

Inquiry Investigations™
Biotechnology Techniques MODULE - 1278357
Grades: 7-10

Frey Scientific
 80 Northwest Boulevard
 Nashua, NH 03063-4067
 1-800-225-3739
 www.freyscientific.com
 www.freyscientific.com/inquiryinvestigations

Alaska Content Standards
Science
Grade 7

PERFORMANCE / CONTENT STANDARD	AK.A1.	Science as Inquiry and Process (SA1, SA2, SA3)
GRADE LEVEL EXPECTATION	[7] SA1.1.	<p>The student demonstrates an understanding of the processes of science by asking questions, predicting, observing, describing, measuring, classifying, making generalizations, inferring and communicating.</p> <ul style="list-style-type: none"> • Biotechnology Techniques: Unit 1 Lab 1 Activity 1: DNA Structure and Replication • Biotechnology Techniques: Unit 1 Lab 2 Activity 1: Preparing a Plant Tissue for DNA Extraction • Biotechnology Techniques: Unit 1 Lab 2 Activity 2: Extracting Cellular DNA • Biotechnology Techniques: Unit 2 Lab 3 Activity 1: Using Restriction Enzymes to Cut DNA Strands • Biotechnology Techniques: Unit 2 Lab 3 Activity 2: Sorting DNA Using Gel Electrophoresis • Biotechnology Techniques: Unit 2 Lab 4 Activity 1: Determining Molecular Mass and Charge • Biotechnology Techniques: Unit 2 Lab 4 Activity 2: Identifying DNA Fragments • Biotechnology Techniques: Unit 2 Lab 5 Activity 1: Restriction Site Mapping • Biotechnology Techniques: Unit 3 Lab 6 Activity 1: Engineering Recombinant DNA Molecules • Biotechnology Techniques: Unit 3 Lab 7 Activity 1: Turning Genes On and Off • Biotechnology Techniques: Unit 4 Lab 8 Activity 1: Discover How Plasmids Transfer Genes • Biotechnology Techniques: Unit 4 Lab 8 Activity 2: The DNA Chip and Gene Expression • Teacher Resource CD: Biotechnology Techniques I - Gel Electrophoresis • Virtual Laboratory: Restriction Enzyme Cleavage of DNA
GRADE LEVEL EXPECTATION	[7] SA1.2.	<p>The student demonstrates an understanding of the processes of science by collaborating to design and conduct simple repeatable investigations, in order to record, analyze (i.e., range, mean, median, mode), interpret data, and present findings. (L)</p> <ul style="list-style-type: none"> • Biotechnology Techniques: Unit 1 Lab 1 Activity 1: DNA Structure and Replication • Biotechnology Techniques: Unit 1 Lab 2 Activity 1: Preparing a Plant Tissue for DNA Extraction

		<ul style="list-style-type: none"> • Biotechnology Techniques: Unit 1 Lab 2 Activity 2: Extracting Cellular DNA • Biotechnology Techniques: Unit 2 Lab 3 Activity 1: Using Restriction Enzymes to Cut DNA Strands • Biotechnology Techniques: Unit 2 Lab 3 Activity 2: Sorting DNA Using Gel Electrophoresis • Biotechnology Techniques: Unit 2 Lab 4 Activity 1: Determining Molecular Mass and Charge • Biotechnology Techniques: Unit 2 Lab 4 Activity 2: Identifying DNA Fragments • Biotechnology Techniques: Unit 2 Lab 5 Activity 1: Restriction Site Mapping • Biotechnology Techniques: Unit 3 Lab 6 Activity 1: Engineering Recombinant DNA Molecules • Biotechnology Techniques: Unit 3 Lab 7 Activity 1: Turning Genes On and Off • Biotechnology Techniques: Unit 4 Lab 8 Activity 1: Discover How Plasmids Transfer Genes • Biotechnology Techniques: Unit 4 Lab 8 Activity 2: The DNA Chip and Gene Expression • Virtual Laboratory: Restriction Enzyme Cleavage of DNA
PERFORMANCE / CONTENT STANDARD	AK.C1.	Concepts of Life Science (SC1, SC2, SC3)
GRADE LEVEL EXPECTATION	[7] SC2.1.	<p>The student demonstrates an understanding of the structure, function, behavior, development, life cycles, and diversity of living organisms by describing the basic structure and function of plant and animal cells.</p> <ul style="list-style-type: none"> • Biotechnology Techniques: Unit 1 Lab 2 Activity 1: Preparing a Plant Tissue for DNA Extraction • Biotechnology Techniques: Unit 1 Lab 2 Activity 2: Extracting Cellular DNA • Biotechnology Techniques: Unit 3 Lab 6 Activity 1: Engineering Recombinant DNA Molecules • Biotechnology Techniques: Unit 4 Lab 8 Activity 1: Discover How Plasmids Transfer Genes • Biotechnology Techniques: Unit 4 Lab 8 Activity 2: The DNA Chip and Gene Expression • Teacher Resource CD: Biotechnology Techniques II - Gene Expression • Teacher Resource CD: Understanding DNA
GRADE LEVEL EXPECTATION	[7] SC3.1.	<p>The student demonstrates an understanding that all organisms are linked to each other and their physical environments through the transfer and transformation of matter and energy by recognizing and explaining that organisms can cause physical and chemical changes (e.g., digestion, growth, respiration, photosynthesis) to matter and recognizing and explaining the importance of energy transfer in these changes.</p> <ul style="list-style-type: none"> • Biotechnology Techniques: Unit 2 Lab 3 Activity 1: Using Restriction Enzymes to Cut DNA Strands • Biotechnology Techniques: Unit 2 Lab 3 Activity 2: Sorting DNA Using Gel Electrophoresis • Biotechnology Techniques: Unit 2 Lab 5 Activity 1: Restriction Site Mapping

