Course Title: Biology
Board Approval Date: 3/18/13
Credit / Hours: 1 credit

Course Description:

Biology focuses on mastery of the PA Academic Standards for Science and Technology as well as Environment and Ecology. As students progress through biology they will participate in a systematic study of the nature of science, biochemistry, cells, genetics, evolution, classification of organisms, and ecology.

Biology is the branch of science that studies the living world. Since there are approximately 1.9 million classified species on the planet, the course will look at the things that are common to all organisms. Wherever possible, activities and lab exercises are used to show biological concepts that apply to our living world. This course will focus on relevant examples from our own biology.

Learning Activities / Modes of Assessment:

Large group instruction	Tests and Quizzes
Laboratory experiments	Projects with Rubrics
Small group work	Lab Reports / Write-ups
Reading assignments	Writing Assignments
	CDT Testing

Instructional Resources:

Biology (Pearson, 2002) by Ken Miller & Joseph Levine
Online access to *Biology* by Ken Miller & Joseph Levine
Laptops
Logger Pro software
Excel, PowerPoint, Word
Moodle
Google Docs
Discovery Education video services
Central Columbia School District Educational Video Library
Various instructional videos and educational websites

Course Pacing Guide

Course: **Biology**

Course Unit (Topic)	**Length of Instruction (Days/Periods)**
1. Science of Biology	8 days
2. Biochemistry	19 days
3. Ecology	27 days
4. Cells	26 days
5. Molecular Genetics	30 days
6. Genetics	29 days
7. Evolution	21 days
DAYS TOTAL	160 Days

Curriculum: CCSD CURRICULUM

PENNSYLVANIA

Course: Biology (3/18/13)

Date: February 6, 2013 ET

Topic: 1-Science of Biology

Days: 8

Subject(s): Science

Grade(s): 10th

Know:	Understand:	Do:
3.3.10.A – Essential Explain the structural and functional similarities and differences found among living things. • Identify and characterize major life forms according to their placement in existing classification groups. • Explain the relationship between structure and function at the molecular and cellular levels. • Describe organizing schemes of classification keys. • Identify and characterize major life forms by kingdom, phyla, class and order.	Science involves the use of technology and the scientific method to solve problems.	**3.3.10.A – Essential** Explain the structural and functional similarities and differences found among living things. • Identify and characterize major life forms according to their placement in existing classification groups. • Explain the relationship between structure and function at the molecular and cellular levels. • Describe organizing schemes of classification keys. • Identify and characterize major life forms by kingdom, phyla, class and order. **3.1.10.D – Compact** Apply scale as a way of relating concepts and ideas to one another by some measure. • Apply dimensional analysis and scale as a ratio. • Convert one scale to another. **3.2.10.A – Essential** Apply knowledge and understanding about the nature of scientific and technological knowledge. • Compare and contrast scientific theories and beliefs. • Know that science uses both direct and indirect observation means to study the world and the universe. • Integrate new information into existing theories and explain implied results. **3.2.10.B – Essential** Apply process knowledge and organize scientific and technological phenomena in varied ways. • Describe materials using precise quantitative and qualitative skills based on observations. • Develop appropriate scientific experiments: raising questions, formulating hypotheses, testing, controlled experiments, recognizing variables, manipulating variables, interpreting data, and producing solutions. • Use process skills to make inferences and predictions using collected information and to communicate, using space / time relationships, defining operationally.

Topic: 1-Science of Biology
Subject(s): Science
Days: 8
Grade(s): 10th

Know:	Understand:	Do:
3.2.10.A – Essential Apply knowledge and understanding about the nature of scientific and technological knowledge. • Compare and contrast scientific theories and beliefs. • Know that science uses both direct and indirect observation means to study the world and the universe. • Integrate new information into existing theories and explain implied results.		**3.2.10.C – Essential** Apply the elements of scientific inquiry to solve problems. • Generate questions about objects, organisms and/or events that can be answered through scientific investigations. • Evaluate the appropriateness of questions. • Design an investigation with adequate control and limited variables to investigate a question. • Conduct a multiple step experiment. • Organize experimental information using a variety of analytic methods. • Judge the significance of experimental information in answering the question. • Suggest additional steps that might be done experimentally.
3.7.10.A – Important Identify and safely use a variety of tools, basic machines, materials and techniques to solve problems and answer questions. • Select and safely apply appropriate tools, materials and processes necessary to solve complex problems. • Apply advanced tool and equipment manipulation techniques to solve problems.		**3.2.10.D – Compact** Identify and apply the technological design process to solve problems. • Examine the problem, rank all necessary information and all questions that must be answered. • Propose and analyze a solution. • Implement the solution. • Evaluate the solution, test, redesign and improve as necessary. • Communicate the process and evaluate and present the impacts of the solution.
		3.7.10.A – Important Identify and safely use a variety of tools, basic machines, materials and techniques to solve problems and answer questions. • Select and safely apply appropriate tools, materials and processes necessary to solve complex problems. • Apply advanced tool and equipment manipulation techniques to solve problems.

Topic: 1-Science of Biology
Days: 8
Subject(s): Science
Grade(s): 10th

Know:	Understand:	Do:
3.7.10.B – Important Apply appropriate instruments and apparatus to examine a variety of objects and processes. • Describe and use appropriate instruments to gather and analyze data. • Compare and contrast different scientific measurement systems; select the best measurement system for a specific situation. • Explain the need to estimate measurements within error of various instruments. • Apply accurate measurement knowledge to solve everyday problems. • Describe and demonstrate the operation and use of advanced instrumentation in evaluating material and chemical properties (e.g., scanning electron microscope, nuclear magnetic resonance machines). **3.1.B.A1.a – Essential** COMMON CHARACTERISTICS OF LIFE - Describe the common characteristics of life.		**3.7.10.B – Important** Apply appropriate instruments and apparatus to examine a variety of objects and processes. • Describe and use appropriate instruments to gather and analyze data. • Compare and contrast different scientific measurement systems; select the best measurement system for a specific situation. • Explain the need to estimate measurements within error of various instruments. • Apply accurate measurement knowledge to solve everyday problems. • Describe and demonstrate the operation and use of advanced instrumentation in evaluating material and chemical properties (e.g., scanning electron microscope, nuclear magnetic resonance machines). **3.1.10.A – Compact** Discriminate among the concepts of systems, subsystems, feedback and control in solving technological problems. • Identify the function of subsystems within a larger system (e.g., role of thermostat in an engine, pressure switch). • Describe the interrelationships among inputs, processes, outputs, feedback and control in specific systems. • Explain the concept of system redesign and apply it to improve technological systems. • Apply the universal systems model to illustrate specific solutions and troubleshoot specific problems. • Analyze and describe the effectiveness of systems to solve specific problems. **3.1.B.A1.a – Essential** COMMON CHARACTERISTICS OF LIFE - Describe the common characteristics of life. 3.3.10.A - Explain the structural and functional similarities and differences found among living things. 3.1.10.D - Apply scale as a way of relating concepts and ideas to one another by some measure.

