**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.

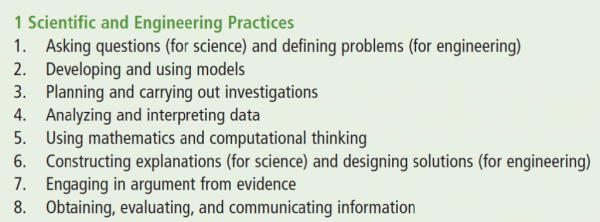
 The map is meant to support effective planning and instruction to rigorous standards. It is *not* meant to replace teacher planning, prescribe pacing or instructional practice.  In fact, our goal is not to merely “cover the curriculum,” but rather to “uncover” it by developing students’ deep understanding 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**

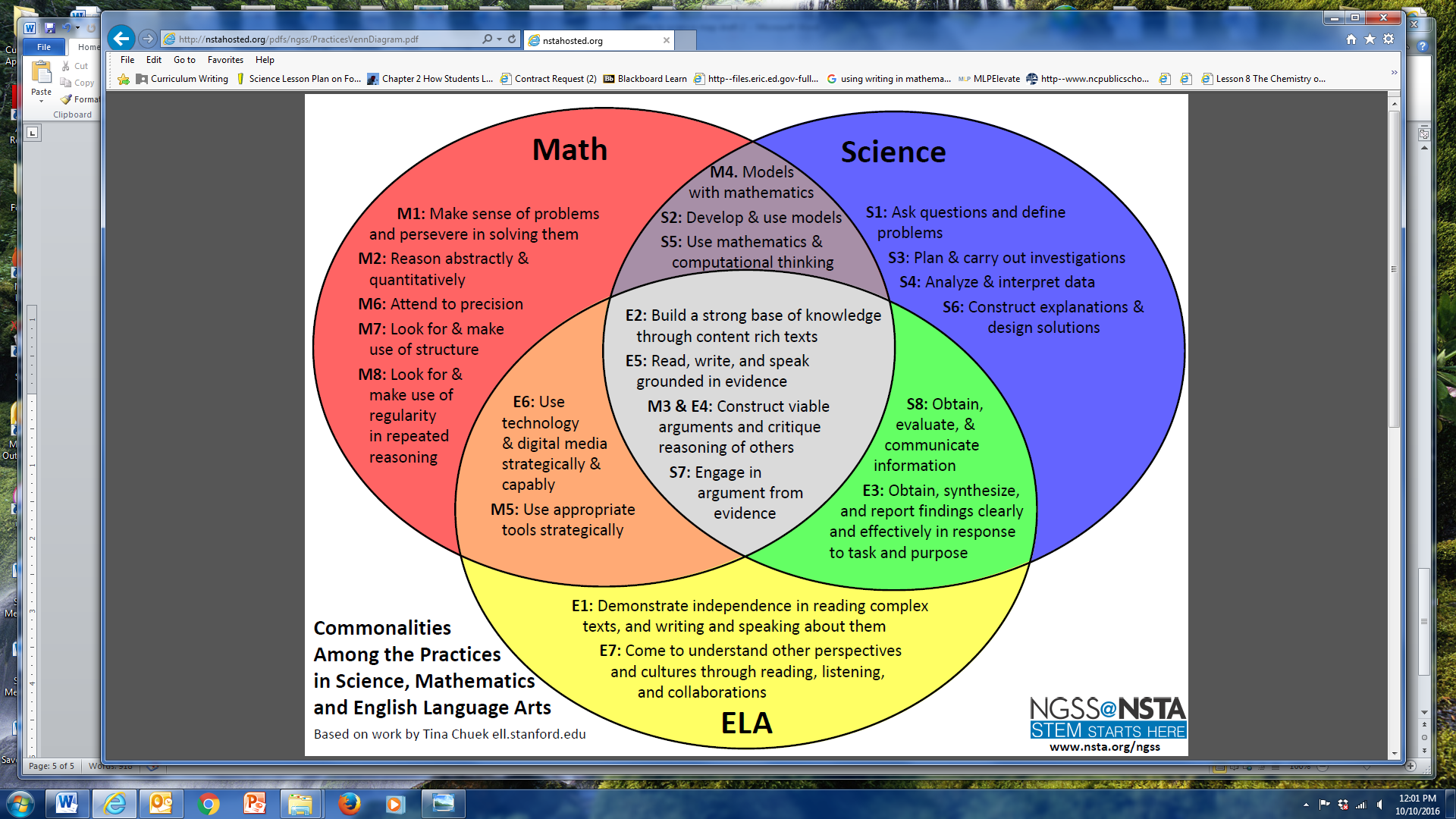
In 2014, the Shelby County Schools Board of Education adopted a set of ambitious, yet attainable goals for school and student performance. The District is committed to these goals, as further described in our strategic plan, Destination 2025. In order to achieve these ambitious goals, we must collectively 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 an opportunity 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 Kuban, 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 scaffolder (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 | |
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| **Standard 5 – Absorption and Excretion - 3 Weeks** | | | | | | | |
| **CLE 3251.5.1** Identify organs of the digestive system and describe their functions.  **CLE 3251.5.2** Investigate mechanisms of digestion and food absorption. | **CLE 3251. Inq.1** Recognize that science is a progressive endeavor that reevaluates and extends what is already accepted.  **CLE 3251. Inq.6** Communicate and defend scientific findings.  **CLE 3251. Inq.5** Compare experimental evidence and conclusions with those drawn by others about the same testable question.  **CLE 3251.Inq. 2** Design and conduct scientific investigations to explore new phenomena, verify previous results, test how well a theory predicts, and compare opposing theories. | Compare the structure and function of organs in the digestive system.  Contrast mechanical and chemical digestion.  Trace a selected food through the alimentary canal.  Identify the enzymes and biochemical reactions that facilitate digestion.  Explain how the products of digestion are absorbed. | | **Hole’s Human Anatomy and Physiology – The Digestive System - Chapter 17**  Anatomy and Physiology Revealed, Digestive System <http://www.biologycorner.com/anatomy/chap15.html>Digestive System - This chapter covers the major organs of the digestive system and the alimentary canal. <http://www.getbodysmart.com/ap/systems/tutorial.html>  Introduction to the Human Body Organ Systems  <http://www.innerbody.com/image/digeov.html>  Digestive system – Anatomy explorer  *The Science Behind the Story* <http://www.storybehindthescience.org/pdf/howtouse.pdf>  Gulp (Don’t Gag): Modeling the Complexity of the Digestive System <http://learning.blogs.nytimes.com/2013/05/01/gulp-dont-gag-modeling-the-complexity-of-the-digestive-system/> Your Digestive System and How It Works - <http://digestive.niddk.nih.gov/ddiseases/pubs/yrdd/> | | **Academic Vocabulary**  Alimentary canal, mucosa, peristalsis, tongue, papillae, palate, teeth, salivary glands,  pharynx, esophagus, stomach, pancreas, liver, bile, gallbladder, small intestine, large intestine, colon, rectum, feces  **Performance Tasks**  **Use the following scenario**: A cream cheese and jelly sandwich contains proteins, carbohydrates, and fats. Write a description as to what happens to the sandwich when you eat it relative to events occurring in ingestion, digestion, absorption, and defecation. Include all details. **(Practice 8/Literacy RST.11-12.9)**  **Critical Thinking and Clinical Application** – A young woman is put through an extensive battery of tests to determine the cause of her stomach pains. She is diagnosed with gastric ulcers. An antihistamine drug is prescribed and she is sent home. Research to find out the following answers concerning her condition. What is the mechanism of her medication? What life-threatening problems can result from a poorly managed ulcer? Why did the clinic doctor warn the woman not to take aspirin? Write a report explaining the above questions.  