**Purpose of Science Curriculum Maps**

This map is meant to help teachers and their support providers (e.g., coaches, leaders) on their path to effective, college and career ready (CCR) aligned instruction and our pursuit of Destination 2025.  It is a resource for organizing instruction around the TN State Standards, which define what to teach and what students need to learn at each grade level. The map is designed to reinforce the grade/course-specific standards and content—the major work of the grade (scope)—and provides *suggested* sequencing, pacing, time frames, and aligned resources. Our hope is that by curating and organizing a variety of standards-aligned resources, teachers will be able to spend less time wondering what to teach and searching for quality materials (though they may both select from and/or supplement those included here) and have more time to plan, teach, assess, and reflect with colleagues to continuously improve practice and best meet the needs of their students.

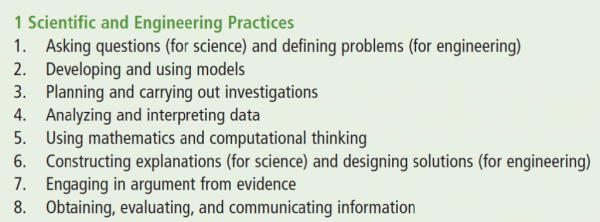
 The map is meant to support effective planning and instruction to rigorous standards. It is *not* meant to replace teacher planning, prescribe pacing or instructional practice.  In fact, our goal is not to merely “cover the curriculum,” but rather to “uncover” it by developing students’ deep understanding of the content and mastery of the standards.  Teachers who are knowledgeable about and intentionally align the learning target (standards and objectives), topic, text(s), task, and needs (and assessment) of the learners are best-positioned to make decisions about how to support student learning toward such mastery. Teachers are therefore expected--with the support of their colleagues, coaches, leaders, and other support providers--to exercise their professional judgment aligned to our shared vision of effective instruction, the Teacher Effectiveness Measure (TEM) and related best practices.  However, while the framework allows for flexibility and encourages each teacher/teacher team to make it their own, our expectations for student learning are non-negotiable.  We must ensure all of our children have access to rigor—high-quality teaching and learning to grade level specific standards, including purposeful support of literacy and language learning across the content areas.