PERFORMANCE / CONTENT STANDARD	AK.E1.	Science and Technology (SE1, SE2, SE3)
GRADE LEVEL EXPECTATION	[7] SE1.1.	<p>The student demonstrates understanding of how to integrate scientific knowledge and technology to address problems by describing how public policy affects the student's life (e.g., public waste disposal). (L)</p> <ul style="list-style-type: none"> • Biotechnology Techniques: Unit 1 Lab 2 Activity 2: Extracting Cellular DNA • Biotechnology Techniques: Unit 2 Lab 3 Activity 1: Using Restriction Enzymes to Cut DNA Strands • Biotechnology Techniques: Unit 2 Lab 3 Activity 2: Sorting DNA Using Gel Electrophoresis • Biotechnology Techniques: Unit 2 Lab 4 Activity 1: Determining Molecular Mass and Charge • Biotechnology Techniques: Unit 2 Lab 4 Activity 2: Identifying DNA Fragments • Biotechnology Techniques: Unit 2 Lab 5 Activity 1: Restriction Site Mapping • Biotechnology Techniques: Unit 3 Lab 6 Activity 1: Engineering Recombinant DNA Molecules • Biotechnology Techniques: Unit 3 Lab 7 Activity 1: Turning Genes On and Off • Biotechnology Techniques: Unit 4 Lab 8 Activity 1: Discover How Plasmids Transfer Genes • Biotechnology Techniques: Unit 4 Lab 8 Activity 2: The DNA Chip and Gene Expression
GRADE LEVEL EXPECTATION	[7] SE2.1.	<p>The student demonstrates an understanding that solving problems involves different ways of thinking by identifying, designing, testing, and revising solutions to a local problem. (L)</p> <ul style="list-style-type: none"> • Biotechnology Techniques: Unit 1 Lab 1 Activity 1: DNA Structure and Replication • Biotechnology Techniques: Unit 1 Lab 2 Activity 1: Preparing a Plant Tissue for DNA Extraction • Biotechnology Techniques: Unit 1 Lab 2 Activity 2: Extracting Cellular DNA • Biotechnology Techniques: Unit 2 Lab 3 Activity 1: Using Restriction Enzymes to Cut DNA Strands • Biotechnology Techniques: Unit 2 Lab 3 Activity 2: Sorting DNA Using Gel Electrophoresis • Biotechnology Techniques: Unit 2 Lab 4 Activity 1: Determining Molecular Mass and Charge • Biotechnology Techniques: Unit 2 Lab 4 Activity 2: Identifying DNA Fragments • Biotechnology Techniques: Unit 2 Lab 5 Activity 1: Restriction Site Mapping • Biotechnology Techniques: Unit 3 Lab 7 Activity 1: Turning Genes On and Off • Biotechnology Techniques: Unit 4 Lab 8 Activity 1: Discover How Plasmids Transfer Genes • Biotechnology Techniques: Unit 4 Lab 8 Activity 2: The DNA Chip and Gene Expression
GRADE LEVEL EXPECTATION	[7] SE3.1.	<p>The student demonstrates an understanding of how scientific discoveries and technological innovations affect our lives and society by recognizing the effects of</p>