Topic: 1-Science of Biology
Days: 8
Subject(s): Science
Grade(s): 10th

Know:	Understand:	Do:
The Process of Scientific Inquiry: scientific method, hypothesis, controlled experiment, independent variable, dependent variable, metric system, biology, dimensional analysis, qualitative data, quantitative data, observation Tools of Biology: compound light microscope, electron microscope, stereo-microscope, centrifuge, Parts of the Compound Light Microscope		3.2.10.A - Apply knowledge and understanding about the nature of scientific and technological knowledge. 3.2.10.B - Apply process knowledge and organize scientific and technological phenomena in varied ways. 3.2.10.C - Apply the elements of scientific inquiry to solve problems. 3.2.10.D - Identify and apply the technological design process to solve problems. 3.7.10.A - Identify and safely use a variety of tools, basic machines, materials and techniques to solve problems and answer questions. 3.7.10.B - Apply appropriate instruments and apparatus to examine a variety of objects and processes. 3.1.10.A - Discriminate among the concepts of systems, subsystems, feedback and control in solving technological problems. S11.A.1.1.1 - Compare and contrast scientific theories, scientific laws, and beliefs (e.g., the law of gravity, how light travels, formation of moons, stages of ecological succession). S11.A.1.1.2 - Analyze and explain how to verify the accuracy of scientific facts, principles, theories, and laws. S11.A.1.1.3 - Evaluate the appropriateness of research questions (e.g., testable vs. not-testable). S11.A.1.1.4 - Explain how specific scientific knowledge or technological design concepts solve practical problems (e.g., momentum, Newton's laws of universal gravitation, tectonics, conservation of mass and energy, cell theory, theory of evolution, atomic theory, theory of relativity, Pasteur's germ theory, relativity, heliocentric theory, gas laws, processing and feedback systems). 9-10.R.S.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. • Identify and characterize major life forms according to their placement in existing classification groups.

Topic: 1-Science of Biology
Days: 8
Subject(s): Science
Grade(s): 10th

Know:	Understand:	Do:
		• Explain the relationship between structure and function at the molecular and cellular levels. • Describe organizing schemes of classification keys. • Identify and characterize major life forms by kingdom, phyla, class and order. • Apply dimensional analysis and scale as a ratio. • Convert one scale to another. • Compare and contrast scientific theories and beliefs. • Know that science uses both direct and indirect observation means to study the world and the universe. • Integrate new information into existing theories and explain implied results. • Describe materials using precise quantitative and qualitative skills based on observations. • Develop appropriate scientific experiments: raising questions, formulating hypotheses, testing, controlled experiments, recognizing variables, manipulating variables, interpreting data, and producing solutions. • Use process skills to make inferences and predictions using collected information and to communicate, using space / time relationships, defining operationally. • Generate questions about objects, organisms and/or events that can be answered through scientific investigations. • Evaluate the appropriateness of questions. • Design an investigation with adequate control and limited variables to investigate a question. • Conduct a multiple step experiment. • Organize experimental information using a variety of analytic methods. • Judge the significance of experimental information in answering the question.

Topic: 1-Science of Biology
Days: 8
Subject(s): Science
Grade(s): 10th

Know:	Understand:	Do:
		• Suggest additional steps that might be done experimentally. • Examine the problem, rank all necessary information and all questions that must be answered. • Propose and analyze a solution. • Implement the solution. • Evaluate the solution, test, redesign and improve as necessary. • Communicate the process and evaluate and present the impacts of the solution. • Select and safely apply appropriate tools, materials and processes necessary to solve complex problems. • Apply advanced tool and equipment manipulation techniques to solve problems. • Describe and use appropriate instruments to gather and analyze data. • Compare and contrast different scientific measurement systems; select the best measurement system for a specific situation. • Explain the need to estimate measurements within error of various instruments. • Apply accurate measurement knowledge to solve everyday problems. • Describe and demonstrate the operation and use of advanced instrumentation in evaluating material and chemical properties (e.g., scanning electron microscope, nuclear magnetic resonance machines). • Identify the function of subsystems within a larger system (e.g., role of thermostat in an engine, pressure switch). • Describe the interrelationships among inputs, processes, outputs, feedback and control in specific systems. • Explain the concept of system redesign and apply it to improve technological systems. • Apply the universal systems model to illustrate specific solutions and troubleshoot specific problems.

Topic: 1-Science of Biology
Days: 8
Subject(s): Science
Grade(s): 10th

Know:	Understand:	Do:
		• Analyze and describe the effectiveness of systems to solve specific problems.

Curriculum: CCSD CURRICULUM

PENNSYLVANIA

Course: Biology (3/18/13)

Date: February 6, 2013 ET

Topic: 2-Biochemistry

Days: 19

Subject(s):

Grade(s):

Know:	Understand:	Do:
3.1.10.B – Essential Describe concepts of models as a way to predict and understand science and technology. • Distinguish between different types of models and modeling techniques and apply their appropriate use in specific applications (e.g., kinetic gas theory, DNA). • Examine the advantages of using models to demonstrate processes and outcomes (e.g., blue print analysis, structural stability). • Apply mathematical models to science and technology.	Biologic molecules are important to the function of all living organisms.	**3.1.10.B – Essential** Describe concepts of models as a way to predict and understand science and technology. • Distinguish between different types of models and modeling techniques and apply their appropriate use in specific applications (e.g., kinetic gas theory, DNA). • Examine the advantages of using models to demonstrate processes and outcomes (e.g., blue print analysis, structural stability). • Apply mathematical models to science and technology. **3.4.10.B – Compact** Analyze energy sources and transfers of heat. • Determine the efficiency of chemical systems by applying mathematical formulas. • Use knowledge of chemical reactions to generate an electrical current. • Evaluate energy changes in chemical reactions. • Use knowledge of conservation of energy and momentum to explain common phenomena (e.g., refrigeration system, rocket propulsion). • Explain resistance, current and electro-motive force (Ohm's Law). **3.1.B.A2.d – Essential** ENERGY FLOW - Explain why many biological macromolecules such as ATP and lipids contain high energy bonds. **3.1.B.A5.b – Essential** FORM AND FUNCTIONS - Explain the role of water in cell metabolism. **3.1.B.A7.a – Essential** MOLECULAR BASIS OF LIFE - Analyze the importance of carbon to the structure of biological macromolecules. **3.1.B.A7.b – Essential** MOLECULAR BASIS OF LIFE - Compare and contrast the functions and structures of proteins, lipids, carbohydrates, and nucleic acids.

Topic: 2-Biochemistry
Days: 19
Subject(s):
Grade(s):

Know:	Understand:	Do:
3.4.10.A – Important Explain concepts about the structure and properties of matter. • Know that atoms are composed of even smaller sub-atomic structures whose properties are measurable. • Explain the repeating pattern of chemical properties by using the repeating patterns of atomic structure within the periodic table. • Predict the behavior of gases through the use of Boyle's, Charles' or the ideal gas law, in everyday situations. • Describe phases of matter according to the Kinetic Molecular Theory. • Explain the formation of compounds and their resulting properties using bonding theories (ionic and covalent). • Recognize formulas for simple inorganic compounds. • Describe various types of chemical reactions by applying the laws of conservation of mass and energy.		**3.1.B.A8.c – Essential** UNIFYING THEMES - SYSTEMS Describe how the unique properties of water support life. 3.1.10.B - Describe concepts of models as a way to predict and understand science and technology. • Distinguish between different types of models and modeling techniques and apply their appropriate use in specific applications (e.g., kinetic gas theory, DNA). • Examine the advantages of using models to demonstrate processes and outcomes (e.g., blue print analysis, structural stability). • Apply mathematical models to science and technology. 3.4.10.B - Analyze energy sources and transfers of heat. • Evaluate energy changes in chemical reactions. • Use knowledge of conservation of energy 3.1.B.A2.e - ENERGY FLOW - Explain the importance of enzymes as catalysts in cell reactions. 3.1.B.A8.b - UNIFYING THEMES - PATTERNS Demonstrate the repeating patterns that occur in biological polymers. S11.B.1.1.1 - Explain how structure determines function at multiple levels of organization (e.g., chemical, cellular, anatomical, ecological). S11.C.1.1.1 - Explain that matter is made of particles called atoms and that atoms are composed of even smaller particles (e.g., proton, neutrons, electrons). S11.C.1.1.2 - Explain the relationship between the physical properties of a substance and its molecular or atomic structure. S11.C.1.1.3 - Explain the formation of compounds and their resulting properties using bonding theories (ionic and covalent).

