SCN114 Biology Honors (BA)

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STATEMENT OF PURPOSE

The Honors Biology course of study is molecular-based and utilizes an inquiry approach to learning. Students are continually stimulated to think about biological topics and issues facing society today. Students will be expected to take the required learning to a higher level, while looking for solutions to a myriad number of problems. This is accomplished through the integration of research-based exercises, kinesthetic activities, and performance-based tasks. The students will also be expected to complete an extensive research project that is done primarily after regular school hours.

Students will learn about the chemistry of living things, the intricate workings of the cell, energy transfer systems, the cell cycle, gene expression, DNA Technology, evolutionary theories, and environmental issues.

The Honors Biology curriculum is designed to help students to develop a deeper understanding of the story of life. Units are structured using backward design principles that clearly establish what the students need to know, and then designs and implements each lesson to build upon and support that goal.

**Special Note for the 2015-16 School Year: In 2014, the New Jersey State Department of Education adopted the New Jersey Student Learning Standards, (NJSLS), that set forth a vision for science education where the Science and Engineering Practices (SEPs), Disciplinary Core Ideas (DCIs) of science, and Crosscutting Concepts (CCCs) of science are blended seamlessly into a three dimensional learning environment for all students. The transition to NJSLS across New Jersey and in the Parsippany Troy Hills School District will be deliberate, and full implementation of NJSLS in New Jersey is planned for the 2016-17 school year. The shifts required in NJSLS implementation are fundamental, and revision of curriculum requires careful consideration of these changes as well as time to develop, pilot, and implement. During this transitional period, resources in support of NJSLS are being developed for teachers' use in buildings and through Professional Development. A core team of experienced teachers attended NJSLS curriculum training in July 2015, and are steadily working to build units that will be implemented throughout the 2015-16 school year, units that incorporate active learning for students, giving them the opportunities to Engage, Explore, Explain, Elaborate and Evaluate Science. As our master teachers implement these new units their experiences and feedback provide momentum for the unfolding new curricula. Separately we assess students to gauge progress and inform instruction. For students in grades 9 through 12 are administered in the form of a midterm and final exam for full year courses. *Special Note: Only final exams are administered at the end of quarter courses and semester courses.

RATIONALE

Honors Biology is designed for the highly motivated science student. It is a fast-paced program in which the students must complete each assignment quickly and efficiently in order to accomplish each of the required elements established by the New Jersey Department of Education and be prepared to take the New Jersey Biology Competency Test (NJBCT) at the end of the school year. The Honors Biology program is very suitable for the student who possesses strong abstract reasoning skills, since each individual will be challenged to synthesize and assimilate information on a daily basis in order to develop a big picture understanding of each concept being studied.

This course is aligned with the New Jersey Core Curriculum Content Standards for Science (NJCCCS), the Nest Generation Science Standards (NGSS), the New Jersey Core Curriculum Content Standards for Technology (NJCCCS for Technology), the New Jersey Core Curriculum Standards for Language Arts Science and Technical Subjects and the 21st Century Life and Careers Standards (NJCCCS for Career Ready Practices). Using a variety of materials, resources, and instructional methods, the course reinforces the educational skills of scientific interpretation, investigation, problem-solving, critical analysis and research. District initiatives in assessment and critical reading and writing are also being emphasized.

THE LIVING CURRICULUM

Curriculum guides are designed to be working documents. Teachers are encouraged to make notes in the margins. Written comments can serve as the basis for future revisions. In addition, the teachers and administrators are invited to discuss elements of the guides as implemented in the classroom and to work collaboratively to develop recommendations for curriculum reforms as needed.

AFFIRMATIVE ACTION

During the development of this course of study, particular attention was paid to material, which might discriminate on the basis of sex, race, religion, national origin, or creed. Every effort has been made to uphold both the letter and spirit of affirmative action mandates as applied to the content, the texts and the instruction inherent in this course.

MODIFICATION AND ADAPTIONS:

For guidelines on how to modify and adapt curricula to best meet the needs of all students, instructional staff should refer to the Curriculum Modifications and Adaptations (http://njcdd.org/wp-content/uploads/2016/08/tools-teacherspart2.pdf). Instructional staff of students with Individualized Education Plans (IEPs) must adhere to the recommended modifications outlined in each individual plan.

GENERAL GOALS

The students will:

1. learn that the study of biology is based on systematic observations, hypotheses, predictions, observations, and experimental tasks, and understand how to apply the processes of scientific inquiry and technological design to investigate questions, conduct experiments, and solve problems..

2. develop an in-depth understanding of complex molecular-based biological processes.

3. explore the historical development of biological concepts and the relationships of those concepts to society and technology today.

4. learn that levels of organization in nature, and the characteristics of life emerge at the single cell level and extend through the entire biosphere.

5. learn that cells assemble, rearrange, and degrade organic compounds mainly through enzyme-mediated reactions.

6. discover that information for producing the heritable traits of single-celled and multi-celled organisms is encoded in DNA.

7. learn that the living world is immensely diverse and that each species is unique in terms of body plan, function, and behavior.

8. learn that the theories of evolution, such as natural selection, help to explain the meaning of life's diversity.

9. learn about our place in nature in terms of how we interact with organisms in the biological system of Earth.

10. recognize the importance of science in everyday living, explore pertinent current scientific issues, and appreciate the interrelationship between science, technology, and society to become scientifically literate and knowledgeable members of society.

11. develop problem-solving and critical thinking skills

GRADING PROCEDURES

MARKING PERIOD GRADES

Long and Short Term Assessments which may include: 90%

- Tests, quizzes, and/or worksheets
- Authentic assessments
- Technology applications
- Projects, reports, presentations
- Laboratory investigations
- Data Analysis
- Analysis of assigned readings

Daily Assessments which may include: 10%

- Active engagement in class activities

- Demonstration of knowledge and understanding of course material
- Skills and safety practices during lab investigations
- Do Now/Exit Questions
- Homework

FINAL GRADE – FULL YEAR COURSE

Full Year Course

- Each marking period shall count as 20% of the final grade (80% total). The midterm assessment, and final assessment will each count as 10% of the final grade (20% total).

GENERAL PERSONAL SAFETY

The science classroom is potentially the most dangerous place in the school. However, this need not constitute a serious threat if the teacher and students have a thorough knowledge of the potential hazards, exercise prudent care and foresight, and use common sense. Accident prevention must be included in the performance of every task, and safety instruction must be an integral part of the overall science program.

1. Precautions should be taken to protect those in the classroom from injury from hot or corrosive materials.

a. In order to reduce the danger from caustic or hot liquids, students and teachers handling such materials should wear protective aprons (plastic or neoprene), goggles, and should roll sleeves (which can absorb the liquid), tightly to above the elbow.

b. Students should never be permitted to work with concentrated acids or bases or with boiling water while seated.

c. Burns from either hot or caustic materials should be flooded immediately and for at least ten minutes with copious amounts of cold water. Following flooding of the bum, the victim should be escorted to the school nurse as quickly possible. Clothing which has absorbed caustic materials should be removed as soon as feasible. The school nurse should be called immediately.

2. High-speed devises such as mechanical rotators, electric drills, fans, etc., should never be operated with protective shields removed or opened. Goggles must be worn.

3. Eating anything in the laboratory should be prohibited since it entails an intolerable hazard from toxic or possible infectious materials

4. Cleanliness and order should be maintained.

a. Extraneous objects should be moved from work surface.

b. Glassware and other hardware should be maintained in a clean condition. Chemical or biological residues may constitute a reactive hazard.

c. Students should be required to thoroughly wash their hands with soap and water following a laboratory session.

5. There are several devices for protecting students and instructors against the corrosive or toxic effects of chemical reagents.

a. Aprons should be worn by all students working in a laboratory, especially when working with corrosive reagents.

b. Gloves should be worn by students when working with concentrated corrosive reagents. Gloves have a tendency to reduce dexterity, which may be a hazard in itself. Gloves are generally rubber or plastic.

c. Long hair can be a serious hazard in the laboratory and should be covered or contained. Fire and reduced visibility are just two of the hazards that result from long hair.

d. Loose clothing is another potential hazard in the laboratory. Loose clothing is less controllable than tight-fitting clothing. Glassware can be knocked off benches, clothes can come into contact with open flame, and manual dexterity can be reduced.

In a demonstration experiment using any flammable liquid such as alcohol, care must be taken to ensure that any flame in the room is a safe distance from the volatile liquid.

6. Demonstrations involving explosive or potentially explosive substances must be so arranged as to shield everyone from any danger. Use the safety shield to protect observers and the face shield and goggles to protect the demonstrators. Size of apparatus and quantities of reagents used in a

demonstration should be consistent with safe practice.

7. Observers should be evacuated from seats directly in front of the demonstration table, even if the possibility is remote that injury to them might occur from splattering of chemicals, inhalation of fumes, etc.

8. All persons performing science activities involving hazards to the eyes must wear approved eye protection devices. All persons in dangerous proximity must likewise be equipped.

9. Chemicals should never be tasted (or placed on the tongue or lips), nor should laboratory glassware be used as drinking vessels.

10. Sandals and open-toe shoes should not be permitted in laboratory areas unless they have a protective covering.

PARSIPPANY-TROY HILLS TOWNSHIP SCHOOLS COURSE PROFICIENCIES

In accordance with district policy as mandated by the New Jersey Administrative Code and the New Jersey Core Curriculum Content Standards, the following are proficiencies required for the successful completion of the above named course.