**Introduction**

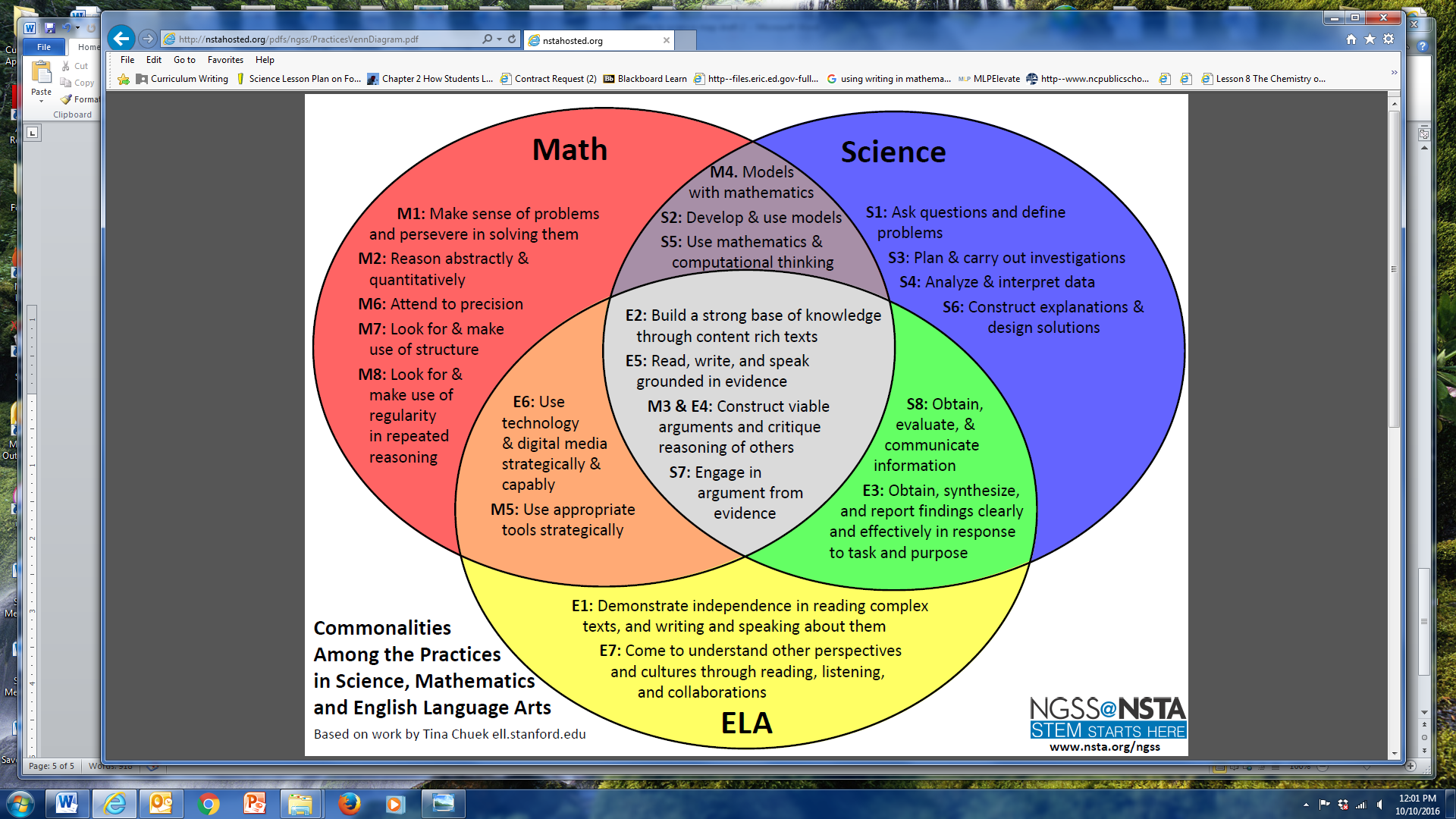
In 2014, the Shelby County Schools Board of Education adopted a set of ambitious, yet attainable goals for school and student performance. The District is committed to these goals, as further described in our strategic plan, Destination 2025. In order to achieve these ambitious goals, we must collectively work to provide our students with high quality, College and Career Ready standards-aligned instruction. The Tennessee State Standards provide a common set of expectations for what students will know and be able to do at the end of a grade. College and Career Ready Standards are rooted in the knowledge and skills students need to succeed in post-secondary study or careers. While the academic standards establish desired learning outcomes, the curriculum provides instructional planning designed to help students reach these outcomes. **The curriculum maps contain components to ensure that instruction focuses students toward college and career readiness.**  Educators will use this guide and the standards as a roadmap for curriculum and instruction. The sequence of learning is strategically positioned so that necessary foundational skills are spiraled in order to facilitate student mastery of the standards.

Our collective goal is to ensure our students graduate ready for college and career. The standards for science practice describe varieties of expertise that science educators at all levels should seek to develop in their students. These practices rest on important “processes and proficiencies” with longstanding importance in science education. The Science Framework emphasizes process standards of which include planning investigations, using models, asking questions and communicating information**. The science maps contain components to ensure that instruction focuses students toward college and career readiness. The maps are centered around four basic components: the state standards and framework (Tennessee Curriculum Center), components of the 5E instructional model (performance tasks), scientific investigations (real world experiences), and informational text (specific writing activities).**

*The Science Framework for K-12 Science Education* provides the blueprint for developing the effective science practices*.* The *Framework* expresses a vision in science education that requires students to operate at the nexus of three dimensions of learning: Science and Engineering Practices, Crosscutting Concepts, and Disciplinary Core Ideas. The *Framework* identified a small number of disciplinary core ideas that all students should learn with increasing depth and sophistication, from Kindergarten through grade twelve. Key to the vision expressed in the *Framework* is for students to learn these disciplinary core ideas in the context of science and engineering practices.

To develop the skills and dispositions to use scientific and engineering practices needed to further their learning and to solve problems, students need to experience instruction in which they use multiple practices in developing a particular core idea and apply each practice in the context of multiple core ideas. We use the term “practices” instead of a term such as “skills” to emphasize that engaging in scientific investigation requires not only skill but also knowledge that is specific to each practice. Students in grades K-12 should engage in all eight practicesover each grade band**.** This guide provides specific goals for science learning in the form of grade level expectations*,* statements about what students should know and be able to do at each grade level.