C:\Users\moorerf\Desktop\Dropbox\Screenshots\Screenshot 2016-10-28 11.30.10.png  **A Winning Wheat**  Look at the Digestive System diagram in the Dig Deeper. Write a narrative telling what it shows. Use your own words. How does it help explain the news article that you read on page 1? Use words to explain time or sequence, as needed  **Science News for Students Online**  **A supplement makes calorie-rich foods less tempting - With the fatty acid propionate, the brain finds high-calorie foods less enticing**  Students will read the article and define gut microbiome. Students will then write an essay explaining why it is important to make sure we eat a healthy, balanced diet. | |
| **Standard 5 – Absorption and Excretion - 2 Weeks** | | | | | | | |
| **CLE 3251.5.3** Describe how nutrition, metabolism, and body temperature are related. | **CLE 3251. Inq.1** Recognize that science is a progressive endeavor that reevaluates and extends what is already accepted.  **CLE 3251. Inq.5** Compare experimental evidence and conclusions with those drawn by others about  **CLE 3251. Inq.6** Communicate and defend scientific findings. | Explain the difference between nutrients and essential nutrients.  Explain how energy values of foods are determined.  Distinguish between a vitamin and a mineral and the function of each.  Discuss the importance an appropriate nutritional diet.  Describe the effects of the lack of proper nutrition.  Describe some medical conditions that affect the ability to obtain adequate nutrition as a person ages. | Human Anatomy and Physiology – Nutrition and Metabolism - Chapter 18 Nutrition and Metabolism<http://www.slideshare.net/1957Hamlet/chapter-18-nutrition-and-metabolism-8712676?related=1>Food and Drug Administration - Navigate the Food Section <http://www.fda.gov/>  Choose My Plate  <http://www.choosemyplate.gov/> | | **Academic Vocabulary**  Metabolism, nutrient, major nutrients, minor nutrients, carbohydrates, lipids, proteins, amino acids, vitamins, minerals,  Catabolism, anabolism glucose, blood sugar, cellular respiration, glycolysis, hyperglycemia, hypoglycemia, acidosis, ketoacidosis, cholesterol, glycogen, low density lipoproteins, high density lipoproteins, basal metabolic rate, heat stroke, heat exhaustion  **Performance Tasks**  **Critical Thinking and Clinical Application**  After chopping wood for about two hours on a hot but breezy afternoon, John stumbled into the house and then fainted. His T-shirt was wringing wet with perspiration, and his pulse was faint and rapid. Was he suffering from heat stroke or heat exhaustion? Explain your reasoning, and not what you should do to help John recover. | |
| **Standard 5 – Absorption and Excretion - 2 Weeks** | | | | | | | |