Topic: 2-Biochemistry
Days: 19
Subject(s):
Grade(s):

Know:	Understand:	Do:
• Apply knowledge of mixtures to appropriate separation techniques. • Understand that carbon can form several types of compounds. **3.4.10.B – Compact** Analyze energy sources and transfers of heat. • Determine the efficiency of chemical systems by applying mathematical formulas. • Use knowledge of chemical reactions to generate an electrical current. • Evaluate energy changes in chemical reactions. • Use knowledge of conservation of energy and momentum to explain common phenomena (e.g., refrigeration system, rocket propulsion). • Explain resistance, current and electro-motive force (Ohm's Law).		S11.C.1.1.4 - Explain how the relationships of chemical properties of elements are represented in the repeating patterns within the periodic table. 9-10.R.S.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.

Topic: 2-Biochemistry
Days: 19
Subject(s):
Grade(s):

Know:	Understand:	Do:
3.1.10.E – Essential Describe patterns of change in nature, physical and man made systems. • Describe how fundamental science and technology concepts are used to solve practical problems (e.g., momentum, Newton's laws of universal gravitation, tectonics, conservation of mass and energy, cell theory, theory of evolution, atomic theory, theory of relativity, Pasteur's germ theory, relativity, heliocentric theory, gas laws, feedback systems). • Recognize that stable systems often involve underlying dynamic changes (e.g., a chemical reaction at equilibrium has molecules reforming continuously). • Describe the effects of error in measurements. • Describe changes to matter caused by heat, cold, light or chemicals using a rate function.		

Topic: 2-Biochemistry
Days: 19
Subject(s):
Grade(s):

Know:	Understand:	Do:
3.1.B.A2.e – Important ENERGY FLOW - Explain the importance of enzymes as catalysts in cell reactions. **3.1.B.A8.b – Compact** UNIFYING THEMES - PATTERNS Demonstrate the repeating patterns that occur in biological polymers. Parts of the Atom Types of Bonding Types of Compounds Chemical Equations and Reactions Terms: matter, atom, molecule, compound, reactant, product, chemistry, biochemistry, covalent, ionic, polar bonding, lipids, carbohydrates, proteins, nucleic acids, water, pH scale, acid, base, buffer		

Curriculum: CCSD CURRICULUM

PENNSYLVANIA

Course: Biology (3/18/13)

Date: February 6, 2013 ET

Topic: 3-Ecology

Days: 27

Subject(s):

Grade(s):

Know:	Understand:	Do:
3.1.10.B – Essential Describe concepts of models as a way to predict and understand science and technology. • Distinguish between different types of models and modeling techniques and apply their appropriate use in specific applications (e.g., kinetic gas theory, DNA). • Examine the advantages of using models to demonstrate processes and outcomes (e.g., blue print analysis, structural stability). • Apply mathematical models to science and technology. **4.1.10.A.b – Important** Analyze possible causes of population fluctuations. **4.1.10.A.d – Important** Describe how organisms become classified as threatened or endangered. **4.1.10.A.e – Important** Describe how limiting factors cause organisms to become extinct.	Living and nonliving things interact with one another in a variety of ways.	**3.1.10.B – Essential** Describe concepts of models as a way to predict and understand science and technology. • Distinguish between different types of models and modeling techniques and apply their appropriate use in specific applications (e.g., kinetic gas theory, DNA). • Examine the advantages of using models to demonstrate processes and outcomes (e.g., blue print analysis, structural stability). • Apply mathematical models to science and technology. **4.1.10.A.a – Essential** Examine the effects of limiting factors on population dynamics. **4.1.10.A.c – Important** Explain the concept of carrying capacity in an ecosystem. 3.1.10.B - Describe concepts of models as a way to predict and understand science and technology. • Distinguish between different types of models and modeling techniques and apply their appropriate use in specific applications (e.g., kinetic gas theory, DNA). • Examine the advantages of using models to demonstrate processes and outcomes (e.g., blue print analysis, structural stability). • Apply mathematical models to science and technology. 3.5.10.D - Assess the value of water as a resource. Refer to Environment and Ecology Standards Categories 4.1, 4.3, 4.8 for standards that deal with environmental impact of Earth structures and forces. • Compare specific sources of potable water (e.g., wells, public systems, rivers) used by people in Pennsylvania.

Topic: 3-Ecology
Days: 27
Subject(s):
Grade(s):

Know:	Understand:	Do:
4.3.10.A.a – Compact Evaluate factors affecting the use of natural resources. **4.5.10.C.a – Compact** Analyze real-world data and explain how point and non-point source pollution can be detected and eliminated. **4.5.10.D.b – Compact** Analyze the relationship between habitat changes to plant and animal population fluctuations. Levels of Study in the field of Ecology:Bioshphere, Ecosystem, Community, Population, Species Energy Transfer in Ecosystems:Food Web, Food Chain, Pyramids, Biomass, Autotroph, Heterotroph Ecosystems of the World:Terrestrial and Aquatic Ecosystems Organism Interactions:Mutualism, Commensalism, Parasitism, Predator/ Prey Population Dynamics:Limiting Factors, Population Density, Growth Curves, Carrying Capacity,		• Identify the components of a municipal/ agricultural water supply system and a wastewater treatment system. • Relate aquatic life to water conditions (e.g., turbidity, temperature, salinity, dissolved oxygen, nitrogen levels, pressure). • Compare commercially important aquatic species in or near Pennsylvania. • Identify economic resources found in marine areas. • Assess the natural and man-made factors that affect the availability of clean water (e.g., rock and mineral deposits, man-made pollution). 4.1.10.A.b - Analyze possible causes of population fluctuations. 4.1.10.A.d - Describe how organisms become classified as threatened or endangered. 4.1.10.A.e - Describe how limiting factors cause organisms to become extinct. 4.3.10.A.a - Evaluate factors affecting the use of natural resources. 4.5.10.C.a - Analyze real-world data and explain how point and non-point source pollution can be detected and eliminated. 4.5.10.C.b - Compare and contrast the environmental effects of different industrial strategies. 4.5.10.D.b - Analyze the relationship between habitat changes to plant and animal population fluctuations. S11.B.3.1.1 - Explain the significance of diversity in ecosystems. S11.B.3.1.2 - Explain the biotic (i.e., plant, animal, and microbial communities) and abiotic (i.e., soil, air, temperature, and water) components of an ecosystem and their interaction. S11.B.3.1.3 - Describe how living organisms affect the survival of one another. S11.B.3.1.4 - Explain the similarities and differences in the major biomes (e.g., desert, tropical rain forest, temperate forest, coniferous forest, tundra) and the communities that inhabit them. S11.B.3.1.5 - Predict how limiting factors (e.g., physical, biological, chemical factors) can affect

Topic: 3-Ecology
Days: 27
Subject(s):
Grade(s):

Know:	Understand:	Do:
Endangered Species, Threatened Species, Extinction Environmental Issues: Acid Rain,Global Warming, Ozone Depletion, Habitat Fragmentation, Resource Conservation		organisms. S11.D.2.1.2 - Compare the transmission, reflection, absorption, and radiation of solar energy to and by the Earth's surface under different environmental conditions (e.g., major volcanic eruptions, greenhouse effect, reduction of ozone layer; increased global cloud cover) S.ID.2 - Use statistics appropriate to the shape of the data distribution to compare center (median, mean) and spread (interquartile range, standard deviation) of two or more different data sets.

