Colquitt County Biology Pacing Guide 2020-2021

(Unit indexes are linked through unit titles.)

Unit	Standards	Time	Textbook Chapters
Unit 1a: Biology Basics Unit 1b: Macromolecules	Lab practices, 7 traits to be considered living, levels of organisms and biochem **SB1c.Construct arguments** supported by evidence to relate the structure of macromolecules (carbohydrates, proteins, lipids, and nucleic acids) to their interactions in carrying out cellular processes. (Clarification statement: The function of proteins as enzymes is limited to a conceptual understanding.)	1 ½ weeks A 2 ½ weeks B	Chapter 1 & 2
Unit 2a: Cells and Cell Transport	**SB1a. Construct an explanation** of how cell structures and organelles (including nucleus, cytoplasm, cell membrane, cell wall, chloroplasts, lysosome, Golgi, endoplasmic reticulum, vacuoles, ribosomes, and mitochondria) interact as a system to maintain homeostasis. **SB1d.Plan and carry out investigations** to determine the role of cellular transport (e.g., active, passive, and osmosis) in maintaining homeostasis.	3 Weeks	Chapter 8
Unit 2b: Cell Energetics	**SB1e.Ask questions to investigate and provide explanations** about the roles of photosynthesis and respiration in the cycling of matter and flow of energy within the cell (e.g., single-celled alga). (Clarification statement: Instruction should focus on understanding the inputs, outputs, and functions of photosynthesis and respiration and the functions of the major sub-processes of each including glycolysis, Krebs cycle, electron transport chain, light reactions, and Calvin cycle.)	3 weeks	Chapter 9 and 10
Unit 3: Cell Cycle, Mitosis	**SB1b.Develop and use models to explain** the role of cellular reproduction (including binary fission, mitosis, and meiosis) in maintaining genetic continuity.	2 weeks	Chapter 11
Unit 4: DNA and Protein Synthesis	**SB2a. Construct an explanation** of how the structures of DNA and RNA lead to the expression of information within the cell via the processes of replication, transcription, and translation.	3 weeks	Chapter 13 and 14
Unit 5a: Mendelian Genetics And non-mendelian	**SB3a.Use Mendel's laws (segregation and independent assortment) to ask questions and define problems** that explain the role of meiosis in reproductive variability. **SB3b. Use mathematical models to predict and explain patterns** of inheritance. (Clarification statement: Students should be able to use Punnett squares (monohybrid and dihybrid crosses) and/or rules of probability, to analyze the following inheritance patterns: dominance, codominance, incomplete dominance.) **SB3c. Construct an argument to support a claim** about the relative advantages and disadvantages of sexual and asexual reproduction.	3 weeks	Chapter 12