| **CLE 3251.5.1** Identify organs of the urinary system and describe their functions  **CLE 3251.5.4** Explain how the kidneys function to remove wastes from the blood.  **CLE 3251.5.3** Describe how nutrition, metabolism, and body temperature are related. | **CLE 3251. Inq.1** Recognize that science is a progressive endeavor that reevaluates and extends what is already accepted.  **CLE 3251. Inq.6** Communicate and defend scientific findings.  **CLE 3251. Inq.5** Compare experimental evidence and conclusions with those drawn by others about the same testable question.  **CLE 3251.Inq. 2** Design and conduct scientific investigations to explore new phenomena, verify previous results, test how well a theory predicts, a | Compare and contrast the male and female urinary systems.  Explain how the kidneys act to maintain homeostasis.  Identify the parts of a nephron and describe how they assist in urine formation.  Describe the composition of urine.  Describe a countercurrent mechanism and explain how it concentrates urine.  Discuss the importance of water and electrolyte balance.  Describe how body temperature is regulated. | | Hole’s Human Anatomy and Physiology - Urinary System – Chapter 20  This chapter covers the major organs of the urinary system with a focus on how the nephrons of the kidney filter the blood.  <http://www.biologycorner.com/anatomy/chap17.html>  Introduction to the Human Body Organ Systems  <http://www.getbodysmart.com/ap/systems/tutorial.html>  Urinary System – anatomy explorer  <http://www.innerbody.com/image/urinov.html>  *The Science Behind the Story* <http://www.storybehindthescience.org/pdf/howtouse.pdf>  Your Urinary System and How It Works <http://kidney.niddk.nih.gov/kudiseases/pubs/yoururinary/>  Let’s Diagnose Then Lab1 – Urinalysis, pp. 25-31 | | **Academic Vocabulary**  Kidney, renal sinus, renal arteries, nephrons, glomerular apparatus, autoregulation, renal plasma threshold, countercurrent mechanism, urea, uric, ureters, urinary bladder, urethra, micturition,  **Performance Tasks**  **Urinary Bladder**  A physician prescribes oral penicillin therapy for a patient with an infection of the urinary bladder. Students will describe for the patient the route the drug follows to reach the bladder. Students should include a labeled diagram of the route.  **Inflammation of the Urinary Bladder**  Inflammation of the urinary bladder is more common women than in men. Students will list the anatomical differences between the female and male urethra and explain this observation. | |
| **Standard 6 – Reproduction, Growth, and Development - 2 Weeks** | | | | | | | |
| **CLE 3251.6.1** Identify the essential and accessory organs of the male and female reproductive systems and describe their functions.  **CLE 3251.6.3** Summarize the principal events that occur during prenatal development | **CLE 3251.Inq.1** Recognize that science is a progressive endeavor that reevaluates and extends what is already accepted.  **CLE 3251.Inq.5** Compare experimental evidence and conclusions with those drawn by others about  **CLE 3251.Inq.6** Communicate and defend scientific findings. | Relate the structures of the male and female reproductive systems to their functions.  Describe the role of hormones in controlling the secondary sex characteristics.  Compare and contrast the processes and products of oogenesis and spermatogenesis.  Trace the pathway that sperm travel from the testes to the exterior of the body.  Review the structures and functions of the male and female reproductive systems.  Examine topics of infertility, fetal development, pregnancy and birth.  Summarize the events of the menstrual cycle.  Describe the hormonal control mechanisms that regulate the menstrual cycle  Sequence the stages of human development from fertilization to birth.  Describe the function of the placenta.  Research and describe methods of controlling human fertility and describe their relative effectiveness. | | Human Anatomy and Physiology Chapter 22, 23, and 24 - Reproductive System  Lab: Male Reproductive System  Lab: Female Reproductive System  This is the last chapter and the unit focuses more on the practical aspects of the human reproductive system, such as contraception, fertility and childbirth.  <http://www.biologycorner.com/anatomy/chap19.html>  Introduction to the Human Body Organ Systems  <http://www.getbodysmart.com/ap/systems/tutorial.html>  Human reproductive systems  <http://www.innerbody.com/image/digeov.html>  *The Science Behind the Story* <http://www.storybehindthescience.org/pdf/howtouse.pdf>  Reproductive System: Facts, Functionsand Diseases  <http://www.livescience.com/26741-reproductive-system.html>  Reproductive System <http://www.uen.org/Lessonplan/preview.cgi?LPid=4565> | | **Academic Vocabulary**  Sperm cell, epididymis, seminal vesicles, prostate gland, scrotum, hypothalamic hormone, pituitary hormone, ovary, oogenesis, spermatogenesis, follicle maturation, uterine tube, fertilization, embryonic stage, birth, neonatal period, growth, development, pregnancy, human chorionic gonadotropin, amnion,  **Performance Tasks**  **Polar Body**  Sometimes a sperm cell fertilizes a polar body rather than a secondary oocyte. An embryo does not develop, and the fertilized polar body degenerates. Students will define a polar body and explain why a polar body is unable to support development of an embryo.  **Twins**  Students are to explain the following scenario in the form of an essay. Why can twins resulting from a single fertilize egg cell exchange blood or receive organ transplants from each other without rejection, while twins resulting from two fertilized eggs sometimes cannot?  **DNA Microarray**  Students will state possible advantages and disadvantages of DNA microarray tests performed shortly after birth to identify susceptibilities and inherited diseases that will likely affect the individual later in life. Students will prepare a powerpoint with the results. | |

| TOOLBOX | |
| --- | --- |
| Unit 4.1  Absorption  **Plans** | The Urinary System  <http://www.biologycorner.com/anatomy/urinary/notes_ch17.html> |
| Unit 4.1  Absorption  **Background for Teachers** | How the Urinary System Works?  <http://umaine.edu/ccids/files/2011/01/urinary.pdf>  Your Urinary System and How It Works  <http://kidney.niddk.nih.gov/kudiseases/pubs/yoururinary/>  Biology 218 – Human Anatomy  <http://www.napavalley.edu/people/briddell/Documents/BIO%20218/Biology_218_Lecture_Outline_26_Urinary_System.pdf> |
| Unit 4.1  Absorption  **Student Activities** | Label the Parts of a Kidney  <http://www.biologycorner.com/anatomy/urinary/urinary_labeling.html>  Anatomy and Function of the Urinary System  <http://www.lpch.org/DiseaseHealthInfo/HealthLibrary/transplant/urinaryant.html> |
| Unit 4.2  The Human Life Cycle  **Plans** | The Reproductive System  <https://docs.google.com/presentation/d/1et2yMdNwnLKXrFgn7V2uxt3mrZUAdPbJNofv6wS5Jcs/present?pli=1&ueb=true#slide=id.i17>  Reproductive Presentation  <https://docs.google.com/presentation/d/1et2yMdNwnLKXrFgn7V2uxt3mrZUAdPbJNofv6wS5Jcs/present?pli=1&ueb=true#slide=id.i11>  Reproductive System  <http://www.uen.org/Lessonplan/preview.cgi?LPid=4565> |
| Unit 4.2  The Human Life Cycle  **Background for Teacher** | Reproductive System: Facts, Functionsand Diseases  <http://www.livescience.com/26741-reproductive-system.html> |
| Unit 4.2  The Human Life Cycle  **Student Activities** | How Much Do You Know About the Reproductive System?  <http://www.biologycorner.com/anatomy/reproduction/reproductive_how_much_do_you_know.html>  Structure of the Nephron  <http://www.biologycorner.com/anatomy/urinary/kidney_coloring.html> Review Guide: Reproductive System<http://www.biologycorner.com/anatomy/reproduction/reproductive_review.html> |