Curriculum: CCSD CURRICULUM

PENNSYLVANIA

Course: Biology (3/18/13)

Date: February 6, 2013 ET

Topic: 4-Cells

Days: 26

Subject(s):

Grade(s):

Know:	Understand:	Do:
3.3.10.C – Essential Describe how genetic information is inherited and expressed. • Compare and contrast the function of mitosis and meiosis. • Describe mutations' effects on a trait's expression. • Distinguish different reproductive patterns in living things (e.g., budding, spores, fission). • Compare random and selective breeding practices and their results (e.g., antibiotic resistant bacteria). • Explain the relationship among DNA, genes and chromosomes. • Explain different types of inheritance (e.g., multiple allele, sex-influenced traits). • Describe the role of DNA in protein synthesis as it relates to gene expression.	Cells are the basic units of living things.	**3.3.10.C – Essential** Describe how genetic information is inherited and expressed. • Compare and contrast the function of mitosis and meiosis. • Describe mutations' effects on a trait's expression. • Distinguish different reproductive patterns in living things (e.g., budding, spores, fission). • Compare random and selective breeding practices and their results (e.g., antibiotic resistant bacteria). • Explain the relationship among DNA, genes and chromosomes. • Explain different types of inheritance (e.g., multiple allele, sex-influenced traits). • Describe the role of DNA in protein synthesis as it relates to gene expression. **3.1.10.B – Essential** Describe concepts of models as a way to predict and understand science and technology. • Distinguish between different types of models and modeling techniques and apply their appropriate use in specific applications (e.g., kinetic gas theory, DNA). • Examine the advantages of using models to demonstrate processes and outcomes (e.g., blue print analysis, structural stability). • Apply mathematical models to science and technology. **3.3.10.A – Essential** Explain the structural and functional similarities and differences found among living things. • Identify and characterize major life forms according to their placement in existing classification groups. • Explain the relationship between structure and function at the molecular and cellular levels. • Describe organizing schemes of classification keys. • Identify and characterize major life forms by kingdom, phyla, class and order.

Topic: 4-Cells
Subject(s):
Days: 26
Grade(s):

Know:	Understand:	Do:
3.1.10.B – Essential Describe concepts of models as a way to predict and understand science and technology. • Distinguish between different types of models and modeling techniques and apply their appropriate use in specific applications (e.g., kinetic gas theory, DNA). • Examine the advantages of using models to demonstrate processes and outcomes (e.g., blue print analysis, structural stability). • Apply mathematical models to science and technology.		**3.3.10.B – Essential** Describe and explain the chemical and structural basis of living organisms. • Describe the relationship between the structure of organic molecules and the function they serve in living organisms. • Identify the specialized structures and regions of the cell and the functions of each. • Explain how cells store and use information to guide their functions. • Explain cell functions and processes in terms of chemical reactions and energy changes. **3.4.10.B – Compact** Analyze energy sources and transfers of heat. • Determine the efficiency of chemical systems by applying mathematical formulas. • Use knowledge of chemical reactions to generate an electrical current. • Evaluate energy changes in chemical reactions. • Use knowledge of conservation of energy and momentum to explain common phenomena (e.g., refrigeration system, rocket propulsion). • Explain resistance, current and electro-motive force (Ohm's Law). **3.7.10.B – Important** Apply appropriate instruments and apparatus to examine a variety of objects and processes. • Describe and use appropriate instruments to gather and analyze data. • Compare and contrast different scientific measurement systems; select the best measurement system for a specific situation. • Explain the need to estimate measurements within error of various instruments. • Apply accurate measurement knowledge to solve everyday problems. • Describe and demonstrate the operation and use of advanced instrumentation in evaluating material and chemical properties (e.g., scanning electron microscope, nuclear magnetic resonance machines).

Topic: 4-Cells
Subject(s):
Days: 26
Grade(s):

Know:	Understand:	Do:
3.3.10.A – Essential Explain the structural and functional similarities and differences found among living things. • Identify and characterize major life forms according to their placement in existing classification groups. • Explain the relationship between structure and function at the molecular and cellular levels. • Describe organizing schemes of classification keys. • Identify and characterize major life forms by kingdom, phyla, class and order.		**3.1.B.A1.b – Essential** COMMON CHARACTERISTICS OF LIFE - Compare and contrast the cellular structures and degrees of complexity of prokaryotic and eukaryotic organisms. **3.1.B.A2.a – Essential** ENERGY FLOW - Identify the initial reactants, final products, and general purposes of photosynthesis and cellular respiration. **3.1.B.A2.b – Essential** ENERGY FLOW - Explain the important role of ATP in cell metabolism. **3.1.B.A2.c – Essential** ENERGY FLOW - Describe the relationship between photosynthesis and cellular respiration in photosynthetic organisms. **3.1.B.A4.a – Essential** CELL CYCLES - Summarize the stages of the cell cycle. **3.1.B.A4.c – Essential** CELL CYCLES - Explain the role of mitosis in the formation of new cells and its importance in maintaining chromosome number during asexual reproduction. **3.1.B.A5.a – Essential** FORM AND FUNCTIONS - Relate the structure of cell organelles to their function (energy capture and release, transport, waste removal, protein synthesis, movement, etc). **3.1.B.A5.c – Essential** FORM AND FUNCTIONS - Explain how the cell membrane functions as a regulatory structure and protective barrier for the cell. **3.1.B.A5.d – Essential** FORM AND FUNCTIONS - Describe transport mechanisms across the plasma membrane.

Topic: 4-Cells
Days: 26
Subject(s):
Grade(s):

Know:	Understand:	Do:
3.3.10.B – Essential Describe and explain the chemical and structural basis of living organisms. • Describe the relationship between the structure of organic molecules and the function they serve in living organisms. • Identify the specialized structures and regions of the cell and the functions of each. • Explain how cells store and use information to guide their functions. • Explain cell functions and processes in terms of chemical reactions and energy changes.		**S11.B.1.1.2 – Essential** Compare and contrast the structural and functional similarities and differences among living things (e.g., classify organisms into existing classification groups, compare systems). **S11.B.1.1.3 – Essential** Compare and contrast cellular processes (e.g., photosynthesis and respiration, meiosis and mitosis, protein synthesis and DNA replication). 3.3.10.C - Describe how genetic information is inherited and expressed. 3.1.10.B - Describe concepts of models as a way to predict and understand science and technology. 3.3.10.A - Explain the structural and functional similarities and differences found among living things. 3.3.10.B - Describe and explain the chemical and structural basis of living organisms. 3.4.10.B - Analyze energy sources and transfers of heat. 3.7.10.B - Apply appropriate instruments and apparatus to examine a variety of objects and processes. 3.1.B.A1.c - COMMON CHARACTERISTICS OF LIFE - Explain that some structures in eukaryotic cells developed from early prokaryotic cells (e.g., mitochondria, chloroplasts) 3.1.B.A2.f - ENERGY FLOW- Identify how factors such as pH and temperature may affect enzyme function. 3.1.B.A3. - LIFE CYCLES - Explain how all organisms begin their life cycles as a single cell and that in multicellular organisms, successive generations of embryonic cells form by cell division. 3.1.B.A4.b - CELL CYCLES - Examine how interactions among the different molecules in the cell cause the distinct stages of the cell cycle which can also be influenced by other signaling molecules. 3.1.B.A6. - ORGANIZATION - Explain how cells differentiate in multicellular organisms. 3.1.B.A7.c - MOLECULAR BASIS OF LIFE - Explain the consequences of extreme changes in pH and temperature on cell proteins.