Unit 5b: Genetics and Meiosis & Biotechnology	**SB2b. Construct an argument based on evidence** to support the claim that inheritable genetic variations may result from: new genetic combinations through meiosis (crossing over, nondisjunction); non-lethal errors occurring during replication (insertions, deletions, substitutions); and/or heritable mutations caused by environmental factors (radiation, chemicals, and viruses) **SB2c.Ask questions to gather and communicate information** about the use and ethical considerations of biotechnology in forensics, medicine, and agriculture. (Clarification statement: The element is intended to include advancements in technology relating to economics and society such as advancements may include Genetically Modified Organisms.)	2 weeks	Chapter 12
Unit 6: Evolution and Natural Selection	**SB6a. Construct an explanation** of how new understandings of Earth's history, the emergence of new species from pre-existing species, and our understanding of genetics have influenced our understanding of biology. **SB6b. Analyze and interpret data to explain patterns** in biodiversity that result from speciation. **SB6c. Construct an argument using valid and reliable sources** to support the claim that evidence from comparative morphology (analogous vs. homologous structures), embryology, biochemistry (protein sequence) and genetics support the theory that all living organisms are related by way of common descent. **SB6d. Develop and use mathematical models to support explanations** of how undirected genetic changes in natural selection and genetic drift have led to changes in populations of organisms. (Clarification statement: Element is intended to focus on basic statistical and graphic analysis. Hardy Weinberg would be an optional application to address this element.) **SB6e. Develop a model to explain** the role natural selection plays in causing biological resistance (e.g., pesticides, antibiotic resistance, and influenza vaccines).	5 weeks	Chapter 20, 17, 18, 19
Unit 7: Classification	**SB4a. Construct an argument supported by scientific information** to explain patterns in structures and function among clades of organisms, including the origin of eukaryotes by endosymbiosis. Clades should include: archaea bacteria eukaryotes fungi plants animals (Clarification statement: This is reflective of 21st century classification schemes and nested hierarchy of clades and is intended to develop a foundation for comparing major groups of organisms. The term 'protist' is useful in describing those eukaryotes that are not within the animal, fungal or plant clades but the term does not describe a well-defined clade or a natural taxonomic group.) **SB4b. Analyze and interpret data to develop models** (i.e., cladograms and phylogenetic trees) based on patterns of common ancestry and the theory of evolution to determine relationships among major groups of organisms.	4 weeks	Chapter 19, 21, 22.2 24.1,
Unit 8:	**SB5a.Plan and carry out investigations and analyze data** to support	7 weeks	Chapter 4,5,

Ecology	explanations about factors affecting biodiversity and populations in ecosystems. (Clarification statement: Factors include population size, carrying capacity, response to limiting factors, and keystone species.) **SB5b. Develop and use models to analyze** the cycling of matter and flow of energy within ecosystems through the processes of photosynthesis and respiration. Arranging components of a food web according to energy flow. Comparing the quantity of energy in the steps of an energy pyramid. Explaining the need for cycling of major biochemical elements (C, O, N, P, and H). **SB5c. Construct an argument to predict** the impact of environmental change on the stability of an ecosystem. **SB5d. Design a solution** to reduce the impact of a human activity on the environment. (Clarification statement: Human activities may include chemical use, natural resources consumption, introduction of non-native species, greenhouse gas production.) **SB5e. Construct explanations** that predict an organism's ability to survive within changing environmental limits (e.g., temperature, pH, drought, fire).		6, 7
EOC Review	ALL UNITS		

Additional Resources

State Standards
https://www.georgiastandards.org/Georgia-Standards/Documents/Science-Biology-Georgia-Standards.pdf

GPB
https://www.gpb.org/education/learn

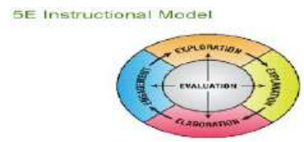
Discovery Education
https://www.discoveryeducation.com/

Achievement Level Descriptors
https://www.gadoe.org/Curriculum-Instruction-and-Assessment/Assessment/Documents/Milestones/ALD/ALDS_for_Milestones_EOC_Biology_12.2017.pdf

Content Weights
https://www.gadoe.org/Curriculum-Instruction-and-Assessment/Assessment/Documents/Milestones/Content%20Weights/ContentWeights_EOCCharts_August_2019.pdf

Georgia Study Guide for Parents and Students
https://www.gadoe.org/Curriculum-Instruction-and-Assessment/Assessment/Documents/Milestones/Study-Resource%20Guides/Study_Guide_GRHS_BIOL_2020.pdf

Science Instructional Framework

5 E Instructional Model

The 5E instructional model is built on the idea that learners build on and construct new ideas on top of their old ones. Advantages of the 5E model include: Enhancing mastery of subject matter,Developing scientific reasoning, Understanding the complexity and ambiguity of empirical work, Developing practical skills, Understanding the nature of science, Cultivating interest in science and interest in learning science,Developing teamwork abilities.

