual arts should illustrate important elements of making and appreciating art, and emphasize important artists, works of art, and artistic concepts. When appropriate, topics in the visual arts may be linked to topics in other disciplines. While the following guidelines specify a variety of artworks in different media and from various cultures, they are not intended to be comprehensive. Teachers are encouraged to build upon the core content and expose children to a wide range of art and artists.

In studying the works of art specified below, and in creating their own art, students should review, develop, and apply concepts introduced in previous grades, such as line, shape, form, space, texture, color, light, design, and symmetry.

I. Art of the Renaissance

Teachers: Study of the following artists and works of art may be integrated with study of related topics in World History 5: The Renaissance.

- The shift in world view from medieval to Renaissance art, a new emphasis on humanity and the natural world
- The influence of Greek and Roman art on Renaissance artists (classical subject matter, idealization of human form, balance and proportion)
- The development of linear perspective during the Italian Renaissance
  The vantage point or point-of-view of the viewer
  Convergence of lines toward a vanishing point, the horizon line
- Observe and discuss works in different genres—such as portrait, fresco, Madonna—by Italian Renaissance artists, including
  Sandro Botticelli, *The Birth of Venus*
  Leonardo da Vinci: *The Proportions of Man, Mona Lisa, The Last Supper*
  Michelangelo, Ceiling of the Sistine Chapel, especially the detail known as *The Creation of Adam*
  Raphael: *The Marriage of the Virgin*, examples of his Madonnas (such as *Madonna and Child with the Infant St. John, The Alba Madonna,* or *The Small Cowper Madonna*)
- Become familiar with Renaissance sculpture, including
  Donatello, *Saint George*
  Michelangelo, *David*
- Become familiar with Renaissance architecture, including
  The Florence Cathedral, dome designed by Filippo Brunelleschi
  St. Peter's in Rome
- Observe and discuss paintings of the Northern Renaissance, including
  Pieter Bruegel, *Peasant Wedding*
  Albrecht Dürer, *Self-Portrait* (such as from 1498 or 1500)
  Jan van Eyck, *Giovanni Arnolfini and His Wife* (also known as *Arnolfini Wedding*)

Note: When you study perspective, review from grade 3 foreground, middle ground, and background; and, for contrast, examine paintings that do not attempt to create an illusion of depth, for example, *Madonna and Child on a Curved Throne* (see Visual Arts 4: Art of the Middle Ages).

II. American Art: Nineteenth-Century United States

- Become familiar with the Hudson River School of landscape painting, including
  Thomas Cole, *The Oxbow* (*The Connecticut River Near Northampton*) (also known as *View from Mount Holyoke, Northampton, Massachusetts, after a Thunderstorm*)
  Albert Bierstadt, *Rocky Mountains, Lander's Peak*
- Become familiar with genre paintings, including
  George Caleb Bingham, *Fur Traders Descending the Missouri*
  William Sidney Mount, *Eel Spearing at Setauket*

- Become familiar with art related to the Civil War, including
  Civil War photography of Mathew Brady and his colleagues
  The Shaw Memorial sculpture of Augustus Saint-Gaudens
- Become familiar with popular prints by Currier and Ives.

See also American History 5: Civil War, *re* photographs by Brady; and African American troops in the Civil War: Shaw and the Massachusetts 54th, *re* Saint-Gaudens's *Shaw Memorial.*

III. Art of Japan

- Become familiar with
  The Great Buddha (also known as the Kamakura Buddha)
  Landscape gardens

See also World History 5: Feudal Japan.

Music: Grade 5

SEE INTRODUCTION, "The Arts in the Curriculum."

Teachers: In schools, lessons on music should feature activities and works that illustrate important musical concepts and terms, and should introduce important composers and works. When appropriate, topics in music may be linked to topics in other disciplines.

The following guidelines focus on content, not performance skills, though many concepts are best learned through active practice (singing, clapping rhythms, playing instruments, etc.).