Topic: 4-Cells
Days: 26
Subject(s):
Grade(s):

Know:	Understand:	Do:
3.4.10.B – Compact Analyze energy sources and transfers of heat. • Determine the efficiency of chemical systems by applying mathematical formulas. • Use knowledge of chemical reactions to generate an electrical current. • Evaluate energy changes in chemical reactions. • Use knowledge of conservation of energy and momentum to explain common phenomena (e.g., refrigeration system, rocket propulsion). • Explain resistance, current and electro-motive force (Ohm's Law).		3.1.B.A8.a - UNIFYING THEMES - CHANGE AND CONSTANCY Recognize that systems within cells and multicellular organisms interact to maintain homeostasis. SI.11-12.1 - Examine the status of existing theories. S11.B.1.1.1 - Explain how structure determines function at multiple levels of organization (e.g., chemical, cellular, anatomical, ecological). 9-10.R.S.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. • Compare and contrast the function of mitosis and meiosis. • Describe mutations' effects on a trait's expression. • Distinguish different reproductive patterns in living things (e.g., budding, spores, fission). • Compare random and selective breeding practices and their results (e.g., antibiotic resistant bacteria). • Explain the relationship among DNA, genes and chromosomes. • Explain different types of inheritance (e.g., multiple allele, sex-influenced traits). • Describe the role of DNA in protein synthesis as it relates to gene expression. • Distinguish between different types of models and modeling techniques and apply their appropriate use in specific applications (e.g., kinetic gas theory, DNA). • Examine the advantages of using models to demonstrate processes and outcomes (e.g., blue print analysis, structural stability). • Apply mathematical models to science and technology. • Identify and characterize major life forms according to their placement in existing classification groups. • Explain the relationship between structure and function at the molecular and cellular levels.

Topic: 4-Cells
Days: 26
Subject(s):
Grade(s):

Know:	Understand:	Do:
3.7.10.B – Important Apply appropriate instruments and apparatus to examine a variety of objects and processes. • Describe and use appropriate instruments to gather and analyze data. • Compare and contrast different scientific measurement systems; select the best measurement system for a specific situation. • Explain the need to estimate measurements within error of various instruments. • Apply accurate measurement knowledge to solve everyday problems. • Describe and demonstrate the operation and use of advanced instrumentation in evaluating material and chemical properties (e.g., scanning electron microscope, nuclear magnetic resonance machines).		• Describe organizing schemes of classification keys. • Identify and characterize major life forms by kingdom, phyla, class and order. • Describe the relationship between the structure of organic molecules and the function they serve in living organisms. • Identify the specialized structures and regions of the cell and the functions of each. • Explain how cells store and use information to guide their functions. • Explain cell functions and processes in terms of chemical reactions and energy changes. • Determine the efficiency of chemical systems by applying mathematical formulas. • Use knowledge of chemical reactions to generate an electrical current. • Evaluate energy changes in chemical reactions. • Use knowledge of conservation of energy and momentum to explain common phenomena (e.g., refrigeration system, rocket propulsion). • Explain resistance, current and electro-motive force (Ohm's Law). • Describe and use appropriate instruments to gather and analyze data. • Compare and contrast different scientific measurement systems; select the best measurement system for a specific situation. • Explain the need to estimate measurements within error of various instruments. • Apply accurate measurement knowledge to solve everyday problems. • Describe and demonstrate the operation and use of advanced instrumentation in evaluating material and chemical properties (e.g., scanning electron microscope, nuclear magnetic resonance machines).

Topic: 4-Cells
Days: 26
Subject(s):
Grade(s):

Know:	Understand:	Do:
3.1.B.A1.b – Essential COMMON CHARACTERISTICS OF LIFE - Compare and contrast the cellular structures and degrees of complexity of prokaryotic and eukaryotic organisms. **3.1.B.A1.c – Important** COMMON CHARACTERISTICS OF LIFE - Explain that some structures in eukaryotic cells developed from early prokaryotic cells (e.g., mitochondria, chloroplasts) **3.1.B.A2.f – Important** ENERGY FLOW- Identify how factors such as pH and temperature may affect enzyme function. **3.1.B.A3. – Important** LIFE CYCLES - Explain how all organisms begin their life cycles as a single cell and that in multicellular organisms, successive generations of embryonic cells form by cell division. **3.1.B.A4.b – Compact** CELL CYCLES - Examine how interactions among the different molecules in the cell cause the distinct stages of the cell cycle which can also be influenced by other signaling molecules.		

Topic: 4-Cells
Subject(s):
Days: 26
Grade(s):

Know:	Understand:	Do:
3.1.B.A5.a – Essential FORM AND FUNCTIONS - Relate the structure of cell organelles to their function (energy capture and release, transport, waste removal, protein synthesis, movement, etc). **3.1.B.A5.c – Essential** FORM AND FUNCTIONS - Explain how the cell membrane functions as a regulatory structure and protective barrier for the cell. **3.1.B.A6. – Compact** ORGANIZATION - Explain how cells differentiate in multicellular organisms. **3.1.B.A7.c – Compact** MOLECULAR BASIS OF LIFE - Explain the consequences of extreme changes in pH and temperature on cell proteins. **3.1.B.A8.a – Important** UNIFYING THEMES - CHANGE AND CONSTANCY Recognize that systems within cells and multicellular organisms interact to maintain homeostasis. **SI.11-12.1 – Important** Examine the status of existing theories.		

Topic: 4-Cells
Days: 26
Subject(s):
Grade(s):

Know:	Understand:	Do:
S11.B.1.1.1 – Essential Explain how structure determines function at multiple levels of organization (e.g., chemical, cellular, anatomical, ecological). Parts of the Cell: Membrane Bound Organelles, Non-Membrane Bound Organelles, Cell Membrane, Cell Wall Types of Cells: Prokaryotic, Eukaryotic Types of Organisms: Unicellular, Multicellular, Differentiation, Specialization Transport Mechanisms: Passive Transport, Osmosis, Active Transport, Photosynthesis: Chlorophyll, Visible Light Spectrum, Chromatograpy, Light Dependent Reactions, Light Independent Reactions Cellular Respiration: Anaerobic Respiration, Lactic Acid Fermentation, Alcoholic Fermentation, Aerobic Respiration, Glycolysis, Electron Transport Chain		

Topic: 4-Cells
Subject(s):
Days: 26
Grade(s):

Know:	Understand:	Do:
Cell Cycle: Interphase, Mitosis, Cytokinesis, Chromosomes,		

Curriculum: CCSD CURRICULUM

PENNSYLVANIA

Course: Biology (3/18/13)

Date: February 6, 2013 ET

Topic: 5-Molecular Genetics

Days: 30

Subject(s):

Grade(s):