Engagement	Exploration	Explanation	Extend/Elaboration	Evaluation
Teacher generates interest, assess prior knowledge, connects prior knowledge, sets instructional focus on the concept,	Students experience key concepts, learn new skills, asking question,reflect on their thinking and develop relationships and understanding of concepts	Connecting prior knowledge to new content/discoveries, use of academic language, teacher and students work together	Apply learning to similar situations, explain new situation with formal academic language,	Should be ongoing throughout the learning phase, shows evidence of accomplishment,Teacher, peer and self assessments
Teacher actions: Motivates, creates interest, raises questions, taps into prior knowledge	**Teacher actions:** Moves into a facilitator role, observes students, asks guiding questions, encourages teamwork, provides materials and resources, provide adequate time for students to engage with the materials	**Teacher actions:** Encourages students to explain understandings in their own words, provides explanations of definitions, laws, theories, ask clarifying questions, builds onto students understanding, provide a variety of instructional strategies, develop academic language, formative assessments to gauge understanding	**Teacher actions:** Provide an opportunity for students to apply their new gained information to enhance additional learning, remind students to look for alternative ways to solve the problem,providing guidance on perseverance	**Teacher actions:** Observes students, asks open-ended questions,assess students, encourages students to self assess
Student actions: Ask questions, attentive to teacher/classmates, makes connections to prior learning, self reflects on what they already know, what do they want to know	**Student actions:** Conducts experiments, activities, work with groups to make meaning of the problem, record observations, use journals, listen to others ideas,	**Student actions:** Explain solutions, critiques or ask further questions of others solutions,refers back to notes and journals to communicate findings and understanding, self assesses their own learning	**Student actions:** Generates interest in new learning, explore related content, records observations and interacts with peers to broaden one's o	**Student actions:** Self evaluates, uses academic language, demonstrates understanding of concept, solves problems
Example: Topic : Observe and describe the process of erosion, transportation, and deposition of the earth's land surface using natural phenomena and models Materials : paint tray (the kind used for a paint roller), pieces of sod	**Example:** Construct a model to investigate how these changes may have occurred. Provide materials so the students can construct their own model of a landscape. It should include a piece of sod, fine potting soil, and a heavy clay like soil. Have	**Example:** Tell me what some of your predictions were before it rained on your landscape. (Record on board.) What actually happened to your landscape when it rained on it? (record so you can make comparisons.) How is your landscape	**Example:** Using the same paint roller tray as the base for their landscape, have the groups of students plan a method to decrease or eliminate erosion. Students should draw a diagram of the model planned and label the materials used in their	**Example:** Have photographs representing each process and have students identify and explain why they identified it as such. Have students take a walk in their own neighborhood tonight to find examples of each

(enough for each group), potting soil, heavy clay like soil, Rainmaker (paper cup with about ten tiny holes poked in the bottom) , Water. Activity 1.bottom of slide under swing 2.end of splash guard by rain spout at entrance to door 3. path leading to the playground at the bottom of hill/slope Do you notice anything different about these areas? (They are just dirt; no grass is growing here.) What do you think caused these changes? (Students walking over them; water running through it)	them use a paint roller tray as the base of the landscape. Do not put any landscape materials in the bottom well; it should remain empty. Once students have constructed their models, have them diagram and label their models and make a prediction as to what will happen if it "rains" on their landscape. One student pours a cup of water all at once into the rainmaker. Hold the rainmaker about 4 inches above the upper end of the landscape and slowly move it back and forth so the water "rains" down on the model landscape. Observe what happens to the landscape. When it is finished raining the students observe the final effects of the rain on their landscape. Have students go back to their predictions and record what actually happened.	different after the rain than before it rained on it? What happened to the soil? Where did it go? Why did this happen? As students share their ideas and understandings, record key phrases on the board. Some phases that may be valuable to your later discussion may include:dirt and soil washed away,the soil collected at the bottom of the slope,the water hollowed out the soil, the rain carried the soil down the hill,when the water washed away the soil it formed a hole Relate their observations to the processes scientists observe over an extended period of time. Use student models to identify and label erosion and deposition. Have students work to create definitions for these terms. When you are sure students have a real understanding of the terms, formulate a final definition and post on board or chart in the classroom for future reference. Demonstrate the process of transportation and lead students to understand that it is the movement of soil particles from one place to another. Refer to the list generated during the engagement and have students make connections; they should use the new terms to discuss and explain what they saw. Help them to understand that they just used water to simulate erosion, transportation, and deposition, but it can also be caused by wind, people, animals, etc.	landscape. They should write a short explanation explaining why they think this will work to curb erosion. (Tell students that you will provide the same materials that they used today and they are responsible for supplying the rest of the materials to build their new landscape tomorrow.) Have students use a variety of resources and references to research various landmarks that are the result of these processes.	process. They should draw and write one sentence telling what they observed. Have students write their own definition and list an example for each process in their science journals.