The student will:

1. demonstrate the ability to work in groups to safely solve biological problems and perform laboratory investigations.
2. select and safely use appropriate instrumentation to design and conduct investigations.
3. make measurements of length mass, volume and temperature using the metric system.
4. Compare and contrast living and nonliving things while describing the characteristics of living things.
5. construct an explanation based on evidence for how the structure of DNA determines the structure of proteins which carry out the essential functions of life through systems of specialized cells.
6. Develop and use a model to Illustrate the hierarchical organization of interacting systems that provide specific functions within multicellular organisms.
7. construct and revise an explanation based on evidence for how carbon, hydrogen, and oxygen from sugar molecules may combine with other elements to form amino acids and/or other large carbon-based molecules.
8. Explain how the properties of water impact living things.
9. Diagram and explain the pH scale.
10. plan and conduct an investigation to provide evidence that feedback mechanisms maintain homeostasis.
11. use a model to illustrate how photosynthesis transforms light energy into stored chemical energy.
12. construct and revise an explanation based on evidence for the cycling of matter and flow of energy in aerobic and anaerobic conditions
13. use a model to illustrate that cellular respiration is a chemical process whereby the bonds of food molecules and oxygen molecules are broken and the bonds in new compounds are formed resulting in a net transfer of energy.
14. examine the structure and function of nucleic acids, and compare and contrast DNA and RNA molecules.
15. differentiate between prokaryotic and eukaryotic cells.
16. explore eukaryotic cell structure.
17. analyze transport of materials across cellular membranes.
18. explain the significance of ATP in cellular energy transfer.
19. analyze the process of aerobic respiration in plant and animal cells.
20. analyze the process of anaerobic respiration in plant and animal cells.
21. investigate the process of photosynthesis in plant cells.
22. examine the “life cycle” of a cell.
23. investigate cellular division, and the process of mitosis and cytokinesis.
24. explain the process of meiosis and compare it to the process of mitosis.
25. analyze the process of transcription and translation.
26. investigate the control of gene expression.
27. explore the causes and effects of point mutations and frameshift mutations
28. demonstrate an understanding of Pedigree analysis for sex-linked and non sex-linked traits.
29. examine uses of karyotype analysis and explain possible interpretations.
30. investigate the use of plasmids and restriction enzymes in the generation of recombinant DNA.

31. analyze the use of electrophoresis to generate DNA fingerprints.
32. scrutinize the sequencing of the human genome and its implications in the area of bioethics.
33. examine the work of Charles Darwin and the concept of evolution as a major theme of biology.
34. explore Linnean classification and contrast it to the system of domains of life.
35. trace factors affecting ecosystems, including the flow of energy through ecosystems, and environmental issues of ecosystems.

SCN114 Biology Honors

Unit	Essential Questions	Enduring Understanding	Suggested Activities	Evaluation / Assessment	Resources
Scientific Investigations and Safety *(Week 1, 2 Weeks)*	How do Biologists conduct scientific investigations safely?	Understanding and respect for the safety rules in a laboratory are vital to a successful Science experience. Safety guidelines are designed to prevent accidents from occurring, and yield quality results.	• Thoroughly review and discuss safety guidelines in a Science classroom. Carefully read and sign a safety contract, keep a copy in their work folder for easy reference. • Design and execute an experiment that investigates factors that affect solubility of a material or weathering rate on Earth Materials. • Perform a lab, Using a Compound Microscope. They will use a typed letter "e" to learn to prepare and view a wet-mount slide. • Conduct microscope lab, *Comparing Plant and Animal Cells* (Miller/Levine). • Practice measuring cells with a microscope lab activity. They may practice measuring cells using a variety of stained and/or prepared slides. Drawings and analysis questions will be completed.	**Signed Safety contract** **Performance: Authentic Task** **Performance: Skill Demonstration** Experimental design, group work, and adherence to safety guidelines will be assessed using teacherdesigned rubric, and continuously monitored throughout the year. **Group work, collaboration, microscope sketches, and safety awareness will be assessed** **Performance: Skill Demonstration** during these activities, and consistently through the school year **Performance: Skill Demonstration** Microscope diagrams will be assessed using a teacher designed rubric; skills will be assessed using teacherdesigned practical. **Performance: Skill Demonstration**	

				Accuracy of measurements, ability to cooperatively work with partner will be assessed. Adherence to safety guidelines will be continuously monitored and addressed throughout the year.	

NJ: 2016 SLS: Literacy in History/Social Studies, Science, & Technical Subjects 6-12
NJ: Grades 11-12
Reading: Science & Technical Subjects
Craft and Structure
NJSLSA.R4 Interpret words and phrases as they are used in a text, including determining technical, connotative, and figurative meanings, and analyze how specific word choices shape meaning or tone.
RST.11-12.4. Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to grades 11–12 texts and topics.
NJSLSA.R6 Assess how point of view or purpose shapes the content and style of a text.
RST.11-12.6 Analyze the author's purpose in providing an explanation, describing a procedure, or discussing an experiment in a text, identifying important issues that remain unresolved.
Integration of Knowledge and Ideas
NJSLSA.R7 Integrate and evaluate content presented in diverse formats and media, including visually and quantitatively, as well as in words.
RST.11-12.7. Integrate and evaluate multiple sources of information presented in diverse formats and media (e.g., quantitative data, video, multimedia) in order to address a question or solve a problem.
NGSS: Science and Engineering Practices
NGSS: 9-12
Practice 1. Asking questions (for science) and defining problems (for engineering)
Asking questions and defining problems in 9–12 builds on K–8 experiences and progresses to formulating, refining, and evaluating empirically testable questions and design problems using models and simulations.
Ask questions that arise from careful observation of phenomena, or unexpected results, to clarify and/or seek additional information.
Practice 2. Developing and using models
Modeling in 9–12 builds on K–8 experiences and progresses to using, synthesizing, and developing models to predict and show relationships among variables between systems and their components in the natural and designed worlds.
Evaluate merits and limitations of two different models of the same proposed tool, process, mechanism or system in order to select or revise a model that best fits the evidence or design criteria.
Practice 3. Planning and carrying out investigations
Planning and carrying out investigations in 9-12 builds on K-8 experiences and progresses to include investigations that provide evidence for and test conceptual, mathematical, physical, and empirical models.
Plan an investigation or test a design individually and collaboratively to produce data to serve as the basis for evidence as part of building and revising models, supporting explanations for phenomena, or testing solutions to problems. Consider possible confounding variables or effects and evaluate the investigation's design to ensure variables are controlled.

Practice 4. Analyzing and interpreting data
Analyzing data in 9–12 builds on K–8 experiences and progresses to introducing more detailed statistical analysis, the comparison of data sets for consistency, and the use of models to generate and analyze data.
Analyze data using tools, technologies, and/or models (e.g., computational, mathematical) in order to make valid and reliable scientific claims or determine an optimal design solution.
Practice 5. Using mathematics and computational thinking
Mathematical and computational thinking in 9-12 builds on K-8 experiences and progresses to using algebraic thinking and analysis, a range of linear and nonlinear functions including trigonometric functions, exponentials and logarithms, and computational tools for statistical analysis to analyze, represent, and model data. Simple computational simulations are created and used based on mathematical models of basic assumptions.
Create and/or revise a computational model or simulation of a phenomenon, designed device, process, or system.
Practice 6. Constructing explanations (for science) and designing solutions (for engineering)
Constructing explanations and designing solutions in 9–12 builds on K–8 experiences and progresses to explanations and designs that are supported by multiple and independent student-generated sources of evidence consistent with scientific ideas, principles, and theories.
Make a quantitative and/or qualitative claim regarding the relationship between dependent and independent variables.
Practice 8. Obtaining, evaluating, and communicating information
Obtaining, evaluating, and communicating information in 9–12 builds on K–8 experiences and progresses to evaluating the validity and reliability of the claims, methods, and designs.
Critically read scientific literature adapted for classroom use to determine the central ideas or conclusions and/or to obtain scientific and/or technical information to summarize complex evidence, concepts, processes, or information presented in a text by paraphrasing them in simpler but still accurate terms.
NGSS: Disciplinary Core Ideas
NGSS: 9-12
ESS2: Earth's Systems
ESS2.C: The Roles of Water in Earth's SurfaceProcesses
The abundance of liquid water on Earth's surface and its unique combination of physical and chemical properties are central to the planet's dynamics. These properties include water's exceptional capacity to absorb, store, and release large amounts of energy,transmit sunlight, expand upon freezing, dissolve and transport materials, and lower the viscosities and melting points of rocks. (HSESS2-5)

NJ: 2014 SLS: 21st Century Life and Careers
NJ: All Grades
Career Ready Practices
Career Ready Practices
CRP1. Act as a responsible and contributing citizen and employee.

CRP2. Apply appropriate academic and technical skills.

CRP3. Attend to personal health and financial well-being.

CRP4. Communicate clearly and effectively and with reason.

CRP6. Demonstrate creativity and innovation.

CRP7. Employ valid and reliable research strategies.