Know:	Understand:	Do:
3.1.10.B – Essential Describe concepts of models as a way to predict and understand science and technology. • Distinguish between different types of models and modeling techniques and apply their appropriate use in specific applications (e.g., kinetic gas theory, DNA). • Examine the advantages of using models to demonstrate processes and outcomes (e.g., blue print analysis, structural stability). • Apply mathematical models to science and technology.	DNA directs the production of proteins necessary for the growth and function of cells.	**3.1.10.B – Essential** Describe concepts of models as a way to predict and understand science and technology. • Distinguish between different types of models and modeling techniques and apply their appropriate use in specific applications (e.g., kinetic gas theory, DNA). • Examine the advantages of using models to demonstrate processes and outcomes (e.g., blue print analysis, structural stability). • Apply mathematical models to science and technology. **3.3.10.C – Essential** Describe how genetic information is inherited and expressed. • Compare and contrast the function of mitosis and meiosis. • Describe mutations' effects on a trait's expression. • Distinguish different reproductive patterns in living things (e.g., budding, spores, fission). • Compare random and selective breeding practices and their results (e.g., antibiotic resistant bacteria). • Explain the relationship among DNA, genes and chromosomes. • Explain different types of inheritance (e.g., multiple allele, sex-influenced traits). • Describe the role of DNA in protein synthesis as it relates to gene expression. **3.1.B.B1.a – Essential** HEREDITY - Explain that the information passed from parents to offspring is transmitted by means of genes which are coded in DNA molecules. **3.1.B.B1.b – Essential** HEREDITY - Explain the basic process of DNA replication. **3.1.B.B1.c – Essential** HEREDITY - Describe the basic processes of transcription and translation.

Topic: 5-Molecular Genetics
Days: 30
Subject(s):
Grade(s):

Know:	Understand:	Do:
3.3.10.C – Essential Describe how genetic information is inherited and expressed. • Compare and contrast the function of mitosis and meiosis. • Describe mutations' effects on a trait's expression. • Distinguish different reproductive patterns in living things (e.g., budding, spores, fission). • Compare random and selective breeding practices and their results (e.g., antibiotic resistant bacteria). • Explain the relationship among DNA, genes and chromosomes. • Explain different types of inheritance (e.g., multiple allele, sex-influenced traits). • Describe the role of DNA in protein synthesis as it relates to gene expression.		**3.1.B.B3.a – Essential** MOLECULAR BASIS OF LIFE - Describe the basic structure of DNA, including the role of hydrogen bonding. **3.1.B.B3.b – Essential** MOLECULAR BASIS OF LIFE - Explain how the process of DNA replication results in the transmission and conservation of the genetic code. **3.1.B.B3.c – Essential** MOLECULAR BASIS OF LIFE - Describe how transmission and translation result in gene expression. **3.1.B.B3.d – Essential** MOLECULAR BASIS OF LIFE - Differentiate among the end products of replication, transcription, and translation. 3.1.10.B - Describe concepts of models as a way to predict and understand science and technology. 3.3.10.C - Describe how genetic information is inherited and expressed. 3.1.B.B3.e - MOLECULAR BASIS OF LIFE - Cite evidence to support that the genetic code is universal. • Distinguish between different types of models and modeling techniques and apply their appropriate use in specific applications (e.g., kinetic gas theory, DNA). • Examine the advantages of using models to demonstrate processes and outcomes (e.g., blue print analysis, structural stability). • Apply mathematical models to science and technology. • Compare and contrast the function of mitosis and meiosis. • Describe mutations' effects on a trait's expression.

Topic: 5-Molecular Genetics
Days: 30
Subject(s):
Grade(s):

Know:	Understand:	Do:
3.6.10.A – Compact Apply biotechnologies that relate to propagating, growing, maintaining, adapting, treating and converting. • Apply knowledge of plant and animal production processes in designing an improvement to existing processes. • Apply knowledge of biomedical technology applications in designing a solution to a simple medical problem (e.g., wheel chair design, artificial arteries). • Apply knowledge of how biomedical technology affects waste products in designing a solution that will result in reduced waste. • Apply ergonomic engineering factors when devising a solution to a specific problem. • Describe various methods of biochemical conversion. • describe specific examples that reflect the impact that agricultural science has had on biotechnology.		• Distinguish different reproductive patterns in living things (e.g., budding, spores, fission). • Compare random and selective breeding practices and their results (e.g., antibiotic resistant bacteria). • Explain the relationship among DNA, genes and chromosomes. • Explain different types of inheritance (e.g., multiple allele, sex-influenced traits). • Describe the role of DNA in protein synthesis as it relates to gene expression.

Topic: 5-Molecular Genetics
Days: 30
Subject(s):
Grade(s):

Know:	Understand:	Do:
3.1.B.B1.a – Essential HEREDITY - Explain that the information passed from parents to offspring is transmitted by means of genes which are coded in DNA molecules. **3.1.B.B3.e – Important** MOLECULAR BASIS OF LIFE - Cite evidence to support that the genetic code is universal. DNA Structure:Parts of a nucleotide,Complementary base pairing, Process of DNA replication:Helicase, DNA Poymerase, Hydrogen Bonding, Semiconservative Model Steps of Protein Synthesis Process of Transcription/ Translation: Messenger RNA, Transfer RNA, Ribosomal RNA, Codon, Anti-Codon, RNA Polymerase		

Curriculum: CCSD CURRICULUM

PENNSYLVANIA

Course: Biology (3/18/13)

Date: February 6, 2013 ET

Topic: 6-Genetics

Days: 29

Subject(s):

Grade(s):

Know:	Understand:	Do:
3.3.10.C – Essential Describe how genetic information is inherited and expressed. • Compare and contrast the function of mitosis and meiosis. • Describe mutations' effects on a trait's expression. • Distinguish different reproductive patterns in living things (e.g., budding, spores, fission). • Compare random and selective breeding practices and their results (e.g., antibiotic resistant bacteria). • Explain the relationship among DNA, genes and chromosomes. • Explain different types of inheritance (e.g., multiple allele, sex-influenced traits). • Describe the role of DNA in protein synthesis as it relates to gene expression.	Genes are inherited and expressed in organisms.	**3.3.10.C – Essential** Describe how genetic information is inherited and expressed. • Compare and contrast the function of mitosis and meiosis. • Describe mutations' effects on a trait's expression. • Distinguish different reproductive patterns in living things (e.g., budding, spores, fission). • Compare random and selective breeding practices and their results (e.g., antibiotic resistant bacteria). • Explain the relationship among DNA, genes and chromosomes. • Explain different types of inheritance (e.g., multiple allele, sex-influenced traits). • Describe the role of DNA in protein synthesis as it relates to gene expression. **3.1.10.B – Essential** Describe concepts of models as a way to predict and understand science and technology. • Distinguish between different types of models and modeling techniques and apply their appropriate use in specific applications (e.g., kinetic gas theory, DNA). • Examine the advantages of using models to demonstrate processes and outcomes (e.g., blue print analysis, structural stability). • Apply mathematical models to science and technology. **3.1.B.B1.a – Essential** HEREDITY - Explain that the information passed from parents to offspring is transmitted by means of genes which are coded in DNA molecules. **3.1.B.B2.a – Essential** REPRODUCTION - Describe how the process of meiosis results in the formation of haploid gametes and analyze the importance of meiosis in sexual reproduction. **3.1.B.B2.b – Essential** REPRODUCTION - Compare and contrast the function of mitosis and meiosis.