		<p>a past scientific discovery, invention, or scientific breakthrough (e.g., DDT, internal combustion engine).</p> <ul style="list-style-type: none"> • Teacher Resource CD: Biotechnology Techniques I - Gel Electrophoresis • Teacher Resource CD: Biotechnology Techniques II - Gene Expression
PERFORMANCE / CONTENT STANDARD	AK.SA.	Science as Inquiry and Process: A student should understand and be able to apply the processes and applications of scientific inquiry. A student who meets the content standard should:
GRADE LEVEL EXPECTATION	SA1.	<p>Develop an understanding of the processes of science used to investigate problems, design and conduct repeatable scientific investigations, and defend scientific arguments.</p> <ul style="list-style-type: none"> • Biotechnology Techniques: Unit 1 Lab 1 Activity 1: DNA Structure and Replication • Biotechnology Techniques: Unit 1 Lab 2 Activity 1: Preparing a Plant Tissue for DNA Extraction • Biotechnology Techniques: Unit 1 Lab 2 Activity 2: Extracting Cellular DNA • Biotechnology Techniques: Unit 2 Lab 3 Activity 1: Using Restriction Enzymes to Cut DNA Strands • Biotechnology Techniques: Unit 2 Lab 3 Activity 2: Sorting DNA Using Gel Electrophoresis • Biotechnology Techniques: Unit 2 Lab 4 Activity 1: Determining Molecular Mass and Charge • Biotechnology Techniques: Unit 2 Lab 4 Activity 2: Identifying DNA Fragments • Biotechnology Techniques: Unit 2 Lab 5 Activity 1: Restriction Site Mapping • Biotechnology Techniques: Unit 3 Lab 6 Activity 1: Engineering Recombinant DNA Molecules • Biotechnology Techniques: Unit 3 Lab 7 Activity 1: Turning Genes On and Off • Biotechnology Techniques: Unit 4 Lab 8 Activity 1: Discover How Plasmids Transfer Genes • Biotechnology Techniques: Unit 4 Lab 8 Activity 2: The DNA Chip and Gene Expression • Virtual Laboratory: Restriction Enzyme Cleavage of DNA
GRADE LEVEL EXPECTATION	SA2.	<p>Develop an understanding that the processes of science require integrity, logical reasoning, skepticism, openness, communication, and peer review.</p> <ul style="list-style-type: none"> • Biotechnology Techniques: Unit 4 Lab 8 Activity 1: Discover How Plasmids Transfer Genes • Biotechnology Techniques: Unit 4 Lab 8 Activity 2: The DNA Chip and Gene Expression
PERFORMANCE / CONTENT STANDARD	AK.SC.	Concepts of Life Science: A student should understand and be able to apply the concepts, models, theories, facts, evidence, systems, and processes of life science. A student who meets the content standard should:
GRADE LEVEL EXPECTATION	SC1.	<p>Develop an understanding of how science explains changes in life forms over time, including genetics, heredity, the process of natural selection, and biological evolution.</p> <ul style="list-style-type: none"> • Biotechnology Techniques: Unit 1 Lab 1 Activity 1: DNA Structure and