CRP8. Utilize critical thinking to make sense of problems and persevere in solving them. CRP12. Work productively in teams while using cultural global competence. Copyright © State of New Jersey, 1996 - 2016					
The Structural and Chemical Basis of Life *(Week 3, 6 Weeks)*	How do organisms live and grow?	All living organisms are made of cells. While a simple definition of life can be difficult to capture, all living organisms can be characterized by common aspects of their structure and functioning	• Contribute to a discussion comparing the meaning of the words biology and biochemistry, and apply these definitions to hierarchy in life. • In groups, utilize iPads or textbook to research and identify the organization from atom to biosphere. Model and communicate the organization of life utilizing classroom supplies. Perform a gallery walk to observe other models and allow students to present and be orally quizzed on their models. • Independently complete Pogil Guided Activity "Prokaryotic Cells and Eukaryotic" https://pogil.org/uploads/media_items/prokaryotic-and-eukaryotic-cells-student.original.pdf • Download and execute the iCell App and complete and applicable activity comparing and contrasting animal and plant cells. App is also a useful tool and reference for future use. • Conduct microscope lab comparing plant and animal cells such as *Comparing Plant and Animal Cells* (Miller/Levine). Diagram and label accurate sketches and answer analysis questions. • Diagram eukaryotic and prokaryotic cells. • Collaboratively construct and argue a list of characteristics that define a living organism and write on board. Watch a 3 minute video, The Introduction of the Characteristics of Life (found on you tube). Challenge students on answers that involve breathing, multiplying, growing etc. Create a finalized list of the characteristics. • Perform an experiment to prove that yeast is alive. An example can be found at	**Other: Teacher Observation** Participation in class discussion, generated characteristic list, and ultimate application in identifying living samples will be assessed for understanding. Comprehension and application of reading material will be assessed Contributions to group discussion will be monitored and assessed for level of understanding. Drawings and written explanations will be assessed for accuracy. Models and discussion will be assessed for understanding. Contributions to class discussion, notes will be assessed for understanding. **Performance: Lab Assignment** Lab reports will be assessed using lab report format	http://www.cellsalive.com Dickey, J. *Laboratory Investigations for Biology: Observing Cells* ***Modifications:*** *http://njcdd.org/wp-content/uploads/2016/08/tools-teacherspart2.pdf*

			https://nevelbiology.files.wordpress.com/2011/10/01-yeastlab.pdf. A variation using Bromothymol Blue as a chemical indicator can be used if your school is a latex free environment. ● Read *Are Viruses Alive?* by Luis Villarreal. Utilize the article to explain (class discussion or written reflection) why viruses walk the fine line of being living/nonliving and why we ultimately consider them to be nonliving. ● Hold a class debate on whether viruses are alive or not. Students will use supporting evidence and scientific justification to win their case. A rubric may be used and viewed in advance to allow students to have a clear understanding of expectations. ● Contribute to a discussion on the structure and function of nucleic acids. ● Utilize iPads or paper supplies to model DNA and RNA. Construct an explanation on the interdependence of DNA, RNA, and proteins in the overall function of an organism. ● Discuss the importance of cells as the basic unit of life. Discuss the organization within internal structures that allow the cell to function. Communicate understanding that human systems are made up of a group of interacting atoms and molecules. ● Observe the following indicators (and be expected to apply techniques in future labs): o Benedict and/or Lugol solutions for carbohydrates o Sudan solution and/or grease spot test for lipids o Biuret solution for proteins ● Discuss the structure and function of simple and complex carbohydrates. Make Nutritional connects and show relations to sugar crashes and "carb loading" for athletes. ● Evaluate a series of molecules and argue which molecules are considered to be carbohydrates. ● Discuss the structure and function of lipids. Be able to explain why it is important to	**Performance: Authentic Task** **Evaluate and Explain** *Major Lab Investigation* Students will design a lab where they will test a series of unknown foods in the effort to identify the macromolecules found in the food. Utilizing their findings, students will construct explanations on the role the food has on the function of the organism; students will describe the overall end result for the molecules in the food. **Summative: Test: Written Summative Assessments** · Biochemistry Unit Test	

			monitor the intake of lipids in relation to their function in the body and their caloric amount per gram. ● Discuss the structure and function of proteins. View a series of animations on the function of proteins throughout the body. ● Model an Insulin Protein and construct an explanation on how the structure of the protein affects proper function. Utilize the class activity and additional research to support their argument. Describe and identify interactions/bonds that hold each level together during protein folding. ● Perform a laboratory exercise testing catalase's enzyme activity under varied laboratory conditions. They will prepare data tables, construct graphs, analyze results, and complete a formal lab report. ● Utilize molecular model kits to construct a model of a carbohydrate molecule, and demonstrate the process of dehydration synthesis/ condensation and hydrolysis reactions. They will then verbally explain their models and draw the structures. Repeat for lipids and proteins, conclude the importance of dehydration synthesis in these reactions. ● Design a lab testing a series of unknown foods to identify the macromolecules found in the food. Utilizing their findings, construct explanations on the role the food has on the function of the organism; construct the molecular formula, and describe the overall macromolecular content and value. ● Communicate the importance of the organic molecules on the overall function. Use specific body system(s) to explain the role the organic molecule plays in homeostasis. ● Contribute to a discussion of what a calorie measures. Analyze a graph that shows different physical activities and the amount of calories they burn. Accurately interpret a nutritional label.		

			• Cooperatively analyze a series of nutritional labels and communicate findings regarding the nutritional importance of the food. Quantify caloric value in various foods utilizing the heat transfer formula. • Setup a calorimeter in an effort to quantify the amount of energy stored in various foods. Evaluate and explain their findings in regards to nutritional value, energy storage, and molecular size. • Model, construct explanations, and provide evidence on the location and function of the organic molecule in regards to homeostasis on the organism and cellular level.		

NJ: 2016 SLS: Literacy in History/Social Studies, Science, & Technical Subjects 6-12
NJ: Grades 9-10
Reading: Science & Technical Subjects
Key Ideas and Details
NJSLSA.R1 Read closely to determine what the text says explicitly and to make logical inferences and relevant connections from it; cite specific textual evidence when writing or speaking to support conclusions drawn from the text.
RST.9-10.1. Accurately cite strong and thorough evidence from the text to support analysis of science and technical texts, attending to precise details for explanations or descriptions.
Craft and Structure
NJSLSA.R4 Interpret words and phrases as they are used in a text, including determining technical, connotative, and figurative meanings, and analyze how specific word choices shape meaning or tone.
RST.9-10.4. Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to grades 9–10 texts and topics.
Integration of Knowledge and Ideas
NJSLSA.R7 Integrate and evaluate content presented in diverse formats and media, including visually and quantitatively, as well as in words.
RST.9-10.7. Translate quantitative or technical information expressed in words in a text into visual form (e.g., a table or chart) and translate information expressed visually or mathematically (e.g., in an equation) into words.
NJ: 2014 SLS: Technology
NJ: Grades 9-12
8.1 Educational Technology
8.1 Educational Technology: All students will use digital tools to access, manage, evaluate, and synthesize information in order to solve problems individually and collaborate and to create and communicate knowledge.
A. Technology Operations and Concepts: Students demonstrate a sound understanding of technology concepts, systems and operations.

8.1.12.A.2 Produce and edit a multi-page digital document for a commercial or professional audience and present it to peers and/or professionals in that related area for review.
D. Digital Citizenship: Students understand human, cultural, and societal issues related to technology and practice legal and ethical behavior.

8.1.12.D.1 Demonstrate appropriate application of copyright, fair use and/or Creative Commons to an original work.
E: Research and Information Fluency: Students apply digital tools to gather, evaluate, and use information.

8.1.12.E.1 Produce a position statement about a real world problem by developing a systematic plan of investigation with peers and experts synthesizing information from multiple sources.
NGSS: Disciplinary Core Ideas
NGSS: 9-12
LS1: From Molecules to Organisms: Structures and Processes
LS1.A: Structure and Function
Systems of specialized cells within organisms help them perform the essential functions of life. (HS-LS1-1)
LS1.B: Growth and Development ofOrganisms
In multicellular organisms individual cells grow and then divide via a process called mitosis, thereby allowing the organism to grow. The organism begins as a single cell (fertilized egg) that divides successively to produce many cells, with each parent cell passing identical genetic material (two variants of each chromosome pair) to both daughter cells. Cellular division and differentiation produce and maintain a complexorganism, composed of systems of tissues and organs that work together to meet the needs of the whole organism. (HS-LS1-4)
LS1.C: Organization for Matter and Energy Flow in Organisms
The process of photosynthesis converts light energy to stored chemical energy by converting carbon dioxide plus water into sugars plus released oxygen. (HS-LS1-5)
LS2: Ecosystems: Interactions, Energy, and Dynamics
LS2.A: Interdependent Relationships in Ecosystems
Ecosystems have carrying capacities, which are limits to the numbers of organisms and populations they can support. These limits result from such factors as the availability of living and non-living resources and from such challenges such as predation, competition, and disease. Organisms would have the capacity to produce populations of great size were it notfor the fact that environments and resources are finite. This fundamental tension affects the abundance (number of individuals) of species in any given ecosystem. (HS-LS2-1),(HSLS2-2)

NJ: 2014 SLS: 21st Century Life and Careers
NJ: All Grades
Career Ready Practices
Career Ready Practices
CRP2. Apply appropriate academic and technical skills.

CRP3. Attend to personal health and financial well-being.

CRP4. Communicate clearly and effectively and with reason.

CRP5. Consider the environmental, social and economic impacts of decisions.

CRP7. Employ valid and reliable research strategies.

CRP8. Utilize critical thinking to make sense of problems and persevere in solving them.