Topic: 6-Genetics
Days: 29
Subject(s):
Grade(s):

Know:	Understand:	Do:
3.1.10.B – Essential Describe concepts of models as a way to predict and understand science and technology. • Distinguish between different types of models and modeling techniques and apply their appropriate use in specific applications (e.g., kinetic gas theory, DNA). • Examine the advantages of using models to demonstrate processes and outcomes (e.g., blue print analysis, structural stability). • Apply mathematical models to science and technology. **3.1.B.B1.a – Essential** HEREDITY - Explain that the information passed from parents to offspring is transmitted by means of genes which are coded in DNA molecules. **3.1.B.B1.d – Important** HEREDITY - Explain how crossing over, jumping genes, and deletion and duplication of genes results in genetic variation.		**3.1.B.B2.c – Essential** REPRODUCTION - Illustrate that the sorting and recombining of genes in sexual reproduction results in a great variety of possible gene combinations in offspring. **3.1.B.B5.a – Essential** UNIFYING THEMES - PATTERNS Describe how Mendel's laws of segregation and independent assortment can be observed through patterns of inheritance. **3.1.B.B5.b – Essential** UNIFYING THEMES - Distinguish among observed inheritance patterns caused by several types of genetic traits (dominant, recessive, codominant, sex-linked, polygenic, incomplete dominance, multiple alleles) **3.1.B.B5.e – Essential** UNIFYING THEMES - SCALE Demonstrate how inherited characteristics can be observed at the molecular, cellular, and organism levels. 3.3.10.C - Describe how genetic information is inherited and expressed. 3.1.10.B - Describe concepts of models as a way to predict and understand science and technology. 3.1.B.B1.d - HEREDITY - Explain how crossing over, jumping genes, and deletion and duplication of genes results in genetic variation. 3.1.B.B1.e - HEREDITY - Explain how mutations can alter genetic information and the possible consequences on resultant cells. 3.1.B.B4. - BIOTECHNOLOGY - Explain how genetic technologies have impacted the fields of medicine, forensics, and agriculture S11.B.2.2.1 - Describe how genetic information is expressed (i.e., DNA, genes, chromosomes, transcription, translation, and replication). S11.B.2.2.2 - Compare and contrast the functions of mitosis and meiosis in passing on genetic information. S11.B.2.2.3 - Explain how different patterns of inheritance affect population variability. (i.e., multiple alleles, co-dominance, dominance,

Topic: 6-Genetics
Subject(s):
Days: 29
Grade(s):

Know:	Understand:	Do:
3.1.B.B1.e – Important HEREDITY - Explain how mutations can alter genetic information and the possible consequences on resultant cells. **3.1.B.B4. – Important** BIOTECHNOLOGY - Explain how genetic technologies have impacted the fields of medicine, forensics, and agriculture **3.1.B.B5.a – Essential** UNIFYING THEMES - PATTERNS Describe how Mendel's laws of segregation and independent assortment can be observed through patterns of inheritance. **3.1.B.B5.b – Essential** UNIFYING THEMES - Distinguish among observed inheritance patterns caused by several types of genetic traits (dominant, recessive, codominant, sex-linked, polygenic, incomplete dominance, multiple alleles) Mendelian Genetics:Dominance, Codominance, Incomplete Dominance, Allele, Trait, Phenotype, Genotype, Law of Segregation, Law of Independent Assortment, Punnett Squares, Probability		recessiveness, and sex-influenced traits). 9-10.R.S.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. • Compare and contrast the function of mitosis and meiosis. • Describe mutations' effects on a trait's expression. • Distinguish different reproductive patterns in living things (e.g., budding, spores, fission). • Compare random and selective breeding practices and their results (e.g., antibiotic resistant bacteria). • Explain the relationship among DNA, genes and chromosomes. • Explain different types of inheritance (e.g., multiple allele, sex-influenced traits). • Describe the role of DNA in protein synthesis as it relates to gene expression. • Distinguish between different types of models and modeling techniques and apply their appropriate use in specific applications (e.g., kinetic gas theory, DNA). • Examine the advantages of using models to demonstrate processes and outcomes (e.g., blue print analysis, structural stability). • Apply mathematical models to science and technology.

Topic: 6-Genetics
Days: 29
Subject(s):
Grade(s):

Know:	Understand:	Do:
Non-Mendelian Genetics:Sex-Linked, Multipe Allele, Polygenic Trait, Mutations, Karyotype, Pedigree, Meiosis:Crossing Over, Tetrad, Synapsis, Spermatogenesis, Oogenesis DNA Technologies:Cloning, Polymerase Chain Reaction, DNA Fingerprinting, Transgenic Organisms, Stem Cell Research		

Curriculum: CCSD CURRICULUM

PENNSYLVANIA

Course: Biology (3/18/13)

Date: February 6, 2013 ET

Topic: 7-Evolution

Days: 21

Subject(s):

Grade(s):

Know:	Understand:	Do:
3.1.10.C – Essential Apply patterns as repeated processes or recurring elements in science and technology. • Examine and describe recurring patterns that form the basis of biological classification, chemical periodicity, geological order and astronomical order. • Examine and describe stationary physical patterns. • Examine and describe physical patterns in motion.	Explain and analyze evidence used to develop theories for evolution, speciation, adaptation, and biological diversity.	**3.1.10.C – Essential** Apply patterns as repeated processes or recurring elements in science and technology. • Examine and describe recurring patterns that form the basis of biological classification, chemical periodicity, geological order and astronomical order. • Examine and describe stationary physical patterns. • Examine and describe physical patterns in motion. **3.3.10.D – Essential** Explain the mechanisms of the theory of evolution. • Analyze data from fossil records, similarities in anatomy and physiology, embryological studies and DNA studies that are relevant to the theory of evolution. • Explain the role of mutations and gene recombination in changing a population of organisms. • Compare modern day descendants of extinct species and propose possible scientific accounts for their present appearance. • Describe the factors (e.g., isolation, differential reproduction) affecting gene frequency in a population over time and their consequences. • Describe and differentiate between the roles of natural selection and genetic drift. • Describe changes that illustrate major events in the earth's development based on a time line. • Explain why natural selection can act only on inherited traits. • Apply the concept of natural selection to illustrate and account for a species' survival, extinction or change over time. (Ecosystem Standards are in the Environment and Ecology Standard Category (4.6).)

Topic: 7-Evolution
Days: 21
Subject(s):
Grade(s):

Know:	Understand:	Do:
3.1.10.E – Essential Describe patterns of change in nature, physical and man made systems. • Describe how fundamental science and technology concepts are used to solve practical problems (e.g., momentum, Newton's laws of universal gravitation, tectonics, conservation of mass and energy, cell theory, theory of evolution, atomic theory, theory of relativity, Pasteur's germ theory, relativity, heliocentric theory, gas laws, feedback systems). • Recognize that stable systems often involve underlying dynamic changes (e.g., a chemical reaction at equilibrium has molecules reforming continuously). • Describe the effects of error in measurements. • Describe changes to matter caused by heat, cold, light or chemicals using a rate function.		**3.3.10.A – Essential** Explain the structural and functional similarities and differences found among living things. • Identify and characterize major life forms according to their placement in existing classification groups. • Explain the relationship between structure and function at the molecular and cellular levels. • Describe organizing schemes of classification keys. • Identify and characterize major life forms by kingdom, phyla, class and order. **3.3.10.C – Essential** Describe how genetic information is inherited and expressed. • Compare and contrast the function of mitosis and meiosis. • Describe mutations' effects on a trait's expression. • Distinguish different reproductive patterns in living things (e.g., budding, spores, fission). • Compare random and selective breeding practices and their results (e.g., antibiotic resistant bacteria). • Explain the relationship among DNA, genes and chromosomes. • Explain different types of inheritance (e.g., multiple allele, sex-influenced traits). • Describe the role of DNA in protein synthesis as it relates to gene expression. **3.1.B.C1.c – Essential** NATURAL SELECTION - Explain how evolution through natural selection can result in changes in biodiversity through the increase or decrease of genetic diversity within a population. **3.1.B.C2.c – Essential** ADAPTATION - Describe how mutations in sex cells may be passed on to successive generations and that the resulting phenotype may help, harm, or have little or no effect on the offspring's success in its environment.