		<p>Replication</p> <ul style="list-style-type: none"> • Biotechnology Techniques: Unit 1 Lab 2 Activity 1: Preparing a Plant Tissue for DNA Extraction • Biotechnology Techniques: Unit 1 Lab 2 Activity 2: Extracting Cellular DNA • Biotechnology Techniques: Unit 2 Lab 3 Activity 1: Using Restriction Enzymes to Cut DNA Strands • Biotechnology Techniques: Unit 2 Lab 3 Activity 2: Sorting DNA Using Gel Electrophoresis • Biotechnology Techniques: Unit 2 Lab 4 Activity 1: Determining Molecular Mass and Charge • Biotechnology Techniques: Unit 2 Lab 4 Activity 2: Identifying DNA Fragments • Biotechnology Techniques: Unit 2 Lab 5 Activity 1: Restriction Site Mapping • Biotechnology Techniques: Unit 3 Lab 6 Activity 1: Engineering Recombinant DNA Molecules • Biotechnology Techniques: Unit 3 Lab 7 Activity 1: Turning Genes On and Off • Biotechnology Techniques: Unit 4 Lab 8 Activity 1: Discover How Plasmids Transfer Genes • Biotechnology Techniques: Unit 4 Lab 8 Activity 2: The DNA Chip and Gene Expression • Teacher Resource CD: Biotechnology Techniques II - Gene Expression • Teacher Resource CD: Understanding DNA
GRADE LEVEL EXPECTATION	SC2.	<p>Develop an understanding of the structure, function, behavior, development, life cycles, and diversity of living organisms.</p> <ul style="list-style-type: none"> • Biotechnology Techniques: Unit 3 Lab 7 Activity 1: Turning Genes On and Off
GRADE LEVEL EXPECTATION	SC3.	<p>Develop an understanding that all organisms are linked to each other and their physical environments through the transfer and transformation of matter and energy.</p> <ul style="list-style-type: none"> • Biotechnology Techniques: Unit 2 Lab 3 Activity 1: Using Restriction Enzymes to Cut DNA Strands • Biotechnology Techniques: Unit 2 Lab 3 Activity 2: Sorting DNA Using Gel Electrophoresis • Biotechnology Techniques: Unit 2 Lab 5 Activity 1: Restriction Site Mapping
PERFORMANCE / CONTENT STANDARD	AK.SE.	<p>Science and Technology: A student should understand the relationships among science, technology, and society. A student who meets the content standard should:</p>
GRADE LEVEL EXPECTATION	SE1.	<p>Develop an understanding of how scientific knowledge and technology are used in making decisions about issues, innovations, and responses to problems and everyday events.</p> <ul style="list-style-type: none"> • Teacher Resource CD: Biotechnology Techniques I - Gel Electrophoresis • Teacher Resource CD: Biotechnology Techniques II - Gene Expression
GRADE LEVEL	SE2.	<p>Develop an understanding that solving problems involves different ways of thinking,</p>

EXPECTATION		<p>perspectives, and curiosity that lead to the exploration of multiple paths that are analyzed using scientific, technological, and social merits.</p> <ul style="list-style-type: none"> • Biotechnology Techniques: Unit 1 Lab 2 Activity 2: Extracting Cellular DNA • Biotechnology Techniques: Unit 2 Lab 3 Activity 1: Using Restriction Enzymes to Cut DNA Strands • Biotechnology Techniques: Unit 2 Lab 3 Activity 2: Sorting DNA Using Gel Electrophoresis • Biotechnology Techniques: Unit 2 Lab 4 Activity 1: Determining Molecular Mass and Charge • Biotechnology Techniques: Unit 2 Lab 4 Activity 2: Identifying DNA Fragments • Biotechnology Techniques: Unit 2 Lab 5 Activity 1: Restriction Site Mapping • Biotechnology Techniques: Unit 3 Lab 6 Activity 1: Engineering Recombinant DNA Molecules • Biotechnology Techniques: Unit 3 Lab 7 Activity 1: Turning Genes On and Off • Biotechnology Techniques: Unit 4 Lab 8 Activity 1: Discover How Plasmids Transfer Genes • Biotechnology Techniques: Unit 4 Lab 8 Activity 2: The DNA Chip and Gene Expression • Teacher Resource CD: Understanding DNA
GRADE LEVEL EXPECTATION	SE3.	<p>Develop an understanding of how scientific discoveries and technological innovations affect and are affected by our lives and cultures</p> <ul style="list-style-type: none"> • Teacher Resource CD: Biotechnology Techniques I - Gel Electrophoresis • Teacher Resource CD: Biotechnology Techniques II - Gene Expression
PERFORMANCE / CONTENT STANDARD	AK.SF.	<p>Cultural, Social, Personal Perspectives and Science: A student should understand the dynamic relationships among scientific, cultural, social, and personal perspectives. A student who meets the content standard should:</p>
GRADE LEVEL EXPECTATION	SF1.	<p>Develop an understanding of the interrelationships among individuals, cultures, societies, science, and technology.</p> <ul style="list-style-type: none"> • Biotechnology Techniques: Unit 1 Lab 2 Activity 2: Extracting Cellular DNA • Biotechnology Techniques: Unit 2 Lab 3 Activity 1: Using Restriction Enzymes to Cut DNA Strands • Biotechnology Techniques: Unit 2 Lab 3 Activity 2: Sorting DNA Using Gel Electrophoresis • Biotechnology Techniques: Unit 2 Lab 4 Activity 1: Determining Molecular Mass and Charge • Biotechnology Techniques: Unit 2 Lab 4 Activity 2: Identifying DNA Fragments • Biotechnology Techniques: Unit 2 Lab 5 Activity 1: Restriction Site Mapping • Biotechnology Techniques: Unit 3 Lab 6 Activity 1: Engineering Recombinant DNA Molecules • Biotechnology Techniques: Unit 3 Lab 7 Activity 1: Turning Genes On and Off • Biotechnology Techniques: Unit 4 Lab 8 Activity 1: Discover How Plasmids Transfer Genes