CRP11. Use technology to enhance productivity. CRP12. Work productively in teams while using cultural global competence. 					
Homeostasis and Water Balance *(Week 9, 5 Weeks)*	How does life maintain itself? Why are water's unique properties so important for life as we know it?	Growth, reproduction and dynamic homeostasis require that cells create and maintain internal environments that are different from their external environments. The structures of materials determine their properties. As a result of water's bent shape and polarity, water has unique properties, such as an ability to dissolve most substances. These properties are responsible for many important characteristics of nature.	• Show understanding of key terms (water, solute, solution, solvent, etc.). Sketch diagrams and compose explanation. • Model or draw out a single water molecule and explain how nonpolar covalent bonds contribute to water's polarity. Properly label partial charges. Then model cohesion using Hydrogen bonds to connect multiple water molecules. Compare and contrast the difference between covalent and hydrogen bonding. • Discuss explanations, focusing on water's structure, polarity, and special properties. With a partner, brainstorm/describe examples of the various properties. • Offer definitions of acids and bases. With lab partner, test various house hold substances with pH paper and meters. Discuss accuracy vs. precision. • Design and execute a lab determining the effect of Acid Rain on Seeds (Can refer to Acid Rains and Seeds Lab in Pearson's Lab Manual B). Have students make environmental connections. Have students research how human activity influences Acid Rain and its environment effects on biodiversity; then propose potential technological solutions to reduce impact and carbon footprints. • Design, implement, and report on transpiration in a plant shoot. Prepare brief proposals for their experiments, protocol for the experiment, and at the end a formal lab report. • Hypothesize the effects of soaking a chicken egg in vinegar, share predictions, conduct experiment, analyze results. Discuss possible	**Formative: Oral: Discussion** Sketches, predictions, and participation in class discussions will be formatively assessed for understanding. **Other: Peer Assessment** Peer analysis of group lists and class presentation **Performance: Lab Assignment** Designed lab activities and resulting pH scales will be assessed for accuracy and understanding Lab report conclusions will be assessed for understanding. Students can make a photo journal of examples of key terms from the unit (homeostasis, osmosis, etc.). They can take selfies of themselves with examples of each and write a short caption to explain. Students can create a comic strip, cartoon, poem or other form of	BSCS *Pre-AP Lab Manual* BSCS *Pre-AP Lab Manual: Normal and Plasmolyzed Cells* http://mysite.cherokee.k12.ga.us/personal/gregg_schumaker/site/Important%20Class%20Documents/1/Equilibrium/Cell%20Transport%20Webquest.pdf

			purposes of the egg shell vs membrane left behind. ● Working in pairs/small groups define the terms solution, solute, and solvent. Discuss. Predict what would happen if a plant were given a salt solution instead of water or if a hospital patient was given pure water instead of a saline solution. Explain predictions and use evidence from Eggsperiment to justify. ● Perform a traditional Osmosis & Diffusion Lab using dialysis tubing, starch, iodine, and water solutions. An example is 'Detecting Diffusion' found in Pearson's Lab Manual B. Extension Activity: Have students propose additional testing steps to achieve quantitative results. ● Using microscopes and various plant cells (onion, elodea, etc.), determine the impact of solutions on cell structures. Document procedures, hypotheses, and observations. Extension activity: after cells reach plasmolysis, challenge students to restore plant cells to original size. ● Design and execute a lab using agar cubes and chemical indicators to investigate the limits of cell growth with emphasis on Surface Area to Volume Ratio. ● Discuss how plants exchange materials with their environments and why they would need to do so. Regroup as a class and share ideas. Discuss the term homeostasis, and discuss what plants might have to do to maintain homeostasis. ● Examine different types of leaves, discuss their observations *(“Why is the top waxy/shiny? Why is the underside different? Etc.”*) Using clear nail polish, make impressions of the underside to view under the microscope. Sketch observations - leading to the observation of guard cells/stomata. Hypothesize about their function. As a class, discuss. Explore stomata behavior under different environmental or species circumstances.	artistic communication to explain homeostasis and water balance. Lab report conclusion will be assessed for level of understanding **Summative: Other: Teacher Observation Evaluate** Teacher designed summative Assessment for the unit -	

			• Prepare a labeled sketch or model of the phospholipid bilayer of the cell membrane. They will then write a statement explaining the process that is occurring. • Complete a lab in which they measure osmosis and diffusion rates in plant cells, and then complete analysis questions. • Investigate a specified Website in order to examine examples of active and passive transport.		

NJ: 2016 SLS: English Language Arts
NJ: Grades 9-10
Speaking and Listening
Comprehension and Collaboration
NJSLSA.SL1 Prepare for and participate effectively in a range of conversations and collaborations with diverse partners, building on others' ideas and expressing their own clearly and persuasively.
SL.9-10.1. Initiate and participate effectively in a range of collaborative discussions (one-on-one, in groups, and teacher-led) with peers on grades 9–10 topics, texts, and issues, building on others' ideas and expressing their own clearly and persuasively.
NJSLSA.SL3 Evaluate a speaker's point of view, reasoning, and use of evidence and rhetoric.
SL.9-10.3. Evaluate a speaker's point of view, reasoning, and use of evidence and rhetoric, identifying any false reasoning or distorted evidence.
NJ: 2016 SLS: Literacy in History/Social Studies, Science, & Technical Subjects 6-12
NJ: Grades 9-10
Reading: Science & Technical Subjects
Craft and Structure
NJSLSA.R4 Interpret words and phrases as they are used in a text, including determining technical, connotative, and figurative meanings, and analyze how specific word choices shape meaning or tone.
RST.9-10.4. Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to grades 9–10 texts and topics.
Integration of Knowledge and Ideas
NJSLSA.R7 Integrate and evaluate content presented in diverse formats and media, including visually and quantitatively, as well as in words.
RST.9-10.7. Translate quantitative or technical information expressed in words in a text into visual form (e.g., a table or chart) and translate information expressed visually or mathematically (e.g., in an equation) into words.
NJ: 2016 SLS: Mathematics
NJ: HS: Algebra
Mathematical Practice
MP.The Standards for Mathematical Practice describe varieties of expertise that mathematics educators at all levels should seek to develop in their students.
MP.2. Reason abstractly and quantitatively.

MP.3. Construct viable arguments and critique the reasoning of others.

MP.4. Model with mathematics.

NGSS: Disciplinary Core Ideas
NGSS: 9-12
LS1: From Molecules to Organisms: Structures and Processes
LS1.A: Structure and Function
Systems of specialized cells within organisms help them perform the essential functions of life. (HS-LS1-1)
LS1.C: Organization for Matter and Energy Flow in Organisms
The process of photosynthesis converts light energy to stored chemical energy by converting carbon dioxide plus water into sugars plus released oxygen. (HS-LS1-5)
LS2: Ecosystems: Interactions, Energy, and Dynamics
LS2.A: Interdependent Relationships in Ecosystems
Ecosystems have carrying capacities, which are limits to the numbers of organisms and populations they can support. These limits result from such factors as the availability of living and non-living resources and from such challenges such as predation, competition, and disease. Organisms would have the capacity to produce populations of great size were it notfor the fact that environments and resources are finite. This fundamental tension affects the abundance (number of individuals) of species in any given ecosystem. (HS-LS2-1),(HSLS2-2)
LS2.B: Cycles of Matter and Energy Transfer inEcosystems
Photosynthesis and cellular respiration (including anaerobic processes)provide most of the energy for life processes. (HS-LS2-3)
ESS3: Earth and Human Activity
ESS3.C: Human Impacts on Earth Systems
Scientists and engineers can make major contributions by developing technologies that produce less pollution and waste and that preclude ecosystem degradation. (HS-ESS3-4)

NJ: 2014 SLS: 21st Century Life and Careers
NJ: All Grades
Career Ready Practices
Career Ready Practices
CRP2. Apply appropriate academic and technical skills.

CRP4. Communicate clearly and effectively and with reason.

CRP5. Consider the environmental, social and economic impacts of decisions.

CRP6. Demonstrate creativity and innovation.

CRP7. Employ valid and reliable research strategies.

CRP8. Utilize critical thinking to make sense of problems and persevere in solving them.