I. Elements of Music

- Through participation, become familiar with basic elements of music (rhythm, melody, harmony, form, timbre, etc.).
  Recognize a steady beat, accents, and the downbeat; play a steady beat, a simple rhythm pattern, simultaneous rhythm patterns, and syncopation patterns.
  Discriminate between fast and slow; gradually slowing down and getting faster; *accelerando* and *ritardando.*
  Discriminate between differences in pitch: high and low.
  Discriminate between loud and soft; gradually increasing and decreasing volume; *crescendo* and *decrescendo.*
  Understand *legato* (smoothly flowing progression of notes) and *staccato* (crisp, distinct notes).
  Sing unaccompanied, accompanied, and in unison.
  Recognize harmony; sing rounds and canons; two- and three-part singing.
  Recognize introduction, interlude, and coda in musical selections.
  Recognize verse and refrain.
  Continue work with timbre and phrasing.
  Recognize theme and variations.
  Sing or play simple melodies while reading scores.

- Understand the following notation and terms:

  names of lines and spaces in the treble clef; middle C

  𝄞 treble clef, 𝄚 staff, bar line, double bar line, measure, repeat signs

  𝅝 whole note 𝅗𝅥 half note ♩ quarter note ♪ eighth note

  whole rest, half rest, quarter rest, eighth rest

  𝅘𝅥𝅯𝅘𝅥𝅯𝅘𝅥𝅯𝅘𝅥𝅯 grouped sixteenth notes

  tied notes and dotted notes

  ♯ sharps ♭ flats

  Da capo [D.C.] *al fine*

  meter signature $\frac{4}{4}$ $\frac{2}{4}$ $\frac{3}{4}$ or common time $\frac{2}{4}$ $\frac{3}{4}$ $\frac{6}{8}$

  soft ***pp*** ***p*** ***mp*** loud ***mf*** ***f*** ***ff***

II. Listening and Understanding

Teachers: Expose children to a wide range of music, including children's music, popular instrumental music, and music from various cultures.

A. COMPOSERS AND THEIR MUSIC

Teachers: Provide brief, child-friendly biographical profiles of the following composers, and listen to representative works:

Note: Children were introduced to Beethoven in grade 2.

- Ludwig van Beethoven, *Symphony No. 5*
- Modest Mussorgsky, *Pictures at an Exhibition* (as orchestrated by Ravel)

B. MUSICAL CONNECTIONS

Teachers: Introduce children to the following works in connection with topics in other disciplines:

See also below, Songs, "Greensleeves"; and see World History 5: The Renaissance.

See also Language Arts 5: Shakespeare's *A Midsummer Night's Dream.*

- Music from the Renaissance (such as choral works of Josquin Desprez; lute songs by John Dowland)
- Felix Mendelssohn, Overture, Scherzo, and Wedding March from *A Midsummer Night's Dream*

III. American Musical Traditions

Note: Spirituals introduced in earlier grades include "Swing Low, Sweet Chariot," "He's Got the Whole World in His Hands," and "This Little Light of Mine."

- Spirituals

  Originated by African-Americans, many spirituals go back to the days of slavery. Familiar spirituals, such as:

  Down by the Riverside
  Sometimes I Feel Like a Motherless Child
  Wayfaring Stranger
  We Shall Overcome

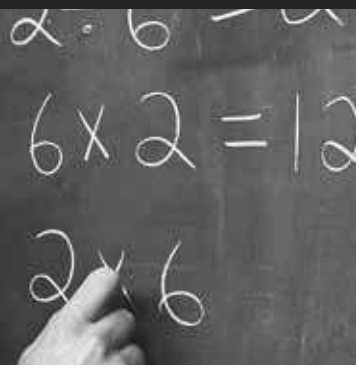
IV. Songs

See also above, III. American Musical Traditions, Spirituals.

See also American History 5: Civil War, *re* "Battle Hymn of the Republic." Also, you may wish to recall songs from grade 2: "Dixie," "Follow the Drinking Gourd," and "When Johnny Comes Marching Home."

Battle Hymn of the Republic
Danny Boy
Dona Nobis Pacem (round)
Git Along Little Dogies
God Bless America
Greensleeves
The Happy Wanderer
Havah Nagilah
If I Had a Hammer
Red River Valley
Sakura
Shenandoah
Sweet Betsy from Pike

Mathematics: Grade 5



Teachers: Mathematics has its own vocabulary and patterns of thinking. It is a discipline with its own language and conventions. Thus, while some lessons may offer occasional opportunities for linking mathematics to other disciplines, it is critically important to attend to math as math. From the earliest years, mathematics requires incremental review and steady practice: not only the diligent effort required to master basic facts and operations, but also thoughtful and varied practice that approaches problems from a variety of angles, and gives children a variety of opportunities to apply the same concept or operation in different types of situations. While it is important to work toward the development of "higher-order problem-solving skills," it is equally important—indeed, it is prerequisite to achieving "higher order" skills—to have a sound grasp of basic facts, and an automatic fluency with fundamental operations.