Science is not taught in isolation. There are commonalities among the practices of science (science and engineering), mathematics (practices), and English Language Arts (student portraits). There is an early focus on informative writing in ELA and science. There’s a common core in all of the standards documents (ELA, Math, and Science). At the core is: reasoning with evidence; building arguments and critiquing the arguments of others; and participating in reasoning-oriented practices with others. The standards in science, math, and ELA provide opportunities for students to make sense of the content through solving problems in science and mathematics by reading, speaking, listening, and writing. Early writing in science can focus on topic specific details as well use of domain specific vocabulary. Scaffold up as students begin writing arguments using evidence during middle school. In the early grades, science and mathematics aligns as students are learning to use measurements as well as representing and gathering data. As students’ progress into middle school, their use of variables and relationships between variables will be reinforced consistently in science class. Elements of the commonalities between science, mathematics and ELA are embedded in the standards, outcomes, content, and connections sections of the curriculum maps.



An instructional model or learning cycle, such as the 5E model is a sequence of stages teachers may go through to help students develop a full understanding of a lesson concept. Instructional models are a form of scaffolding, a technique a teacher uses that enables a student to go beyond what he or she could do independently. Some instructional models are based on the constructivist approach to learning, which says that learners build or construct new ideas on top of their old ideas. Engage captures the students’ attention. Gets the students focused on a situation, event, demonstration, of problem that involves the content and abilities that are the goals of instruction. In the explore phase, students participate in activities that provide the time and opportunities to conducts activities, predicts, and forms hypotheses or makes generalizations. The explain phase connects students’ prior knowledge and background to new discoveries. Students explain their observations and findings in their own words. Elaborate, in this phase the students are involved in learning experience that expand and enrich the concepts and abilities developed in the prior phases. Evaluate, in this phase, teachers and students receive feedback on the adequacy of their explanations and abilities. The components of instructional models are found in the content and connection columns of the curriculum maps.



**Science Curriculum Maps Overview**

**The science maps contain components to ensure that instruction focuses students toward college and career readiness. The maps are centered around four basic components: the state standards and framework (Tennessee Curriculum Center), components of the 5E instructional model (performance tasks), scientific investigations (real world experiences), informational text (specific writing activities), and NGSS (science practices).**

At the end of the elementary science experience, students can observe and measure phenomena using appropriate tools. They are able to organize objects and ideas into broad concepts first by single properties and later by multiple properties. They can create and interpret graphs and models that explain phenomena. Students can keep notebooks to record sequential observations and identify simple patterns. They are able to design and conduct investigations, analyze results, and communicate the results to others. Students will carry their curiosity, interest and enjoyment of the scientific world view, scientific inquiry, and the scientific enterprise into middle school.

At the end of the middle school science experience, students can discover relationships by making observations and by the systematic gathering of data. They can identify relevant evidence and valid arguments. Their focus has shifted from the general to the specific and from the simple to the complex. They use scientific information to make wise decision related to conservation of the natural world. They recognize that there are both negative and positive implications to new technologies.

As an SCS graduate, former students should be literate in science, understand key science ideas, aware that science and technology are interdependent human enterprises with strengths and limitations, familiar with the natural world and recognizes both its diversity and unity, and able to apply scientific knowledge and ways of thinking for individual and social purposes.

**How to Use the Science Curriculum Maps**

**Tennessee State Standards**

The TN State Standards are located in the first three columns. Each content standard is identified as the following: grade level expectations, embedded standards, and outcomes of the grade/subject. Embedded standards are standards that allow students to apply science practices. Therefore, you will see embedded standards that support all science content. It is the teachers' responsibility to examine the standards and skills needed in order to ensure student mastery of the indicated standard.

**Content**

The performance tasks blend content, practices, and concepts in science with mathematics and literacy. Performance tasks should be included in your plans. These can be found under the column content and/or connections. Best practices tell us that making objectives measureable increases student mastery.