Energy *(Week 14, 7 Weeks)*	How do organisms obtain and use the matter and energy they need to live and grow?	Sustaining life requires substantial energy and material inputs. As matter and energy flow through different organizational levels of living systems, chemical elements are recombined in different ways to form different products. The results of these chemical reactions is that energy is transferred from one system of interacting molecules to another.	● Perform iodine (starch indicator) test on plant leaves, both light exposed and non light exposed. Work in pairs/groups and determine possible explanations for results. ● Read "Life's Greatest Invention: Photosynthesis" and discuss the following questions or complete the following activities for understanding: o *What is the author's overall attitude towards photosynthesis?* o Create a Venn diagram that compares the types of life that existed on Earth prior to and after photosynthesis. o Describe the early version of photosynthesis. o According to the reading, *How did the evolution of oxygen-using microbes pave the way for the evolution of complex life and its colonization of land?* ● Read a short narrative about the beginning of the Earth formed by the big bang theory. Have students perform research to finish the story about how life began on this new Earth. Have students all start in the same place- a single cell. ● Participate in Life Science Assessment Probes "The Giant Sequoia Tree" and/or "Needs of Seeds". Follow with a class discussion encouraging students to use previous knowledge to help explain/justify answers. ● Complete a Photosynthesis Project where students can choose different mediums to display their knowledge of various scientific terms, structure & function, enzymes, chemiosmosis, and connect the pathways of the Light Reactions and Calvin Cycle. Teacher generated rubrics may be used for consistency and clear grading expectations. ● Participate in a Stomata Density Lab where students will hypothesize, analyze, and compare stomatal densities on upper and lower leaf surfaces.	**Oral: Discussion** Scientific explanations will be assessed for accuracy and understanding Class discussion/responses will be assessed for level of understanding and need for further instruction. **Other: Teacher Observation** Designed lab activities will be assessed for understanding. **Performance: Lab Assignment** Participation in lab activity, lab data and conclusion will be assessed for understanding.	See Teacher Resource Book for *ATP Structure* activity. BSCS *Pre-AP Lab Manual: Factors Influencing the Rate of Yeast Respiration* Campbell, Reese, *Mitchell Laboratory Investigations for Biology: Alcoholic Fermentation* BSCS *Pre-AP Manual: Chloroplast Pigment Analysis*

			• Design and Execute "Alcoholic Fermentation In Yeast - Bioengineering Design Challenge" where students need to solve Jim Baker's problem (making bread as fluffy as possible without spending too much time waiting for dough to rise). Students will need to plan out two experiments and apply past knowledge of enzyme function to cellular respiration in order to solve the problem. Lab information can be found at http://serendip.brynmawr.edu/sci_edu/waldron/pdf/YeastProtocol.pdf • Diagram all 3 stages of Cellular Respiration and link anaerobic and aerobic respiration to exercise and daily activities. • Construct a paper model of the structure and function of ATP, show ATP and ADP in their applicable cycle, and then complete analysis questions. • Complete a lab activity in which they investigate alcoholic fermentation by measuring molecules produced by anaerobic cells, then complete analysis questions and conclusion statement or a formal lab report. • Complete a lab activity using a spectrometer to analyze chloroplast pigment samples obtained from different types of plant leaves. Then, complete calculations, analysis, and prepare a formal lab report.		

NJ: 2016 SLS: Literacy in History/Social Studies, Science, & Technical Subjects 6-12
NJ: Grades 9-10
Reading: Science & Technical Subjects
NJSLSA.R2 Determine central ideas or themes of a text and analyze their development; summarize the key supporting details and ideas.
RST.9-10.2. Determine the central ideas, themes, or conclusions of a text; trace the text's explanation or depiction of a complex process, phenomenon, or concept; provide an accurate summary of the text.
NJSLSA.R3 Analyze how and why individuals, events, or ideas develop and interact over the course of a text.
RST.9-10.3. Follow precisely a complex multistep procedure when carrying out experiments, taking measurements, or performing technical tasks attending to special cases or exceptions defined in the text.
Craft and Structure
NJSLSA.R4 Interpret words and phrases as they are used in a text, including determining technical, connotative, and figurative meanings, and analyze how specific word choices shape meaning or tone.

RST.9-10.4. Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to grades 9–10 texts and topics.

Integration of Knowledge and Ideas

NJSLSA.R7 Integrate and evaluate content presented in diverse formats and media, including visually and quantitatively, as well as in words.

RST.9-10.7. Translate quantitative or technical information expressed in words in a text into visual form (e.g., a table or chart) and translate information expressed visually or mathematically (e.g., in an equation) into words.

NJ: 2014 SLS: Technology

NJ: Grades 9-12

8.1 Educational Technology

8.1 Educational Technology: All students will use digital tools to access, manage, evaluate, and synthesize information in order to solve problems individually and collaborate and to create and communicate knowledge.

A. Technology Operations and Concepts: Students demonstrate a sound understanding of technology concepts, systems and operations.

8.1.12.A.3 Collaborate in online courses, learning communities, social networks or virtual worlds to discuss a resolution to a problem or issue.

E: Research and Information Fluency: Students apply digital tools to gather, evaluate, and use information.

8.1.12.E.1 Produce a position statement about a real world problem by developing a systematic plan of investigation with peers and experts synthesizing information from multiple sources.

NGSS: Disciplinary Core Ideas

NGSS: 9-12

LS1: From Molecules to Organisms: Structures and Processes

LS1.C: Organization for Matter and Energy Flow in Organisms

The process of photosynthesis converts light energy to stored chemical energy by converting carbon dioxide plus water into sugars plus released oxygen. (HS-LS1-5)

LS2: Ecosystems: Interactions, Energy, and Dynamics

LS2.A: Interdependent Relationships in Ecosystems

Ecosystems have carrying capacities, which are limits to the numbers of organisms and populations they can support. These limits result from such factors as the availability of living and non-living resources and from such challenges such as predation, competition, and disease. Organisms would have the capacity to produce populations of great size were it notfor the fact that environments and resources are finite. This fundamental tension affects the abundance (number of individuals) of species in any given ecosystem. (HS-LS2-1),(HSLS2-2)

LS2.B: Cycles of Matter and Energy Transfer inEcosystems

Photosynthesis and cellular respiration (including anaerobic processes)provide most of the energy for life processes. (HS-LS2-3)

LS2.C: Ecosystem Dynamics,Functioning, and Resilience

A complex set of interactions within an ecosystem can keep its numbers and types of organisms relatively constant over long periods of time under stable conditions. If a modest biological or physical disturbance toan ecosystem occurs, it may return to its more or less original status (i.e.,the ecosystem is resilient), as opposed to becoming a very differentecosystem. Extreme fluctuations in conditions or the size of anypopulation, however, can challenge the functioning of ecosystems interms of resources and habitat availability. (HS-LS2-2),(HS-LS2-6)

ESS2: Earth's Systems

ESS2.D: Weather and Climate

Gradual atmospheric changes were due to plants and other organisms that captured carbon dioxide and released oxygen. (HSESS2-6),(HS-ESS2-7)

PS3: Energy

PS3.D: Energy in Chemical Processes and Everyday Life

Although energy cannot be destroyed, it can be converted to less usefulforms—for example, to thermal energy in the surrounding environment.(HS-PS3-3),(HS-PS3-4) 					
NJ: 2014 SLS: 21st Century Life and Careers **NJ: All Grades** **Career Ready Practices** **Career Ready Practices** CRP2. Apply appropriate academic and technical skills. CRP3. Attend to personal health and financial well-being. CRP4. Communicate clearly and effectively and with reason. CRP6. Demonstrate creativity and innovation. CRP11. Use technology to enhance productivity. CRP12. Work productively in teams while using cultural global competence. 					
Genetics and Inheritance *(Week 21, 9 Weeks)*	1. How can probability be used to predict genetic traits? 2. How is the hereditary information in genes inherited and expressed?	1. Genes and chromosomes determine the expressions of inherited traits. 2. All species tend to maintain themselves from generation to generation using the same genetic code. However, there are genetic mechanisms that lead to variation in a population.	• Research and present a specified scientist and their scientific experiments and conclusions that led to the discovery of the 3-dimensional structure of the DNA molecule. • View the movie "Secret of Photo 51". Write an analysis based on the race to discover the Double Helix. • Sketch and label cell cycle diagrams, and answer analysis questions and use information learned to engage in large group discussion. • Utilize a specified Website to play the *Cell Cycle* game in which they will role play as components at checkpoints of the cell cycle to save a dying cell. They will write a summary of the cell cycle and how the game helped them to understand it.	**Other: Teacher Observation** Assessed using formal lab report rubric Diagram and questions assessed for completion and accuracy. Summaries assessed for accuracy and understanding Sketches and analysis questions assessed for completion and accuracy Explanations and questions assessed for completion and accuracy	

			• Investigate selected databases in order to research the role of cell cycle in a specified type of cancer, and prepare a multimedia presentation of their choosing. • Utilize the microscope to observe and identify cells in various stages of mitotic division, and prepare sketches along with analysis questions. • Work in pairs to complete a simulation of the stages of meiosis using pop beads, and prepare sketches along with completing a Venn diagram comparing mitosis and meiosis, write a summary statement describing their understanding. • Watch specified animations describing DNA replication. Answer questions while viewing on the specific enzymes and molecule orientation involved in the process. Animations: http://www.wiley.com/college/pratt/0471393878/instructor/animations/dna_replication/index.html • Complete a paper simulation of gene transcription and translation in which they use template DNA to make mRNA, then use tRNAs to build an amino acid sequence and form a protein. Then, verbally explain their model and complete analysis questions. • Complete a modeling chromosomal mutations lab with pipe cleaners and beads. • Analyze DNA and RNA sequences to determine the type of point mutation that has occurred. • Construct and utilize paper models of DNA to examine the effects of mutation on cell cycle and control, then answer analysis questions. • Explore inherited traits and the use of a Punnett square in predicting outcomes in offspring,and answer analysis questions. • Complete an investigation in which they generate their own pedigree analysis, then complete a written hypothesis, protocol, and	Reflections assessed for depth of understanding Models and questions assessed for completion and accuracy Punnett squares and questions assessed for completion and accuracy Written justification assessed for accuracy and completion Plasmid construction and analysis questions assessed for accuracy and completion Hypothesis, protocol, and analyses assessed for accuracy and completion DNA fingerprints and analysis questions assessed for accuracy and completion Teacher anecdotal notes will be made during case study activity **Other: Teacher Rubric** Presentation assessed using teacher-made rubric **Other: Peer Assessment**	

			analysis of results to justify their Pedigree Results. ● Utilize a specified Website to complete an online karyotyping activity and diagnose three case histories who present abnormal karyotypes, then produce written justification of their diagnosis. ● Complete a paper karyotyping lab in which each "child" has a genetic disorder. Students will research and present genetic disorders and indicates specifics of the diseases such as mode of inheritance etc. ● Conduct a Forensics based Lab where students will perform blood typing techniques (using simulated blood samples and Rh factor solutions) to find the potential suspect. ● Analyze the importances of knowing blood type in regards to blood transfusions.	Student Pedigrees and conclusions peer assessed for accuracy and completion	