I. Numbers and Number Sense

- Read and write numbers (in digits and words) up to the billions.
- Recognize place value up to billions.
- Order and compare numbers to 999,999,999 using the signs <, >, and = .
- Write numbers in expanded form.
- Integers
  - Locate positive and negative integers on a number line.
  - Compare integers using the symbols <, >, = .
  - Know that the sum of an integer and its opposite is 0.
  - Add and subtract positive and negative integers.
- Using a number line, locate positive and negative whole numbers.
- Round to the nearest ten; to the nearest hundred; to the nearest thousand; to the nearest hundred thousand.
- Exponents
  - Review perfect squares and square roots to 144; recognize the square root sign, $\sqrt{\ }$.
  - Using the terms *squared* and *cubed* and *to the nth power*, read and evaluate numerical expressions with exponents.
  - Identify the powers of ten up to 10^6.
- Identify a set and the members of a set, as indicated by { }.
- Identify numbers under 100 as prime or composite.
- Identify prime factors of numbers to 100 and write using exponential notation for multiple primes.
- Determine the greatest common factor (GCF) of given numbers.
- Determine the least common multiple (LCM) of given numbers.

II. Ratio and Percent

A. RATIO

- Determine and express simple ratios.
- Use ratio to create a simple scale drawing.
- Ratio and rate: solve problems on speed as a ratio, using the formula S = D/T (or D = R x T).

B. PERCENT

- Recognize the percent sign (%) and understand percent as "per hundred."
- Express equivalences between fractions, decimals, and percents, and know common equivalences:
  - $\frac{1}{10}$ = 10%
  - $\frac{1}{4}$ = 25%
  - $\frac{1}{2}$ = 50%
  - $\frac{3}{4}$ = 75%
- Find the given percent of a number.

III. Fractions and Decimals

A. FRACTIONS

- Determine the least common denominator (LCD) of fractions with unlike denominators.
- Recognize equivalent fractions (for example, $\frac{1}{2} = \frac{3}{6}$).
- Put fractions in lowest terms.
- Compare fractions with like and unlike denominators, using the signs <, >, and = .
- Identify the reciprocal of a given fraction; know that the product of a given number and its reciprocal = 1.
- Add and subtract mixed numbers and fractions with like and unlike denominators.
- Multiply and divide fractions.
- Add and subtract fractions with like and unlike denominators.
- Add and subtract mixed numbers and fractions; multiply mixed numbers and fractions.
- Round fractions to the nearest whole number.
- Write fractions as decimals (e.g., $\frac{1}{4} = 0.25$; $\frac{17}{25} = 0.68$; $\frac{1}{3} = 0.3333\ldots$ or 0.33, rounded to the nearest hundredth).

B. DECIMALS

- Read, write, and order decimals to the nearest ten-thousandth.
- Write decimals in expanded form.
- Read and write decimals on a number line.
- Round decimals (and decimal quotients) to the nearest tenth; to the nearest hundredth; to the nearest thousandth.
- Estimate decimal sums, differences, and products by rounding.
- Add and subtract decimals through ten-thousandths.
- Multiply decimals: by 10, 100, and 1,000; by another decimal.
- Divide decimals by whole numbers and decimals.

IV. Computation

A. ADDITION

- Commutative and associative properties: know the names and understand the properties.

B. MULTIPLICATION

- Commutative, associative, and distributive properties: know the names and understand the properties.
- Multiply two factors of up to four digits each.
- Write numbers in expanded form using multiplication.
- Estimate a product.
- Use mental computation strategies for multiplication, such as breaking a problem into partial products, for example: 3 x 27 = (3 x 20) + (3 x 7) = 60 + 21 = 81.
- Solve word problems involving multiplication.

C. DIVISION

- Understand multiplication and division as inverse operations.
- Know what it means for one number to be "divisible" by another number.
- Know that you cannot divide by 0; that any number divided by 1 = that number.
- Estimate the quotient.
- Know how to move the decimal point when dividing by 10, 100, or 1,000.
- Divide dividends up to four digits by one-digit, two-digit, and three-digit divisors.
- Solve division problems with remainders; round a repeating decimal quotient.
- Check division by multiplying (and adding remainder).