**Connections**

District and web-based resources have been provided in the Instructional Support and Resources column. The additional resources provided are supplementary and should be used as needed for content support and differentiation.

(More Academic Vocabulary support can be found at the following link: <http://www.berkeleyschools.net/wp-content/uploads/2013/05/BUSD_Academic_Vocabulary.pdf>)

Following the vocabulary development work of Beck, McKeown and Kucan, the CCSS references three tiers of words that are vital to academic achievement:

* Tier One words are the words of everyday speech usually learned in the early grades… Tier Two words (what the Standards refer to as general academic words) are far more likely to appear in written texts than in speech. They appear in all sorts of texts: informational texts (words such as relative, vary, formulate, specificity, and accumulate), technical texts (calibrate, itemize, periphery), and literary texts (dignified, faltered).
* Tier Two words often represent subtle or precise ways to say relatively simple things—saunter instead of walk, for example. Because Tier Two words are found across many types of texts, they are highly generalizable.
* Tier Three words (what the Standards refer to as domain-specific words) are specific to a domain or field of study (lava, legislature, circumference, aorta) and key to understanding a new concept within a text… Recognized as new and “hard” words for most readers (particularly student readers), they are often explicitly defined by the author of a text, repeatedly used, and otherwise heavily scaffolded (e.g., made a part of a glossary).

It is important to target specific instruction on Tier 2 and Tier 3 vocabulary words to help students develop deep understanding that cannot be acquired through independent reading. Since Tier 3 words are typically targeted in content specific instruction, it's particularly important and challenging to identify and target Tier 2 words, since they appear across all disciplines.

Basic Guidelines for effective structured language practice strategies:

* Make the target language rigorous, and mandatory.
* Never use structured language practice strategies with language that hasn’t been explicitly taught first.
* Post the graphic organizers or word banks and sentence frames that you’ve taught. Require students to use them during the activity and continuously remind them to focus on their use of the language.
* Use a timer, chime, or other signal to mark the beginning, transitions, and ending of the activity. Keep it moving! Don’t adjust your pace to allow all students to finish. If you use these strategies regularly, students will increase their speed to match your snappy pace.
* Circulate to monitor for participation as well as accuracy. Provide targeted support as needed.
* Take it to writing. A brief written product (sentence(s) in a journal, language log, note sheet, poster, post-it, exit ticket…) helps hold all students accountable.

Strategies include

* Classroom Instructional Strategy - <https://drive.google.com/drive/folders/0B_iyFfHv_OU6Z1FHOWN2TFFpdDQ>
* Word Webs - <https://drive.google.com/drive/folders/0B_iyFfHv_OU6Z1FHOWN2TFFpdDQ>
* Academic Vocabulary Log - <https://drive.google.com/drive/folders/0B_iyFfHv_OU6Z1FHOWN2TFFpdDQ>