NJ: 2016 SLS: Literacy in History/Social Studies, Science, & Technical Subjects 6-12
NJ: Grades 9-10
Reading: Science & Technical Subjects
NJSLSA.R2 Determine central ideas or themes of a text and analyze their development; summarize the key supporting details and ideas.
RST.9-10.2. Determine the central ideas, themes, or conclusions of a text; trace the text's explanation or depiction of a complex process, phenomenon, or concept; provide an accurate summary of the text.
NJSLSA.R3 Analyze how and why individuals, events, or ideas develop and interact over the course of a text.
RST.9-10.3. Follow precisely a complex multistep procedure when carrying out experiments, taking measurements, or performing technical tasks attending to special cases or exceptions defined in the text.
Craft and Structure
NJSLSA.R4 Interpret words and phrases as they are used in a text, including determining technical, connotative, and figurative meanings, and analyze how specific word choices shape meaning or tone.
RST.9-10.4. Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to grades 9–10 texts and topics.
NJSLSA.R6 Assess how point of view or purpose shapes the content and style of a text.
RST.9-10.6. Determine the author's purpose in providing an explanation, describing a procedure, or discussing an experiment in a text, defining the question the author seeks to address.
Integration of Knowledge and Ideas
NJSLSA.R7 Integrate and evaluate content presented in diverse formats and media, including visually and quantitatively, as well as in words.
RST.9-10.7. Translate quantitative or technical information expressed in words in a text into visual form (e.g., a table or chart) and translate information expressed visually or mathematically (e.g., in an equation) into words.

NJSLSA.R8 Delineate and evaluate the argument and specific claims in a text, including the validity of the reasoning as well as the relevance and sufficiency of the evidence.
RST.9-10.8. Determine if the reasoning and evidence in a text support the author's claim or a recommendation for solving a scientific or technical problem.
NJSLSA.R9 Analyze and reflect on how two or more texts address similar themes or topics in order to build knowledge or to compare the approaches the authors take.
RST.9-10.9. Compare and contrast findings presented in a text to those from other sources (including their own experiments), noting when the findings support or contradict previous explanations or accounts.
NJSLSA.R10 Read and comprehend complex literary and informational texts independently and proficiently with scaffolding as needed.
RST.9-10.10. By the end of grade 10, read and comprehend science/technical texts in the grades 9–10 text complexity band independently and proficiently.
Writing
NJSLSA.W2 Write informative/explanatory texts to examine and convey complex ideas and information clearly and accurately through the effective selection, organization, and analysis of content.
WHST.9-10.2. Write informative/explanatory texts, including the narration of historical events, scientific procedures/ experiments, or technical processes.
Production and Distribution of Writing
NJSLSA.W4 Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience.
WHST.9-10.4. Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience.
Research to Build and Present Knowledge
NJSLSA.W7 Conduct short as well as more sustained research projects based on focused questions, demonstrating understanding of the subject under investigation.
WHST.9-10.7. Conduct short as well as more sustained research projects to answer a question (including a self-generated question) or solve a problem; narrow or broaden the inquiry when appropriate; synthesize multiple sources on the subject, demonstrating understanding of the subject under investigation.
NJSLSA.W8 Gather relevant information from multiple print and digital sources, assess the credibility and accuracy of each source, and integrate the information while avoiding plagiarism.
WHST.9-10.8. Gather relevant information from multiple authoritative print and digital sources, using advanced searches effectively; assess the usefulness of each source in answering the research question; integrate information into the text selectively to maintain the flow of ideas, avoiding plagiarism and following a standard format for citation.
NJSLSA.W9 Draw evidence from literary or informational texts to support analysis, reflection, and research.
WHST.9-10.9. Draw evidence from informational texts to support analysis, reflection, and research.
NJ: 2016 SLS: Mathematics
NJ: HS: Num/Quantity
Quantities
HSN-Q.A. Reason quantitatively and use units to solve problems.
HSN-Q.A.1. Use units as a way to understand problems and to guide the solution of multi-step problems; choose and interpret units consistently in formulas; choose and interpret the scale and the origin in graphs and data displays.
Mathematical Practice
MP.The Standards for Mathematical Practice describe varieties of expertise that mathematics educators at all levels should seek to develop in their students.
MP.3. Construct viable arguments and critique the reasoning of others.

MP.4. Model with mathematics.

NJ: 2016 SLS: Science
NJ: HS Life Sciences

HS-LS1 From Molecules to Organisms: Structures and Processes
Performance Expectations

HS-LS1-1. Construct an explanation based on evidence for how the structure of DNA determines the structure of proteins which carry out the essential functions of life through systems of specialized cells.

HS-LS1-4. Use a model to illustrate the role of cellular division (mitosis) and differentiation in producing and maintaining complex organisms.

HS-LS3 Heredity: Inheritance and Variation of Traits
Performance Expectations

HS-LS3-1. Ask questions to clarify relationships about the role of DNA and chromosomes in coding the instructions for characteristic traits passed from parents to offspring.

HS-LS3-2. Make and defend a claim based on evidence that inheritable genetic variations may result from: (1) new genetic combinations through meiosis, (2) viable errors occurring during replication, and/or (3) mutations caused by environmental factors.

HS-LS3-3. Apply concepts of statistics and probability to explain the variation and distribution of expressed traits in a population.

NJ: 2014 SLS: Technology
NJ: Grades 9-12
8.1 Educational Technology
8.1 Educational Technology: All students will use digital tools to access, manage, evaluate, and synthesize information in order to solve problems individually and collaborate and to create and communicate knowledge.
A. Technology Operations and Concepts: Students demonstrate a sound understanding of technology concepts, systems and operations.

8.1.12.A.2 Produce and edit a multi-page digital document for a commercial or professional audience and present it to peers and/or professionals in that related area for review.
F: Critical thinking, problem solving, and decision making: Students use critical thinking skills to plan and conduct research, manage projects, solve problems, and make informed decisions using appropriate digital tools and resources.

8.1.12.F.1 Evaluate the strengths and limitations of emerging technologies and their impact on educational, career, personal and or social needs.

NJ: 2014 SLS: 21st Century Life and Careers
NJ: All Grades
Career Ready Practices
Career Ready Practices
CRP1. Act as a responsible and contributing citizen and employee.

CRP2. Apply appropriate academic and technical skills.

CRP4. Communicate clearly and effectively and with reason.

<table>
<tr><td colspan="6">CRP5. Consider the environmental, social and economic impacts of decisions.

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<tr>
<td>Evolution & Classification
(Week 30, 5 Weeks)</td>
<td>1. How do organisms change over time in response to changes in the environment?”
2. What evidence shows that different species are related?</td>
<td>1. All life on earth evolved from a common ancestor that first appeared billions of years ago.
2. Variation exists in all species and allows some individuals to be better able to survive in a particular environment than others.</td>
<td>Design a lab investigation showing natural selection in finch beaks. Students will collect and analyze data. Examples of lab investigation could include, "Bird Beak Buffet"
Explore the role of adaption in survival of a species by examining data provided to them, then answer analysis questions.
Perform 'Investigating Hominoid Fossils' in Pearson's Lab Manual B. Students will measure and compare skulls and hands to reveal evidence for the evolution of humans.
Complete a laboratory investigation of the biochemical evidence for evolutionary theories using their understanding of DNA sequences and proteins to determine evolutionary similarities and differences among species, then answer analysis questions.
Complete the "Dry lab evidence of evolution" to analyze the evidences of evolution. See attached document.
Perform a paper amino acid sequencing lab and analyze the cytochrome C sequences for a variety of species.
Analyze characteristics of several organisms including the Barbellus fish in order to hypothesize about the evolutionary relationship among illustrated organisms, and create an evolutionary tree showing the divergent evolution, then justify their hypothesis with a written conclusion statement.
Create an evolutionary timeline to isolate major events in Earth’s history and their affects on the evolution of organisms.</td>
<td>Other: Teacher Observation
Analysis questions assessed for completion and accuracy

Data, observations, and analyses assessed for accuracy and completion

Notes and reflection assessed for accuracy and depth of understanding

Evolution of Barbellus evolutionary tree and conclusion statements assessed for understanding

Cladagram assessed for accuracy and completion

Classifications assessed for accuracy

Summary statements assessed for accuracy and completion

Solutions and justifications assessed for depth of understanding
Other: Peer Assessment
presentations peer-assessed using</td>
<td></td>
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			- Create and analyze a cladogram based on given data of amino acid differences in specified organisms. - Utilize a dichotomous key to classify similar species of sharks. - View video segment on *United Streaming: Elements of Biology, Biological Evolutions* and explain how evolution has changed the earth's atmosphere over time. Then share ideas in peer groups. - Analyze graphs of the 3 types of selection (directional, stabilizing and disruptive) and propose real life evolutionary scenarios to match each graph. - Calculate probable allele and genotypic frequencies for various scenarios depicting Hardy-Weinberg equilibrium. - Analyze the various mechanisms of microevolution, including genetic drift, the bottleneck and founders effect. EvidenceforEvolutionActivity.pdf	teacher/student-made rubric	