Topic: 7-Evolution
Days: 21
Subject(s):
Grade(s):

Know:	Understand:	Do:
3.3.10.D – Essential Explain the mechanisms of the theory of evolution. • Analyze data from fossil records, similarities in anatomy and physiology, embryological studies and DNA studies that are relevant to the theory of evolution. • Explain the role of mutations and gene recombination in changing a population of organisms. • Compare modern day descendants of extinct species and propose possible scientific accounts for their present appearance. • Describe the factors (e.g., isolation, differential reproduction) affecting gene frequency in a population over time and their consequences. • Describe and differentiate between the roles of natural selection and genetic drift.		**3.1.B.C3.a – Important** UNIFYING THEMES - CONSTANCY AND CHANGE Compare and contrast various theories of evolution. **3.1.B.C3.b – Essential** UNIFYING THEMES - Interpret data from fossil records, anatomy and physiology, and DNA studies relevant to the theory of evolution. **3.1.B.C3.c – Essential** UNIFYING THEMES - PATTERNS Discuss the implications of a universal genetic code for evolution. 3.1.10.C - Apply patterns as repeated processes or recurring elements in science and technology. 3.3.10.D - Explain the mechanisms of the theory of evolution.(Ecosystem Standards are in the Environment and Ecology Standard Category (4.6).) 3.3.10.A - Explain the structural and functional similarities and differences found among living things. 3.3.10.C - Describe how genetic information is inherited and expressed. 3.1.B.C1.a - NATURAL SELECTION - Describe species as reproductively distinct groups of organisms. 3.1.B.C1.b - NATURAL SELECTION - Analyze the role that geographic isolation can play in speciation. 3.1.B.C1.d - NATURAL SELECTION - Describe how the degree of kinship between species can be inferred from the similarity in their DNA sequences. 3.1.B.C2.a - ADAPTATION - Describe the theory suggesting that life on Earth arose as a single, primitive prokaryote about 4 billion years ago and that for the next 2 billion years, a huge diversity of singlecelled organisms evolved. 3.1.B.C2.b - ADAPTATION - Analyze how increasingly complex, multicellular organisms evolved once cells with nuclei developed. 3.1.B.C2.d - ADAPTATION - Describe the relationship between environmental changes and changes in the gene pool of a population.

Topic: 7-Evolution
Days: 21
Subject(s):
Grade(s):

Know:	Understand:	Do:
• Describe changes that illustrate major events in the earth's development based on a time line. • Explain why natural selection can act only on inherited traits. • Apply the concept of natural selection to illustrate and account for a species' survival, extinction or change over time. (Ecosystem Standards are in the Environment and Ecology Standard Category (4.6).)		S11.B.2.1.1 - Explain the theory of evolution by interpreting data from fossil records, similarities in anatomy and physiology, embryological studies, or DNA studies that are relevant to the theory of evolution. S11.B.2.1.2 - Explain the role of mutations, differential reproduction, and gene recombination in changing the genetic makeup of a population. S11.B.2.1.3 - Explain the role of selective breeding and biotechnology in changing the genetic makeup of a population. S11.B.2.1.4 - Explain why natural selection can act only on inherited traits. • Examine and describe recurring patterns that form the basis of biological classification, chemical periodicity, geological order and astronomical order. • Examine and describe stationary physical patterns. • Examine and describe physical patterns in motion. • Analyze data from fossil records, similarities in anatomy and physiology, embryological studies and DNA studies that are relevant to the theory of evolution. • Explain the role of mutations and gene recombination in changing a population of organisms. • Compare modern day descendants of extinct species and propose possible scientific accounts for their present appearance. • Describe the factors (e.g., isolation, differential reproduction) affecting gene frequency in a population over time and their consequences. • Describe and differentiate between the roles of natural selection and genetic drift. • Describe changes that illustrate major events in the earth's development based on a time line. • Explain why natural selection can act only on inherited traits.

Topic: 7-Evolution
Days: 21
Subject(s):
Grade(s):

Know:	Understand:	Do:
3.3.10.A – Essential Explain the structural and functional similarities and differences found among living things. • Identify and characterize major life forms according to their placement in existing classification groups. • Explain the relationship between structure and function at the molecular and cellular levels. • Describe organizing schemes of classification keys. • Identify and characterize major life forms by kingdom, phyla, class and order.		• Apply the concept of natural selection to illustrate and account for a species' survival, extinction or change over time. • Identify and characterize major life forms according to their placement in existing classification groups. • Explain the relationship between structure and function at the molecular and cellular levels. • Describe organizing schemes of classification keys. • Identify and characterize major life forms by kingdom, phyla, class and order. • Compare and contrast the function of mitosis and meiosis. • Describe mutations' effects on a trait's expression. • Distinguish different reproductive patterns in living things (e.g., budding, spores, fission). • Compare random and selective breeding practices and their results (e.g., antibiotic resistant bacteria). • Explain the relationship among DNA, genes and chromosomes. • Explain different types of inheritance (e.g., multiple allele, sex-influenced traits). • Describe the role of DNA in protein synthesis as it relates to gene expression.

Topic: 7-Evolution
Days: 21
Subject(s):
Grade(s):

Know:	Understand:	Do:
3.3.10.C – Essential Describe how genetic information is inherited and expressed. • Compare and contrast the function of mitosis and meiosis. • Describe mutations' effects on a trait's expression. • Distinguish different reproductive patterns in living things (e.g., budding, spores, fission). • Compare random and selective breeding practices and their results (e.g., antibiotic resistant bacteria). • Explain the relationship among DNA, genes and chromosomes. • Explain different types of inheritance (e.g., multiple allele, sex-influenced traits). • Describe the role of DNA in protein synthesis as it relates to gene expression. **3.1.B.C1.a – Important** NATURAL SELECTION - Describe species as reproductively distinct groups of organisms.		

Topic: 7-Evolution
Subject(s):
Days: 21
Grade(s):

Know:	Understand:	Do:
3.1.B.C1.b – Important NATURAL SELECTION - Analyze the role that geographic isolation can play in speciation. **3.1.B.C1.d – Important** NATURAL SELECTION - Describe how the degree of kinship between species can be inferred from the similarity in their DNA sequences. **3.1.B.C2.a – Important** ADAPTATION - Describe the theory suggesting that life on Earth arose as a single, primitive prokaryote about 4 billion years ago and that for the next 2 billion years, a huge diversity of singlecelled organisms evolved. **3.1.B.C2.b – Compact** ADAPTATION - Analyze how increasingly complex, multicellular organisms evolved once cells with nuclei developed. **3.1.B.C2.d – Important** ADAPTATION - Describe the relationship between environmental changes and changes in the gene pool of a population. Theoris of Evolution: Charles Darwin, Lamarck, Wallace,		

Topic: 7-Evolution
Days: 21
Subject(s):
Grade(s):

Know:	Understand:	Do:
natural selection, inheritance of acquired characteristics, artificial selection, Evidences of Evolution: homologous structures, fossils, vestigal organs, comparitive embryology, comparitive biochemistry Patterns of Evolution: gene pool, genetic variation, types of selection, genetic drift, genetic equilibrium, speciation, adaptive radiation, convergent evolution, divergent evolution, punctuated equilibrium Classification of Organisms: binomial nomenclature, taxons, Linnaeus, cladogram, phylogenetic tree, domain, kingdom, species, Archaebacteria, Eubacteria, Protista, Fungi, Plantae, Animalia		