D. SOLVING PROBLEMS AND EQUATIONS

- Solve word problems with multiple steps.
- Solve problems with more than one operation.

V. Measurement

Teachers: Review and reinforce as necessary from grade 4 topics on linear measure, weight, and capacity (volume). Also review various equivalences, which students should be able to recall from memory.

- Convert to common units in problems involving addition and subtraction of different units.
- Time: Solve problems on elapsed time; regroup when multiplying and dividing amounts of time.

VI. Geometry

- Identify and draw points, segments, rays, lines.
- Identify and draw lines: horizontal; vertical; perpendicular; parallel; intersecting.
- Measure the degrees in angles, and know that
  right angle = 90° acute angle: less than 90°
  obtuse angle: greater than 90° straight angle = 180°
- Identify and construct different kinds of triangles: equilateral, right, and isosceles.
- Know what it means for triangles to be congruent.
- Identify polygons:
  triangle, quadrilateral, pentagon, hexagon, and octagon
  parallelogram, trapezoid, rhombus, rectangle, square
- Know that regular polygons have sides of equal length and angles of equal measure.
- Identify and draw diagonals of polygons.
- Circles
  Identify arc, chord, radius (plural: radii), and diameter (radius = $\frac{1}{2}$ diameter).
  Using a compass, draw circles with a given diameter or radius.
  Find the circumference of a circle using the formulas $C = \pi d$, and $C = 2 \pi r$, using 3.14 as the value of *pi*.
- Area
  Review the formula for the area of a rectangle (Area = length x width) and solve problems involving finding area in a variety of square units (such as mi^2; yd^2; ft^2; in^2; km^2; m^2; cm^2; mm^2).
  Find the area of triangles, using the formula $A = \frac{1}{2}(b \times h)$.
  Find the area of a parallelogram using the formula $A = b \times h$.
  Find the area of an irregular figure (such as a trapezoid) by dividing into regular figures for which you know how to find the area.
  Compute volume of rectangular prisms in cubic units (cm^3, in^3), using the formula $V = l \times w \times h$.
  Find the surface area of a rectangular prism.

VII. Probability and Statistics

- Understand probability as a measure of the likelihood that an event will happen; using simple models, express probability of a given event as a fraction, as a percent, and as a decimal between 0 and 1.
- Collect and organize data in graphic form (bar, line, and circle graphs).
- Solve problems requiring interpretation and application of graphically displayed data.
- Find the average (mean) of a given set of numbers.
- Plot points on a coordinate plane, using ordered pairs of positive and negative whole numbers.
- Graph simple functions.

VIII. Pre-Algebra

- Recognize variables and solve basic equations using variables.
- Write and solve equations for word problems.
- Find the value of an expression given the replacement values for the variables, for example: What is $7 - c$ if c is 3.5?

Science: Grade 5

Teachers: Effective instruction in science requires hands-on experience and observation. In the words of the 1993 report from the American Association for the Advancement of Science, Benchmarks for Science Literacy, "From their very first day in school, students should be actively engaged in learning to view the world scientifically. That means encouraging them to ask questions about nature and to seek answers, collect things, count and measure things, make qualitative observations, organize collections and observations, discuss findings, etc."

While experience counts for much, book learning is also important, for it helps bring coherence and order to a child's scientific knowledge. Only when topics are presented systematically and clearly can children make steady and secure progress in their scientific learning. The child's development of scientific knowledge and understanding is in some ways a very disorderly and complex process, different for each child. But a systematic approach to the exploration of science, one that combines experience with book learning, can help provide essential building blocks for deeper understanding at a later time.

I. Classifying Living Things

Teachers: As the children study animal classification, discuss: Why do we classify? How does classification help us understand the natural world?

- Scientists have divided living things into five large groups called kingdoms, as follows:
  Plant
  Animal
  Fungus (mushrooms, yeast, mold, mildew)
  Protist (algae, protozoans, amoeba, euglena)
  Moneran, also called Prokaryote (bacteria, blue-green algae/cyano bacteria)
- Each kingdom is divided into smaller groupings as follows:
  Kingdom
  Phylum
  Class
  Order
  Family
  Genus
  Species
  (Variety)

Note: A useful mnemonic device is "King Philip Came Over For Good Spaghetti."