NJ: 2016 SLS: Literacy in History/Social Studies, Science, & Technical Subjects 6-12
NJ: Grades 9-10
Reading: Science & Technical Subjects
NJSLSA.R2 Determine central ideas or themes of a text and analyze their development; summarize the key supporting details and ideas.
RST.9-10.2. Determine the central ideas, themes, or conclusions of a text; trace the text's explanation or depiction of a complex process, phenomenon, or concept; provide an accurate summary of the text.
Craft and Structure
NJSLSA.R4 Interpret words and phrases as they are used in a text, including determining technical, connotative, and figurative meanings, and analyze how specific word choices shape meaning or tone.
RST.9-10.4. Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to grades 9–10 texts and topics.
NJSLSA.R5 Analyze the structure of texts, including how specific sentences, paragraphs, and larger portions of the text (e.g., a section, chapter, scene, or stanza) relate to each other and the whole.
RST.9-10.5. Analyze the relationships among concepts in a text, including relationships among key terms (e.g., force, friction, reaction force, energy).
Integration of Knowledge and Ideas
NJSLSA.R7 Integrate and evaluate content presented in diverse formats and media, including visually and quantitatively, as well as in words.
RST.9-10.7. Translate quantitative or technical information expressed in words in a text into visual form (e.g., a table or chart) and translate information expressed visually or mathematically (e.g., in an equation) into words.

NJSLSA.R8 Delineate and evaluate the argument and specific claims in a text, including the validity of the reasoning as well as the relevance and sufficiency of the evidence.
RST.9-10.8. Determine if the reasoning and evidence in a text support the author's claim or a recommendation for solving a scientific or technical problem.
NJSLSA.R9 Analyze and reflect on how two or more texts address similar themes or topics in order to build knowledge or to compare the approaches the authors take.
RST.9-10.9. Compare and contrast findings presented in a text to those from other sources (including their own experiments), noting when the findings support or contradict previous explanations or accounts.
Writing
NJSLSA.W2 Write informative/explanatory texts to examine and convey complex ideas and information clearly and accurately through the effective selection, organization, and analysis of content.
WHST.9-10.2. Write informative/explanatory texts, including the narration of historical events, scientific procedures/ experiments, or technical processes.
Production and Distribution of Writing
NJSLSA.W4 Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience.
WHST.9-10.4. Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience.
NJ: 2014 SLS: Technology
NJ: Grades 9-12
8.1 Educational Technology
F: Critical thinking, problem solving, and decision making: Students use critical thinking skills to plan and conduct research, manage projects, solve problems, and make informed decisions using appropriate digital tools and resources.

8.1.12.F.1 Evaluate the strengths and limitations of emerging technologies and their impact on educational, career, personal and or social needs.
NGSS: Disciplinary Core Ideas
NGSS: 9-12
ESS2: Earth's Systems
ESS2.E:Biogeology
The many dynamic and delicate feedbacks between the biosphereand other Earth systems cause a continual co-evolution of Earth'ssurface and the life that exists on it. (HS-ESS2-7)

NJ: 2014 SLS: 21st Century Life and Careers
NJ: All Grades
Career Ready Practices
Career Ready Practices
CRP2. Apply appropriate academic and technical skills.

CRP4. Communicate clearly and effectively and with reason.

Ecological Systems	1. How do matter and energy link organisms to each other and	1. Matter needed to sustain life is continually recycled among	• Complete the activity, Life or Death Food chain decision.	**Formative: Written: Report**	See Teacher Resource Book for *What is a*

(Week 35, 6 Weeks)	their environments? 2. How do humans have an impact on the diversity and stability of ecosystems?	and between organisms and the environment. 2. Organisms and their environments are interconnected. Changes in one part of the system will affect other parts of the system.	http://chalmersbiology.weebly.com/uploads/5/5/7/1/5571931/energy_flow_activity.pdf ● Create a fictitious food pyramid and investigate the effects of population changes at different levels, then generate a written summary statement. ● investigate the various ways in which humans alter food pyramids in living ecosystems, and predict the effects of the varied human activities. Then, students will provide possible solutions, with justification, to identified problems. ● List and discuss the different symbiotic relationships that exist in nature. ● Diagram and explain the role of the biogeochemical cycles (carbon, nitrogen, phosphorus, and water) in the process of photosynthesis, cellular respiration. ● Construct a written story explaining the importance of nitrogen and phosphorous and its role in food chain/webs. Explain the impact of eutrophication. ● Participate in the game, Oh Deer! Identify a list of factors that limit a populations growth. Discuss the pros and cons to the list of limiting factors ● Analyze graphs and identify if an example of logistic or exponential growth. ● Create a venn diagram depicting the differences between R and K strategists. ● Complete an online webquest comparing and contrasting primary vs. secondary succession. www.mrphome.net/mrp/succession.swf ● Investigate teacher-selected internet sites to research an environmental concern, identify contributing human activities, and analyze the potential long-reaching effects; then develop a proposal to reduce environmental risk in our world. ● Produce a multimedia presentation using text, graphics, moving images and sound that distinguishes between naturally-occurring	Summary Statements assessed for accuracy and completion **Formative: Performance: Authentic Task** Solutions and justifications assessed for depth and understanding. **Summative: Oral: Presentation** Students will present specified biogeochemical cycle. Will be assessed for understanding and human impact. **Environmental risk reduction proposal** **Summative: Performance: Authentic Task** Proposal and presentation will be assessed using teacher generated rubric	*Food Pyramid* activity. See Teacher Resource Book for *What are the Effects of Human Intervention on a Food Web?*

			extinctions and those caused by humans. Supporting scientific data must be incorporated in the presentation. ● Investigate a specified Website and view selected clips from *An Inconvenient Truth*, examine their personal activities and estimate their own impact on the environment, then find ways we can reduce the damage to our environment. Complete a teacher –made survey and written analysis.		

NJ: 2016 SLS: Literacy in History/Social Studies, Science, & Technical Subjects 6-12
NJ: Grades 9-10
Reading: History/Social Studies
NJSLSA.R2 Determine central ideas or themes of a text and analyze their development; summarize the key supporting details and ideas.
RH.9-10.2. Determine the theme, central ideas, key information and/or perspective(s) presented in a primary or secondary source; provide an accurate summary that makes clear the relationships among the key details and ideas.
Craft and Structure
NJSLSA.R4 Interpret words and phrases as they are used in a text, including determining technical, connotative, and figurative meanings, and analyze how specific word choices shape meaning or tone.
RH.9-10.4. Determine the meaning of words and phrases as they are used in a text, including vocabulary describing political, social, or economic aspects of history and the social sciences; analyze the cumulative impact of specific word choices on meaning and tone.
NJSLSA.R6 Assess how point of view or purpose shapes the content and style of a text.
RH.9-10.6. Compare the point of view of two or more authors in regards to how they treat the same or similar topics, including which details they include and emphasize in their respective accounts.
NJSLSA.R8 Delineate and evaluate the argument and specific claims in a text, including the validity of the reasoning as well as the relevance and sufficiency of the evidence.
RH.9-10.8. Assess the extent to which the reasoning and evidence in a text support the author’s claims.
NJSLSA.R9 Analyze and reflect on how two or more texts address similar themes or topics in order to build knowledge or to compare the approaches the authors take.
RH.9-10.9. Compare and contrast treatments of the same topic, or of various perspectives, in several primary and secondary sources; analyze how they relate in terms of themes and significant historical concepts.
Writing
NJSLSA.W2 Write informative/explanatory texts to examine and convey complex ideas and information clearly and accurately through the effective selection, organization, and analysis of content.
WHST.9-10.2. Write informative/explanatory texts, including the narration of historical events, scientific procedures/ experiments, or technical processes.
Production and Distribution of Writing
NJSLSA.W4 Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience.
WHST.9-10.4. Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience.