| **State Standards** | **Embedded Standards** | **Outcomes** | **Content** | | **Connections** |
| --- | --- | --- | --- | --- | --- |
| **Standard 4 – Heredity – 4.5 Weeks** | | | | | |
| CLE 3210.4.1 Investigate how genetic information is encoded in nucleic acids.  Scaffolded (Unpacked) Ideas  1. The chromosomes contributed by parent(s) determine the inherited characteristics of the offspring.  2. Each chromosome contains many genes, working subunits of the DNA (deoxyribonucleic acid) molecules that make up chromosomes.  3. The genome is an organism’s complete set of DNA.  4. The human genome is estimated to contain 20,000-25,000 genes.  5. Although DNA from all organisms is made up of the same chemical and physical components, its information code is determined by the arrangement of four different bases along the DNA strand.  6. DNA is a vast chemical information database that carries the complete set of instructions for making all of the proteins that guide cell functions.  7. Each different protein molecule consists of a long chain made from 20 different kinds of amino acids whose properties depend on the specific sequence of amino acids and the shape. | CLE3210. Inq.6 Communicate and defend scientific findings  CLE3210. Inq.2 Design and conduct scientific investigations to explore new phenomena verify previous results test how well a theory predicts, and compare opposing theories.  CLE. Math.2 Analyze graphs to interpret biological events. | Identify the structure and function of DNA.  Associate the process of DNA replication with its biological significance.  Recognize the interactions between DNA and RNA during protein synthesis.  Use models of DNA, RNA, and amino acids to explain replication and protein synthesis.  Describe the processes and outcomes of transcription and translation. | **Glencoe Biology – Molecular Genetics - Chapter 12**  12.1 The Genetic Material  12.2 Replication of DNA  12.3 DNA, RNA, and Protein  12.4 Gene Regulation and Mutation  **Launch Lab** – Who discovered DNA? p. 325 – make a timeline of the discovery of DNA.  **Mini-Lab** -- Model DNA Structure, p. 331 – What is the structure of the DNA molecule?  **Mini – Lab** -- Model DNA Replication p. 334 – Use a model to understand the replication of the DNA molecule.  **Data Analysis** - Lab 12.1 – p. 340 – How can a virus affect transcription?  **Data Analysis** - Lab 12.2 - p. 348 – How can we know if a compound is a mutagen?  Biology Corner  <https://www.biologycorner.com/worksheets/DNAcoloring.html>  DNA - The Double Helix  <https://www.biologycorner.com/worksheets/DNA_snorks.html>  In this simulation, you will examine the DNA sequence of a fictitious organism - the Snork.  [Teachers Guide for the Snork **Activity**](https://www.google.com/url?q=https://www.biologycorner.com/worksheets/DNA_snorks_key.html&sa=U&ved=0ahUKEwjPoYCGpbrQAhVL4IMKHbvyBMkQFggGMAE&client=internal-uds-cse&usg=AFQjCNEBxRUHz9yzYHBXS3g9FpVMFrPTnw)  <https://www.biologycorner.com/worksheets/DNA_snorks_key.html>  Assessment Practice pp. 356-357  BioLab – Forensics: How is DNA Extracted p. 351  **Prentice Hall Chapter 12**  12.1 DNA  12.2 Chromosomes and DNA Replication  12.3 DNA and Protein Synthesis  12.4 Mutations  12.5 Gene Regulation  **Activities/Labs**  Inquiry Activity – How do codes work? p. 286  Demo – Polymer – Link paper clips together to make a chain to make a polymer. p. 291  Build Science Skills – DNA Molecule – Use various materials to build a model of DNA.  –p. 293  Demo – DNA and Chromosomes – Illustrate how large a DNA molecule is compared to the cell into which it is packed. – p. 295  Data Analysis –Synthesis of New DNA Molecules: How can you investigate when and where cells synthesize DNA? – p. 296  Quick Lab – How does a cell interpret DNA? p. 303  Exploration – Modeling DNA Replication – Students will use models to determine how DNA is replicated. p. 313  Assessment prep – p. 317 | **Academic Vocabulary**  Double helix, nucleosome, DNA polymerase, RNA, Okazaki fragment, semiconservative replication, codon, exon, intron, messenger RNA, ribosomal RNA, RNA polymerase, transcription, transfer RNA, translation, gene regulation, mutagen, mutation, operon  **Vocabulary Strategy**  **Science Words for Knowledge Rating-**Directions: Here are son words we will be learning in our next science unit. Please place an X in the box that best describes your understanding of this word.  