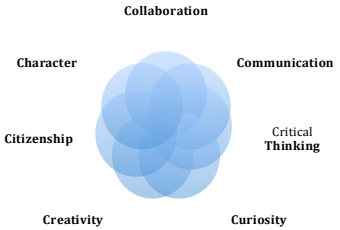
Content Area	Course: Biotechnology	Grade Level: 10-12
	**R14 The Seven Cs of Learning** 	

Unit Titles	Length of Unit
• Introduction to Biotechnology	• 3 weeks
• DNA Structure and Analysis	• 3 weeks
• Microbiology	• 3 weeks
• Polymerase Chain Reaction	• 3 weeks
• Bioethics	• 2 weeks

Strands	Course Level Expectations
Structure and Function	• The structure of a DNA nucleotide and how its structure enhances the ability to separate DNA fragments • Apply concept of gel electrophoresis to compare unknown DNA samples to a standard to see if there is a match • Demonstrate various techniques to identify bacteria • How antibiotics work and how they are tested in bacteria
Inheritance of Traits and Biodiversity	• Analyze food to determine if it was genetically modified. • Construct an explanation using evidence for how PCR is used in scientific research • Model the process of Polymerase Chain Reaction using a Thermal cycler
Bioethics	• Defend a position on a bioethical issue using evidence. • Construct a scientific explanation using evidence outlining the risks and benefits of altering genetic composition

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Unit Title	Introduction to Biotechnology	Length of Unit	3 weeks

Inquiry Questions (Engaging & Debatable)	● How has biotechnology changed over time? ● What basic biotechnology techniques and equipment are important to know in order to execute proper procedures?
Standards*	HS-ETS1.1, HS-ETS1.2, HS-ETS1.2
Unit Strands & Concepts	**DISCIPLINARY CORE IDEAS (DCI):** ● Developing Possible Solutions ● Optimizing the Solution Design. **Cross Cutting Concepts (CCC)** ● Systems and System Models
Key Vocabulary	Biotechnology, genetic engineering, microbiology, DNA fingerprinting, molecular biology, transformation, biochemistry, Pipetting, aliquot, aseptic technique, chromatography, Volumetric flask, Autoclave , Microtubes, Serological pipets, Pipet pumps, Transfer pipets, Adjustable-volume micropipettes, Erlenmeyer flask

*Standards based on Next Generation Science Standards (NGSS) For more information visit: https://www.nextgenscience.org/

Unit Title	Introduction to Biotechnology	Length of Unit	3 weeks

Critical Content: My students will Know…	Key Skills: My students will be able to (Do)…
● The definition of biotechnology ● Advances in technology have affected the biotechnology industry. ● Required safety practices and procedures in the classroom and laboratory environment. ● Different units of concentration ● Different separation techniques used in biotechnology. ● How to interpret MSDS sheets. ● Proper sterile technique. ● How to select, set and use a variety of pipettes or micropipettes within their designated ranges to measure small quantities. ● Proper pipetting technique.	● Investigate a biotechnology timeline event and write a short synopsis of the significance of the event. ● Research the educational requirements and responsibilities for positions within the biotechnology industry. ● Write a standard operating procedure ● Interpret results and draw conclusions ● Calculate the amount of solute needed to make a specific solution. ● Create different molar solutions ● Calculate and demonstrate how to make a specific dilution from a stock solution ● Separate pigments using chromatography

Assessments:	Performance based assessment, MSDS sheets Activity, Chromatography lab Summative Assessment
Teacher Resources:	Brown, J. Kirk. *Biotechnology*. Hercules: Bio-Rad Laboratories, 2011. Print. Brown, J. Kirk. *Biotechnology: A Laboratory Skills Course Teacher Supplement*. Hercules: Bio-Rad Laboratories, Inc., 2011. Print., Region 14 Implementation Guide

Unit Title	DNA Structure and Analysis	Length of Unit	3 weeks

Inquiry Questions (Engaging & Debatable)	● How does the structure of DNA promote its use in biotechnology? ● How can DNA be used to identify an organism?
Standards	HS-LS1-1, HS-LS3-1
Unit Strands & Concepts	**DISCIPLINARY CORE IDEAS (DCI):** ● Structure and Function ● Inheritance of Traits **Cross Cutting Concepts (CCC)** ● Structure and Function
Key Vocabulary	DNA, nucleotide, restriction enzyme, gel-electrophoresis, recombinant DNA, genetic engineering Vortex, centrifuge, buffer

Unit Title	DNA Structure and Analysis	Length of Unit	3 Weeks

Critical Content: My students will Know…	Key Skills: My students will be able to (Do)…
● The structure of a DNA nucleotide and formation of DNA double helix using appropriate terminology. ● How the structure of DNA enhances the ability to separate DNA fragments ● How restriction enzymes cut DNA into fragments ● How to predict where restriction enzymes will cut in a bacteriophage lambda DNA sequence ● How gel electrophoresis works to separate DNA fragments. ● How to determine the lengths of DNA fragments using a known standard	● Prepare and cast a gel for gel electrophoresis ● Interpret gel bands and identify patterns ● Isolate DNA from cells ● Apply concept of gel electrophoresis to compare unknown DNA samples to a standard to see if there is a match ● Predict restriction enzyme cutting sites using online technology

Assessments:	Formative Assessment on DNA structure, Performance based assessment DNA Lab , Casting of Agarose gels – students make gels Forensic Lab, Summative Assessment
Teacher Resources:	Brown, J. Kirk. *Biotechnology*. Hercules: Bio-Rad Laboratories, 2011. Print. Brown, J. Kirk. *Biotechnology: A Laboratory Skills Course Teacher Supplement*. Hercules: BIO-RAD Laboratories, Inc., 2011. Print., Region 14 Implementation Guide