Research to Build and Present Knowledge
NJSLSA.W7 Conduct short as well as more sustained research projects based on focused questions, demonstrating understanding of the subject under investigation.
WHST.9-10.7. Conduct short as well as more sustained research projects to answer a question (including a self-generated question) or solve a problem; narrow or broaden the inquiry when appropriate; synthesize multiple sources on the subject, demonstrating understanding of the subject under investigation.
NJSLSA.W8 Gather relevant information from multiple print and digital sources, assess the credibility and accuracy of each source, and integrate the information while avoiding plagiarism.
WHST.9-10.8. Gather relevant information from multiple authoritative print and digital sources, using advanced searches effectively; assess the usefulness of each source in answering the research question; integrate information into the text selectively to maintain the flow of ideas, avoiding plagiarism and following a standard format for citation.
NJSLSA.W9 Draw evidence from literary or informational texts to support analysis, reflection, and research.
WHST.9-10.9. Draw evidence from informational texts to support analysis, reflection, and research.
NGSS: Disciplinary Core Ideas
NGSS: 9-12
LS2: Ecosystems: Interactions, Energy, and Dynamics
LS2.A: Interdependent Relationships in Ecosystems
Ecosystems have carrying capacities, which are limits to the numbers of organisms and populations they can support. These limits result from such factors as the availability of living and non-living resources and from such challenges such as predation, competition, and disease. Organisms would have the capacity to produce populations of great size were it notfor the fact that environments and resources are finite. This fundamental tension affects the abundance (number of individuals) of species in any given ecosystem. (HS-LS2-1),(HSLS2-2)
LS2.B: Cycles of Matter and Energy Transfer inEcosystems
Plants or algae form the lowest level of the food web. At each link upward in a food web, only a small fraction of the matter consumed at the lower level is transferred upward, to produce growth and release energy incellular respiration at the higher level. Given this inefficiency, there are generally fewer organisms at higher levels of a food web. Some matterreacts to release energy for life functions, some matter is stored in newlymade structures, and much is discarded. The chemical elements that make up the molecules of organisms pass through food webs and into and out of the atmosphere and soil, and they are combined and recombined in different ways. At each link in an ecosystem, matter and energy are conserved. (HS-LS2-4)
Photosynthesis and cellular respiration are important components of the carbon cycle, in which carbon is exchanged among the biosphere,atmosphere, oceans, and geosphere through chemical, physical,geological, and biological processes. (HS-LS2-5)
LS2.C: Ecosystem Dynamics,Functioning, and Resilience
A complex set of interactions within an ecosystem can keep its numbers and types of organisms relatively constant over long periods of time under stable conditions. If a modest biological or physical disturbance toan ecosystem occurs, it may return to its more or less original status (i.e.,the ecosystem is resilient), as opposed to becoming a very differentecosystem. Extreme fluctuations in conditions or the size of anypopulation, however, can challenge the functioning of ecosystems interms of resources and habitat availability. (HS-LS2-2),(HS-LS2-6)
Moreover, anthropogenic changes (induced by human activity) in the environment—including habitat destruction, pollution, introduction of invasive species, overexploitation, and climate change—can disrupt an ecosystem and threaten the survival of some species. (HS-LS2-7)
LS2.D: Social Interactions and Group Behavior
Group behavior has evolved because membership can increase the chances of survival for individuals and their genetic relatives. (HSLS2-8)
LS4: Biological Evolution: Unity and Diversity
LS4.D: Biodiversityand Humans
Humans depend on the living world for the resources and other benefits provided by biodiversity. But human activity is also having adverse impacts on biodiversity through overpopulation, overexploitation, habitat destruction, pollution, introduction of invasive species, and climate change. Thus sustaining biodiversity so that ecosystem functioning and productivity are maintained is essential to supporting and enhancing life on Earth. Sustaining biodiversity also aids humanity by preserving landscapes of recreational or inspirational value. (secondary to HS-LS2-7)(HS-LS4-6)

ESS2: Earth's Systems
ESS2.D: Weather and Climate
The foundation for Earth's global climate systems is the electromagnetic radiation from the sun, as well as its reflection,absorption, storage, and redistribution among the atmosphere,ocean, and land systems, and this energy's re-radiation into space.(HS-ESS2-4)
ESS3: Earth and Human Activity
ESS3.A: Natural Resources
All forms of energy production and other resource extraction have associated economic, social, environmental, and geopolitical costs and risks as well as benefits. New technologies and social regulationscan change the balance of these factors. (HS-ESS3-2)
ESS3.B: Natural Hazards
Natural hazards and other geologic events have shaped the course of human history; [they] have significantly altered the sizes of human populations and have driven human migrations. (HS-ESS3-1)
ESS3.C: Human Impacts on Earth Systems
The sustainability of human societies and the biodiversity that supports them requires responsible management of natural resources. (HS-ESS3-3)
Scientists and engineers can make major contributions by developing technologies that produce less pollution and waste and that preclude ecosystem degradation. (HS-ESS3-4)
ESS3.D: Global Climate Change
Through computer simulations and other studies, important discoveries are still being made about how the ocean, the atmosphere, and the biosphere interact and are modified in responseto human activities. (HS-ESS3-6)

NJ: 2014 SLS: 21st Century Life and Careers
NJ: All Grades
Career Ready Practices
Career Ready Practices
CRP1. Act as a responsible and contributing citizen and employee.

CRP2. Apply appropriate academic and technical skills.

CRP4. Communicate clearly and effectively and with reason.

CRP5. Consider the environmental, social and economic impacts of decisions.

CRP8. Utilize critical thinking to make sense of problems and persevere in solving them.

Appendix A Sample Authentic Assessment
(Week 1, 1 Week)

Appendix B Sample Lab Activity
(Week 1, 1 Week)

TIME SEQUENCE COMPARING NORMAL MITOSIS
TO
ABNORMAL MITOSIS IN CANCER CELLS

OBJECTIVE:

What is the normal time sequence for the stages of mitosis and how is the timing altered in cancer cells?

MATERIALS:

Prepared slide of onion root tip
Compound microscope
Graph paper

PROCEDURE:

PART I

- Obtain a clean onion root tip slide and scan it under low power. Adjust the light for optimum viewing.

- Switch to high power and center your slide so that you have a field of view in which all the cells are in various stages of mitosis (including interphase).

- Start at the top right corner of the field and record the stage of each cell in Data Table 1. Count your cells in a systematic manner. This will be considered Area 1.

- After completing the count in the first area, move the slide to a new area and perform the identification and count a second time. Record this data in the table as well.

- Repeat the procedure a third time, with yet another field of view.

Sample Lab Activity (Procedures/Part I continued)

- On a separate sheet of unlined paper make a drawing of one cell in each of the various stages. Be sure to draw only what you actually see, but include all details that are visible. Your drawings will not necessarily look exactly like the ones in a text book.

- Return to Data Table 1 and record the total numbers of cells in each phase **for all three trial areas**.

- Add the total number of cells viewed in each stage. Write the total count of cells viewed in all three trials in the appropriate place on the data table.

- There is a direct relationship between the number of cells counted in a given stage of mitosis and the time that that stage takes to complete. This may be calculated if the total time for mitosis in onion root tip cells is known. (The total time is measured from interphase to interphase). It is generally acknowledged that this time for onion cells is 720 minutes (12 hours). Set-up a ratio of the number of cells in each phase compared to the total number of cell counted, then multiply this fraction by the total time (720 minutes) needed to complete one mitotic division. Thus, the time for a specific phase is equal to:

- Using your data, calculate the time required for the completion of each stage. **Be sure to use the totals for all three trials**. Enter these results in the appropriate column of Data Table 1.

- Prepare a bar graph to illustrate your results. The vertical axis should be marked in “minutes to complete each stage.” On the horizontal axis, allow equal space for each of the stages beginning with interphase and ending with telophase.

PART II: Mitotic Cell Division In Cancer Cells

- An important characteristic of cancer cells is that they no longer follow their normal timing of mitosis. You may have heard cancer cells called “runaway cells” that have no control on their rate of reproduction. It is this characteristic that allows some cancer cells to grow and spread quite rapidly. In this section, you will analyze data to determine the differences in timing of mitosis between normal and cancerous stomach cells in a chicken.

- Study the data in Table 2. Assume that the total time needed for one normal mitotic division of these cells is 625 minutes. Calculate, in the same manner as before, the total time needed for each normal phase of mitosis. Enter this data in the appropriate column of Data Table 2.

Sample Lab Activity (Procedure/Part II continued)

- Repeat this analysis for the data in Table 3. In the case of cancer cells, however, the total time required for one mitotic division is only 448 minutes. Enter the time required for each stage in Data Table 3.

- Prepare another bar graph, similar to your first, using the data from Tables 2 and 3. Put the data for both the normal and cancer cells in each phase directly next to each other.

CONCLUSION QUESTIONS:

Refer to your data and graph from Part 1 to answer the following:

1. Which stage in the mitotic cycle takes the most time? What percentage of the total time is this?

1. Why do you think that this stage (the one in question 1) takes so long? What activities in relation to mitosis are occurring during this phase?

1. Which stage is the second longest? What percentage of the total time does this stage take? Again, what events are occurring during this stage identified in question 3?

1. List the remaining stages in order, from longest to shortest duration. Referring to your data and graph from Part II answer the following: 1. How does the data for each phase in the normal chicken cell compare with that of the onion root tip cell? Are the percentages of time for the two longest phases similar? Can you make a general conclusion based on this information? 1. In which stages are the most dramatic differences in timing between normal and cancerous chicken cells? 1. What nuclear and cytoplasmic changes would you expect to find in cancer cells, as compared to their normal counterparts? (HINT: What events would be most affected by the alteration in the timing sequence of mitosis?) Sample Lab Activity.docx
Miller and Levine, Lab Manual Holt, Biology: Visualizing Life, “Using a Compound Light Microscope”, pp. 828-829 **Explore/Explain/Evaluate** *XCC: Scale, Proportion & Quality* *Practice: Model, construct explanations, and communication* Classroom supplies to be given may include: paper clips, pipe cleaners, beads, construction paper, cups, wire hangers, string, etc. Biology Resource binder contains “Is Sammy Alive?” activity Segue discussion into CHNOPS and the macromolecules **Engage/Explain** *XCC: Structure & function* *Practice: Ask questions, argue from evidence, analyze data*

Engage/Explain
XCC: Structure & function
Practice: Ask questions, analyze data

Explore
XCC: Structure & function, stability & change
Practice: Model, construct explanations, argue from evidence

See calculating calories sheet in the Biology Resource binder
See Soda Can Calorimeter in the Biology Resource binder
See Insulin Paper Model Activity in the Biology Resource binder

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