- When classifying living things, scientists use special names made up of Latin words (or words made to sound like Latin words), which help scientists around the world understand each other and ensure that they are using the same names for the same living things.
  Homo sapiens: the scientific name for the species to which human beings belong (genus *Homo*, species *sapiens*)
  Taxonomists: biologists who specialize in classification
- Different classes of vertebrates and major characteristics: fish, amphibians, reptiles, birds, mammals (review from grade 3)

Teachers: Introduce an example of how an animal is classified, in order for students to become familiar with the system of classification, not to memorize specific names. For example, a collie dog is classified as follows:

Kingdom: Animalia
Phylum: Chordata (Subphylum: Vertebrata)
Class: Mammalia (mammal)
Order: Carnivora (eats meat)

Family: Canidae (a group with doglike characteristics)
Genus: *Canis* (a coyote, wolf, or dog)
Species: *familiaris* (a domestic dog)
Variety: Collie

II. Cells: Structures and Processes

Note: Students will study cell division in more detail, including the processes of mitosis and meiosis, in grade 7.

See below, III. B, Photosynthesis *re* plant cells.

- All living things are made up of cells.
- Structure of cells (both plant and animal)
  - Cell membrane: selectively allows substances in and out
  - Nucleus: surrounded by nuclear membrane, contains genetic material, divides for reproduction
  - Cytoplasm contains organelles, small structures that carry out the chemical activities of the cell, including mitochondria (which produce the cell's energy) and vacuoles (which store food, water, or wastes).
- Plant cells, unlike animal cells, have cell walls and chloroplasts.
- Cells without nuclei: monerans (bacteria)
- Some organisms consist of only a single cell: for example, amoeba, protozoans, some algae.
- Cells are shaped differently in order to perform different functions.
- Organization of cells into tissues, organs, and systems:
  - In complex organisms, groups of cells form tissues (for example, in animals, skin tissue or muscle tissue; in plants, the skin of an onion or the bark of a tree).
  - Tissues with similar functions form organs (for example, in some animals, the heart, stomach, or brain; in some plants, the root or flower).
  - In complex organisms, organs work together in a system (recall, for example, from earlier studies of the human body, the digestive, circulatory, and respiratory systems).

III. Plant Structures and Processes

A. STRUCTURE: NON-VASCULAR AND VASCULAR PLANTS

- Non-vascular plants (for example, algae)
- Vascular plants
  - Vascular plants have tubelike structures that allow water and dissolved nutrients to move through the plant.
  - Parts and functions of vascular plants: roots, stems and buds, leaves

B. PHOTOSYNTHESIS

- Photosynthesis is an important life process that occurs in plant cells, but not animal cells (photo = light; synthesis = putting together). Unlike animals, plants make their own food, through the process of photosynthesis.
- Role in photosynthesis of: energy from sunlight, chlorophyll, carbon dioxide and water, xylem and phloem, stomata, oxygen, sugar (glucose)

C. REPRODUCTION

See below, IV. Life Cycles and Reproduction: asexual and sexual reproduction.

- Asexual reproduction
  - Example of algae
  - Vegetative reproduction: runners (for example, strawberries) and bulbs (for example, onions), growing plants from eyes, buds, leaves, roots, and stems
- Sexual reproduction by spore-bearing plants (for example, mosses and ferns)
- Sexual reproduction of non-flowering seed plants: conifers (for example, pines), male and female cones, wind pollination
- Sexual reproduction of flowering plants (for example, peas)
  - Functions of sepals and petals, stamen (male), anther, pistil (female), ovary (or ovule)

Process of seed and fruit production: pollen, wind, insect and bird pollination, fertilization, growth of ovary, mature fruit

Seed germination and plant growth: seed coat, embryo and endosperm, germination (sprouting of new plant), monocots (for example, corn) and dicots (for example, beans)

IV. Life Cycles and Reproduction

A. THE LIFE CYCLE AND REPRODUCTION

- Life cycle: development of an organism from birth to growth, reproduction, death
  Example: Growth stages of a human: embryo, fetus, newborn, infancy, childhood, adolescence, adulthood, old age
- All living things reproduce themselves. Reproduction may be asexual or sexual.
  Examples of asexual reproduction: fission (splitting) of bacteria, spores from mildews, molds, and mushrooms, budding of yeast cells, regeneration and cloning
  Sexual reproduction requires the joining of special male and female cells, called gametes, to form a fertilized egg.