Unit Title	Microbiology	Length of Unit	3 weeks

Inquiry Questions (Engaging & Debatable)	● How are microbes used in food production? ● How are antibodies used to identify unknown bacterial infections?
Standards	HS-LS2-3**,** HS-LS2-6**,** HS-LS3-2
Unit Strands & Concepts	**DISCIPLINARY CORE IDEAS (DCI):** ● Cycles of Matter and Energy Transfer in Ecosystems ● Ecosystem Dynamics, Functioning, and Resilience ● Variation of Traits **Cross Cutting Concepts (CCC)** ● Energy and Matter ● Stability and Change ● Cause and Effect
Key Vocabulary	Aseptic technique, bacterial fermentation, Elisa assay, antibiotic, aerobic, anaerobic, antibody, petri plate, media, media tube, inoculation loop, agar plates

Unit Title	Microbiology	Length of Unit	3 weeks

Critical Content: My students will Know…	Key Skills: My students will be able to (Do)…
• How antibiotics work and how they are tested in bacteria • The different bacterial fermentation processes • How microbes are used in food production • Antibiotics kill bacteria. • There are specific tests that can be done to determine the type of microorganism present.. • Bacteria can be identified by the sugars it consumes and the waste products it produces. • Bacteria can be identified by the antibodies produced by the host.	• Prepare microbiology media for bacterial growth and pour plates aseptically. • Demonstrate aseptic technique to transfer bacteria • Perform an Eliza Assay • Observe and document bacteria characteristics • Perform bacterial fermentations to identify bacteria

Assessments:	Sterile Techniques Lab, Bacteria Fermentations lab, Microbiology techniques lab Summative Assessment
Teacher Resources:	Brown, J. Kirk. *Biotechnology*. Hercules: BIO-RAD Laboratories, 2011. Print. Brown, J. Kirk. *Biotechnology: A Laboratory Skills Course Teacher Supplement*. Hercules: Bio-Rad Laboratories, Inc., 2011. Print. Region 14 Implementation Guide

Unit Title	Polymerase Chain Reaction	Length of Unit	3 Weeks

Inquiry Questions (Engaging & Debatable)	● How does PCR facilitate research in the genetics field?
Standards	HS-LS1-1, HS-LS2-3, HS-LS3-2
Unit Strands & Concepts	**DISCIPLINARY CORE IDEAS (DCI):** ● Structure and Function ● Cycles of Matter and Energy Transfer in Ecosystems ● Variation of Traits **Cross Cutting Concepts (CCC)** ● Energy and Matter ● Cause and Effect ● Structure and Function
Key Vocabulary	Genetically modified organism (GMO), Polymerase Chain Reaction (PCR), thermal cycler, polymerase, denaturation, annealing, extension, primer, instagene matrix

Unit Title	Polymerase Chain Reaction	Length of Unit	3 Weeks

Critical Content: My students will Know…	Key Skills: My students will be able to (Do)…
• How PCR is used i the research • Polymerase Chain Reaction (PCR) is a powerful tool that allows scientists to produce billions of copies of DNA or a gene sequence in a short period of time for their further study. • PCR has enabled scientists to analyze DNA sequences to determine their genomes. • Genetic modifications in foods can be detected using PCR.	• Analyze food to determine if it was genetically modified. • Construct an explanation using evidence for how PCR is used in scientific research • Model the process of Polymerase Chain Reaction using a Thermal cycler

Assessments:	Performance based assessment- PCR Laboratory techniques Lab: GMO detection by PCR Summative Assessment
Teacher Resources:	Brown, J. Kirk. *Biotechnology*. Hercules: BIO-RAD Laboratories, 2011. Print. Brown, J. Kirk. *Biotechnology: A Laboratory Skills Course Teacher Supplement*. Hercules: BIO-RAD Laboratories, Inc., 2011. Print. Region 14 Implementation Guide

Unit Title	Bioethics	Length of Unit	2 Weeks

Inquiry Questions (Engaging & Debatable)	● Should there be international bioethics regulations recognized by all countries? ● Should we clone humans or be able to design babies?
Standards	HS-LS2-7, HS-LS4-6
Unit Strands & Concepts	**DISCIPLINARY CORE IDEAS (DCI):** ● Biodiversity and Humans ● Adaptation **Cross Cutting Concepts (CCC)** ● Stability and Change ● Cause and Effect
Key Vocabulary	Bioethics, Pro, Con, excellent justification, weak justification, stakeholders, social responsibilities, scientific community

Unit Title	Bioethics	Length of Unit	2 weeks

Critical Content: **My students will Know…**	**Key Skills:** **My students will be able to (Do)…**
● How to evaluate reputable sources of information ● How ● Scientific advances require establishment of regulations. ● With information comes responsibility for maintaining people's' privacy. ● Most scientific advances require ethical decisions. ● The risks and benefits of altering the genetic composition and cell products of existing organisms.	● Defend a position on a bioethical issue using evidence. ● Construct a scientific explanation using evidence outlining the risks and benefits of altering genetic composition

Assessments:	Checkpoints on ethical issue symposium research Presentation of opposing sides of a bioethical issue – symposium
Teacher Resources:	Brown, J. Kirk. Biotechnology. Hercules: Bio-Rad Laboratories, 2011. Print. Brown, J. Kirk. Biotechnology: A Laboratory Skills Course Teacher Supplement. Hercules: Bio-Rad Laboratories, Inc., 2011. Print. Region 14 Implementation Guide