Science and Engineering Practices

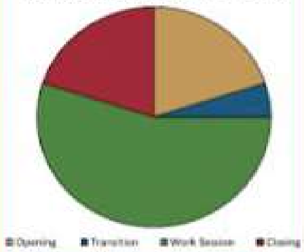
Asking questions and defining problems	Developing and using models
A practice of science is to ask and refine questions that lead to	A practice of both science and engineering is to use and

descriptions and explanations of how the natural and designed world(s) works and which can be empirically tested. Engineering questions clarify problems to determine criteria for successful solutions and identify constraints to solve problems about the designed world. Both scientists and engineers also ask questions to clarify ideas.	construct models as helpful tools for representing ideas and explanations. These tools include diagrams, drawings, physical replicas, mathematical representations, analogies, and computer simulations. Modeling tools are used to develop questions, predictions and explanations; analyze and identify flaws in systems; and communicate ideas. Models are used to build and revise scientific explanations and proposed engineered systems. Measurements and observations are used to revise models and designs.
Planning and carrying out investigations	Using mathematics and computational thinking
Scientists and engineers plan and carry out investigations in the field or laboratory, working collaboratively as well as individually. Their investigations are systematic and require clarifying what counts as data and identifying variables or parameters. Engineering investigations identify the effectiveness, efficiency, and durability of designs under different conditions	In both science and engineering, mathematics and computation are fundamental tools for representing physical variables and their relationships. They are used for a range of tasks such as constructing simulations; solving equations exactly or approximately; and recognizing, expressing, and applying quantitative relationships. Mathematical and computational approaches enable scientists and engineers to predict the behavior of systems and test the validity of such predictions.
Analyzing and interpreting data	Constructing explanations and designing solutions
Scientific investigations produce data that must be analyzed in order to derive meaning. Because data patterns and trends are not always obvious, scientists use a range of tools—including tabulation, graphical interpretation, visualization, and statistical analysis—to identify the significant features and patterns in the data. Scientists identify sources of error in the investigations and calculate the degree of certainty in the results. Modern technology makes the collection of large data sets much easier, providing secondary sources for analysis. Engineering investigations include analysis of data collected in the tests of designs. This allows comparison of different solutions and determines how well each meets specific design criteria— that is, which design best solves the problem within given constraints. Like scientists, engineers require a range of tools to identify patterns within data and interpret the results. Advances in science make analysis of proposed solutions more efficient and effective.	The end-products of science are explanations and the end-products of engineering are solutions. The goal of science is the construction of theories that provide explanatory accounts of the world. A theory becomes accepted when it has multiple lines of empirical evidence and greater explanatory power of phenomena than previous theories. The goal of engineering design is to find a systematic solution to problems that is based on scientific knowledge and models of the material world. Each proposed solution results from a process of balancing competing criteria of desired functions, technical feasibility, cost, safety, aesthetics, and compliance with legal requirements. The optimal choice depends on how well the proposed solutions meet criteria and constraints.
Engaging in argument from evidence	Obtaining, evaluating, and communicating information
Argumentation is the process by which evidence-based conclusions and solutions are reached. In science and engineering, reasoning and argument based on evidence are essential to identifying the best explanation for a natural phenomenon or the best solution to a design problem. Scientists and engineers use argumentation to listen to, compare, and evaluate competing ideas and methods based on merits. Scientists and engineers engage in argumentation when investigating a phenomenon, testing a design solution, resolving questions about measurements, building data models, and using evidence to evaluate claims	Scientists and engineers must be able to communicate clearly and persuasively the ideas and methods they generate. Critiquing and communicating ideas individually and in groups is a critical professional activity. Communicating information and ideas can be done in multiple ways: using tables, diagrams, graphs, models, and equations as well as orally, in writing, and through extended discussions. Scientists and engineers employ multiple sources to obtain information that is used to evaluate the merit and validity of claims, methods, and designs