Teacher prepares a table and lists the words on the left and uses the following knowledge ratings   |  |  |  |  |  | | --- | --- | --- | --- | --- | | **Word** | **No clue** | **Have heard or seen it** | **Know the word** | **Know it well and can define it** |   **Performance Tasks**  **Comparing Transcription and Translation – Graphic Organizer –** Students will make a graphic organizer to compare the processes of transcription and translation.  **Fredrick Griffith – Genetic Material -** Student will write a poem, story or play about the Griffith experiment. Tell them that their creative work should demonstrate an understanding of the scientific process and the methods of Griffith experiment.  **Codons**  Have students write a simple sentence in their notebooks. Each word must contain only three letters. For example, “the fat cat ate the big rat becomes Hef atc ata tet Then ask students to shift the letters. Point out that the three letter words model codons  **DNA Extraction from Corn - Report -** Imagine you are the first researcher to extract DNA from corn. Write a report detailing your methods and possible applications of your discovery. To learn more about DNA extraction, visit BioLabs at [www.biologygmh.com](http://www.biologygmh.com).  **Francis Crick and James Watson-** Have students do research in the library or on the internet to find out what Francis Crick or James Watson has worked on since discovering the structure of DNA. Students should organize their findings about the scientist’s work and write a short essay.  **(Practice 8/Literacy RST.11-12.9)**  **Qualifications for Each Type of RNA**  An RNA molecule is looking for a job in a protein synthesis factory and it asks you to write its resume. This RNA molecule is not yet specialized and could, with some structural changes, function as mRNA, tRNA, or rRNA. The resume you create should reflect the qualifications needed for each type of RNA.  C:\Users\moorerf\Desktop\Dropbox\Screenshots\Screenshot 2016-10-28 11.30.10.png  **Can Genetically Modified Foods End World Hunger?**  After reading the article, students will research to answer the following questions, does changing nature do more harm than good? Use reasons and facts from what you read about the benefits and risks of GM crops in your answer. Also use facts that you saw on the maps. | |
| **Standard 4 – Heredity - 4.5 Weeks** | | | | | |
| CLE 3210.4.6 Describe the connection between mutations and human genetic disorders.  CLE 3210.4.7 Assess the scientific and ethical ramifications of emerging genetic technologies.  Scaffolded (Unpacked) Ideas  1. Gene mutations occur when segments of DNA molecules are inserted, deleted, or substituted.  2. Exposure of cells to certain chemicals and radiation increases mutations and thus increase the chance of cancer, which is the uncontrolled division of a cell.  3. When gene mutations occur in sex cells, they can be passed on to offspring; if they occur in other cells, they can only be passed on to descendant cells.  4. New traits that result from gene mutations may help, harm, or have little or no effect on the offspring's success in its environment.  5. New technologies have been developed that enable DNA to be intentionally changed in ways that do not occur under natural conditions.  6. The most common form of genetic engineering involves insertion of new genetic material into the genome of a plant or animal.  7. Genetic engineering raises important ethical and social issues that should be considered before the application of the technology becomes widespread | CLE 3210. Inq.5 Compare experimental evidence and conclusions with those drawn by others about the same testable question.  CLE 3210. Inq.1 Recognize that science is a progressive endeavor that reevaluates and extends what is already accepted. | Describe how meiosis is involved in the production of egg and sperm cells.  Determine the relationship between mutations and human genetic disorders.  Describe the connection between mutations and human genetic disorders.  Investigate how radiation affects the germination of seeds and the characteristics of the seedlings  Assess the scientific and ethical issues associated with the following emerging genetic technologies: genetic engineering, cloning, transgenic organism production, stem cell research, and DNA fingerprinting.  Analyze the results of gel electrophoresis of DNA samples.  Evaluate the scientific and ethical issues associated with gene technologies: genetic engineering, cloning, transgenic organism production, stem cell research, and DNA fingerprinting.  . | **Glencoe Biology – Genetics and Biotechnology** -**Chapter 13**  13.1 Applied Genetics  13.2 DNA Technology  13.3 The Human Genome  Launch Lab – How does selective breeding work? Students will model selective breeding to create a population of cards with similar suites. p. 359  Mini-Lab – Model Hybridization – How are hybrid lilies produced? p. 361  Mini- Lab Model Restriction Enzymes – How are sticky ends produced? - p. 365  Data Analysis Lab 13.1 – How can DNA microarrays be used to classify types of prostate cancer? p. 376  Bio-lab – How can genetic engineering be used to solve a crime? P. 381  [Biology Corner-Mutations](http://www.biologycorner.com/bio2/genetics/notes_mutations.html)  <https://www.biologycorner.com/bio2/genetics/notes_mutations.html>  Changes in genetic codes  [Genetic Technologies webpage](http://www.genetictechnologies.com/)  <http://www.genetictechnologies.com/>  [DNA Fingerprinting](http://www.biologycorner.com/worksheets/fingerprint.html)  <https://www.biologycorner.com/worksheets/fingerprint.html>  Another simulation, this one from PBS, that walks you through the steps of creating a DNA Fingerprint  [Cloning](http://www.biologycorner.com/worksheets/cloning.html)  <https://www.biologycorner.com/worksheets/cloning.html>  Click and Clone at GSLC where you can read about how clones are made and clone your own virtual mouse.  Assessment Practice pp. 386-387  **Prentice Hall Chapter 13**  13.1 Changing the Living World  13.2 Manipulating DNA  13.3 Cell Transformation  13.4 Application of Genetic Engineering  Engage/ Explore - Inquiry Activity-Students will be able to determine how to improve plant breeding. p. 318  Demonstration  Using the DNA Sequence – demonstrate DNA restriction analysis and gel electrophoresis. p. 324  Quick Lab – How can restriction enzymes be modeled? P. 326  Build Science Skills – Transforming Animal Cells - Students will model the changes made to the DNA molecule when an animal cell is transformed. p. 329  Design an Experiment - Investigating the Effects of Radiation on Seeds –  p 334-335  **The Human Genome Chapter 14**  14.1 Human Heredity  14.2 Human Chromosomes  14.3 Human Molecular Genetics  Engage/Explore - Inquiry Activity – Can you predict chin shape? – Students will be able to predict chin shape with Punnett Squares. - p. 340  Quick Lab – How is colorblindness transmitted? Students will be able to determine how colorblindness is transmitted– p. 351  Problem Solving – Using a Pedigree – p. 343 -  Demo – The Human Genome Project – Sequencing the human genome was like putting together a puzzle. - p. 357  Real World Lab – Modeling DNA Probes – Students will be able to use models to determine how DNA probes help to identify individuals. - p. 361 | | **Academic Vocabulary** Selective breeding, inbreeding, test cross, genetic engineering, genome, restriction enzyme, gel electrophoresis, recombinant DNA, transformation, cloning, polymerase chain reaction, transgenic organism, DNA fingerprinting, bioinformatics, DNA microarray, single nucleotide polymorphism, haplotype, pharmacogenomics, gene therapy, genomics, proteomics  **Vocabulary Strategy**  **Science Words for Knowledge Rating-**Directions: Here are son words we will be learning in our next science unit. Please place an X in the box that best describes your understanding of this word.  Teacher prepares a table and lists the words on the left and uses the following knowledge ratings:   |  |  |  |  |  | | --- | --- | --- | --- | --- | | **Word** | **No clue** | **Have heard or seen it** | **Know the word** | **Know it well and can define it** |   **Purebred Organisms– Persuasive Writing –** Have students choose one purebred organism and write an essay discussing the advantages and disadvantages of purebred organisms.  **DNA Fingerprinting ––** Imagine that a lunch bag was left on the bus and you had to use DNA fingerprinting to identify the owner. The lunch bag had a strand of hair, a fingernail, or an eyelash on it. Have students write a narrative describing the process of identifying the owner of the bag.  **(Practice 4/LiteracyRST.11-12.9)**  **Scientific Argumentation in BIOLOGY-** text pgs. 191-201: Evaluate Alternatives Activity 16: Environmental Influence on Genotypes and Phenotype.  **Plan for an Experiment –**Imagine that you are a generic engineer. Determine what your next experiment will be. Then, write up the steps you will follow and what your intended result will be.  . **Explaining a Process –** Write a paragraph explaining the process of nondisjunction. Create a flowchart that shows the steps in the process.  **Read Issues in Biology –Who Controls Your DNA? p. 354 – Forming Your Opinion –** Students will form an opinion on should the control of DNA databases be a matter of law, or should it be a matter to be negotiated between people, their employers, and insurance companies? |