B. SEXUAL REPRODUCTION IN ANIMALS

- Reproductive organs: testes (sperm) and ovaries (eggs)
- External fertilization: spawning
- Internal fertilization: birds, mammals
- Development of the embryo: egg, zygote, embryo, growth in uterus, fetus, newborn

V. The Human Body

A. CHANGES IN HUMAN ADOLESCENCE

- Puberty
  Glands and hormones (see below, Endocrine System), growth spurt, hair growth, breasts, voice change

B. THE ENDOCRINE SYSTEM

- The human body has two types of glands: duct glands (such as the salivary glands), and ductless glands, also known as endocrine glands.
- Endocrine glands secrete (give off) chemicals called hormones. Different hormones control different body processes.
- Pituitary gland: located at the bottom of the brain; secretes hormones that control other glands, and hormones that regulate growth
- Thyroid gland: located below the voice box; secretes a hormone that controls the rate at which the body burns and uses food
- Pancreas: both a duct and ductless gland; secretes a hormone called insulin that regulates how the body uses and stores sugar; when the pancreas does not produce enough insulin, a person has a sickness called diabetes (which can be controlled)
- Adrenal glands: secrete a hormone called adrenaline, especially when a person is frightened or angry, causing rapid heartbeat and breathing

C. THE REPRODUCTIVE SYSTEM

- Females: ovaries, fallopian tubes, uterus, vagina, menstruation
- Males: testes, scrotum, penis, urethra, semen
- Sexual reproduction: intercourse, fertilization, zygote, implantation of zygote in the uterus, pregnancy, embryo, fetus, newborn

Note: There is some flexibility in the grade-level placement of the study of topics relating to human reproduction, as different schools and districts have differing local requirements, typically introducing these topics in either fifth or sixth grade.

VI. Chemistry: Matter and Change

A. ATOMS, MOLECULES, AND COMPOUNDS

- Basics of atomic structure: nucleus, protons (positive charge), neutrons (neutral), electrons (negative charge)
- Atoms are constantly in motion, electrons move around the nucleus in paths called shells (or energy levels).
- Atoms may join together to form molecules and compounds.
- Common compounds and their formulas:
  water H_2O
  salt NaCl
  carbon dioxide CO_2

B. ELEMENTS

Note: Students will examine the relation between the periodic table and atomic structure in more detail in grade 7.

- Elements have atoms of only one kind, having the same number of protons. There are a little more than 100 different elements.
- The Periodic Table: organizes elements with common properties
  Atomic symbol and atomic number
- Some well-known elements and their symbols:

Hydrogen	H
Helium	He
Carbon	C
Nitrogen	N
Oxygen	O
Sodium	Na
Aluminum	Al
Silicon	Si
Chlorine	Cl
Iron	Fe
Copper	Cu
Silver	Ag
Gold	Au

- Two important categories of elements: metals and non-metals
  Metals comprise about $\frac{2}{3}$ of the known elements.
  Properties of metals: most are shiny, ductile, malleable, conductive

C. CHEMICAL AND PHYSICAL CHANGE

Note: Qualitative description and investigation of chemical change is sufficient at this grade level.

- Chemical change changes what a molecule is made up of and results in a new substance with a new molecular structure. Examples of chemical change: rusting of iron, burning of wood, milk turning sour
- Physical change changes only the properties or appearance of the substance, but does not change what the substance is made up of. Examples of physical change: cutting wood or paper, breaking glass, freezing water

VII. Science Biographies

See also World History 5: The Renaissance, *re* Galileo. See above, Classifying Living Things, *re* Linnaeus; Cells, *re* Ernest Just; Human Body—Endocrine System (Hormones), *re* Percy Lavon Julian.

Galileo ("Father of modern science" who provided scientific support for Copernicus's sun-centered universe)
Percy Lavon Julian (biologist and inventor who developed synthetic cortisone to treat arthritis pain)
Ernest Just (biologist and medical pioneer who specialized in studying cells and reproduction in marine animals)
Carl Linnaeus (botanist and "Father of taxonomy" who standardized the classification system)