The Science Standards-Based Classroom Instructional Framework provides a common language of instruction in order to successfully implement high quality practices. The tool can be used to develop lesson plans as well as a guide for teachers to reference during instruction. It is imperative that an opening, transition, work and closing is addressed with each lesson.

SCIENCE
STANDARDS-BASED CLASSROOM
INSTRUCTIONAL FRAMEWORK

Instructional Framework



Time will vary based on instructional focus

PERVASIVE LESSON PRACTICES

Teacher will embed pervasive practices throughout lesson based on instructional focus

Literacy Across the Content:
- Disciplinary literacy
- Content literacy
- Close reading
- Disciplinary research/ reading to learn

Writing Across the Content
- Content writing
- Writing process
- Writing to learn

Vocabulary Development:
- Academic vocabulary
- Content vocabulary
- Discipline vocabulary
- Engages in three-dimensional learning

Formative Assessment:
- Formal assessments
- Informal assessments
- Standards-based feedback

Classroom Culture:
- Models practices and procedures
- Encourages risk-taking and collaboration
- Demonstrates high expectations in classroom discourse
- Emphasizes safety practices

OPENING

Teacher:
- Introduces phenomena to engage students in investigations
- Engages students/accesses prior knowledge and makes connections by encouraging them to ask questions
- Provides explicit instruction aligned to standard(s), including skill development and conceptual understanding
- Models science and engineering practices and questioning based on crosscutting concepts

Student:
- Accesses prior knowledge
- Asks thought-provoking and clarifying questions.
- Participates in classroom discussions; engages in investigations and analyzes thinking

TRANSITION TO WORK SESSION

Teacher:
- Provides guidance to engage in exploration of phenomena
- Helps students in identifying routines to engage in collaboration
- Introduces organizing tools
- Reviews success criteria and expectations for work

Student:
- Engages in exploration of phenomena
- Participates in discussion
- Prepares organizing tools
- Asks questions or define problems

WORK SESSION

Teacher:
- Facilitates independent and small group work; scaffolds learning tasks
- Engages students in the 3-dimensions of science instruction
- Monitors, assesses and documents student progress and provides standards-based feedback
- Provides small group instruction
- Allows students to engage in productive struggle, make mistakes, and engage in error analysis
- Conferences formally and informally with students

Student:
- Engages in independent or collaborative learning
- Demonstrates proficiency of science and engineering practices, crosscutting concepts and core disciplinary ideas
- Completes conceptually rich performance tasks, research or guided practice
- Conferences with teacher and receives standards-based feedback

CLOSING

Teacher:
- Formally or informally assesses student understanding
- Asks questions targeting students' explanations and claims to provide feedback
- Provides phenomena that challenges students' explanations
- Engages students in summarizing learning and celebrates progress toward mastery of standard(s)
- Identifies next steps for instruction based on data analysis

Student:
- Shares, assesses, and justifies work using language of the standards
- Provides peer feedback and asks clarifying questions using language of the standards
- Reflects and summarizes progress toward mastery of learning target/standard based on success criteria