| **TOOLBOX** | |
| --- | --- |
| Unit 4.1 Molecular Genetics  **Teacher Plans/**  **Student Activities** | **DNA Structure, Function and Replication –** Hands –on modeling of DNA Replication, analysis and discussion activity that can be used to introduce students to key concepts about DNA structure, function and replication.  [DNA Structure, Function and Replication](http://serendip.brynmawr.edu/exchange/bioactivities/DNA)  **DNA Extraction Lab –** Students extract DNA from their cheeks and relate the steps in the procedure to the characteristics of cells and biological molecules. Students learn key concepts about the function of DNA during the intervals required for the extraction procedure. A second option section develops student understanding of the fundamentals of DNA structure, function and replication; this section includes hands-on modeling of DNA replication (NGSS)  [DNA Extraction](http://serendip.brynmawr.edu/sci_edu/waldron/#dna)  **Transcription and Translation –** Students learn how a gene provides the instructions for making a protein, and how genes can cause albinism or sickle cell anemia. Simple paper models and used to simulate the molecular processes of transcription and translation. This activity can be used to introduce students to these topics or to reinforce student understanding. (NGSS)  [From Gene to Protein](http://serendip.brynmawr.edu/sci_edu/waldron/#trans)  **Compass Learning -** Understanding Genetics Unit |
| Unit 4.2  Genetics Disorders and Genetic Engineering | **Genetic Mutations and Muscular Dystrophy –** An analysis and discussion activity where students explore the effects of different types of point mutations and deletion mutations and analyze the reasons why deletion mutations generally have more severe effects than point mutations. Students use their understanding of the molecular biology of mutations to analyze the genetic basis for the differences in severity of two types of muscular dystrophy.  [Mutations](http://serendip.brynmawr.edu/exchange/bioactivities/mutation)  **Genetic Conditions** - This analysis and discussion activity guides students in thinking about how genetic conditions that are not inherited can result from a new mutation or meiotic nondisjunction. This activity also addresses the reasons for the rarity of inherited lethal dominant alleles.  [This Genetic Condition Was Not Inherited](http://serendip.brynmawr.edu/exchange/bioactivities/GeneticsInherited)  **Genetic Engineering Challenge –** How can scientist develop a type of rice that could prevent vitamin A deficiency? This analysis and discussion activity begins with and introduction to vitamin A deficiency, rice seeds, and genetic engineering. Students will design a basic plan that could produce a genetically engineered rice plant that makes rice grains that contain pro-vitamin A. This activity guides students in developing an understanding of the basic techniques of genetic engineering.  [Genetic Engineering Challenge](http://serendip.brynmawr.edu/exchange/bioactivities/geneticengineer) |
| **CLIP (Literacy) Focus** | **Scientific Argumentation IN BIOLOGY text pgs. 55-65: Generate an Argument Activity 5: DNA Family Relationship Analysis –** The purpose of this activity is to help students understand the molecular basis of heredity and the role that DNA technology can play in solving social problems. This activity also helps students learn how to engage in practices such as constructing explanations, engaging in argument from evidence, and communicating information. This activity is designed to give students an opportunity to learn how to write in science and develop their speaking and listening skills, which are important goals for literacy in science.  **Scientific Argumentation IN BIOLOGY text pgs. 315-320: Rebuttal Writing Activity 29: Misconception About Inheritance of Traits –** The purpose of this activity is to help students understand that acquired traits are not passed down from parent to offspring. This activity is also designed to address the CCSS for ELA and Literacy for writing arguments focused on discipline-specific content, writing in a clear and coherent manner, and developing and strengthening papers through a process of planning, revising, editing, and rewriting. Students will be able to conduct a short research project, gather relevant information from multiple print and digital sources, access credibility and accuracy of each source, and quote or paraphrase the data and conclusions of others while avoiding plagiarism.  **Scientific Argumentation IN BIOLOGY text pgs. 191-201: Evaluate Alternatives Activity 16: Environmental Influence on Genotypes and Phenotypes –** The purpose of this activity is to help students understand Mendelian genetics and how the environment can influence the phenotypes of organisms. The activity also helps students learn how to engage in practices such as using mathematics and computational thinking, using planning and carrying out investigations, arguing from evidence, and communicating information. Additionally, this activity is designed to give students the opportunity to develop their speaking and listening skills.  **STEAM Lesson on the Human Eye (Retinoblastoma Case Studies)** – These activities include case studies, flipped classroom videos, laboratory experiment, a project based application activity, and discussion/writing activities. This activity can be used when students are learning about genetic disorders and how technology plays a role in genetics. This link includes all case study scenarios, hand-outs, projects, and lesson plans.  [STEAM Lesson on the Human Eye](https://www.cure4kids.org/ums/sites/teachers/plugins/gdocs.php?op=op_save&tags=&g%5B353%5D=yes&vocab_g%5B%5D=1338) |