		<ul style="list-style-type: none"> • Biotechnology Techniques: Unit 4 Lab 8 Activity 2: The DNA Chip and Gene Expression • Teacher Resource CD: Understanding DNA
PERFORMANCE / CONTENT STANDARD	AK.SG.	History and Nature of Science: A student should understand the history and nature of science. A student who meets the content standard should:
GRADE LEVEL EXPECTATION	SG1.	<p>Develop an understanding that historical perspectives of scientific explanations demonstrate that scientific knowledge changes over time, building on prior knowledge.</p> <ul style="list-style-type: none"> • Biotechnology Techniques: Unit 1 Lab 2 Activity 2: Extracting Cellular DNA • Biotechnology Techniques: Unit 2 Lab 3 Activity 1: Using Restriction Enzymes to Cut DNA Strands • Biotechnology Techniques: Unit 2 Lab 3 Activity 2: Sorting DNA Using Gel Electrophoresis • Biotechnology Techniques: Unit 2 Lab 4 Activity 1: Determining Molecular Mass and Charge • Biotechnology Techniques: Unit 2 Lab 4 Activity 2: Identifying DNA Fragments • Biotechnology Techniques: Unit 2 Lab 5 Activity 1: Restriction Site Mapping • Biotechnology Techniques: Unit 3 Lab 6 Activity 1: Engineering Recombinant DNA Molecules • Biotechnology Techniques: Unit 3 Lab 7 Activity 1: Turning Genes On and Off • Biotechnology Techniques: Unit 4 Lab 8 Activity 1: Discover How Plasmids Transfer Genes • Biotechnology Techniques: Unit 4 Lab 8 Activity 2: The DNA Chip and Gene Expression • Teacher Resource CD: Understanding DNA
GRADE LEVEL EXPECTATION	SG2.	<p>Develop an understanding that the advancement of scientific knowledge embraces innovation and requires empirical evidence, repeatable investigations, logical arguments, and critical review in striving for the best possible explanations of the natural world.</p> <ul style="list-style-type: none"> • Biotechnology Techniques: Unit 4 Lab 8 Activity 1: Discover How Plasmids Transfer Genes • Biotechnology Techniques: Unit 4 Lab 8 Activity 2: The DNA Chip and Gene Expression • Teacher Resource CD: Understanding DNA
GRADE LEVEL EXPECTATION	SG3.	<p>Develop an understanding that scientific knowledge is ongoing and subject to change as new evidence becomes available through experimental and/or observational confirmation(s).</p> <ul style="list-style-type: none"> • Teacher Resource CD: Understanding DNA
GRADE LEVEL EXPECTATION	SG4.	<p>Develop an understanding that advancements in science depend on curiosity, creativity, imagination, and a broad knowledge base.</p> <ul style="list-style-type: none"> • Teacher Resource CD: Understanding DNA

Alaska Content Standards
Science
Grade 8

PERFORMANCE / CONTENT STANDARD	AK.A1.	Science as Inquiry and Process (SA1, SA2, SA3)
GRADE LEVEL EXPECTATION	[8] SA1.1.	<p>The student demonstrates an understanding of the processes of science by asking questions, predicting, observing, describing, measuring, classifying, making generalizations, inferring and communicating.</p> <ul style="list-style-type: none"> • Biotechnology Techniques: Unit 1 Lab 1 Activity 1: DNA Structure and Replication • Biotechnology Techniques: Unit 1 Lab 2 Activity 1: Preparing a Plant Tissue for DNA Extraction • Biotechnology Techniques: Unit 1 Lab 2 Activity 2: Extracting Cellular DNA • Biotechnology Techniques: Unit 2 Lab 3 Activity 1: Using Restriction Enzymes to Cut DNA Strands • Biotechnology Techniques: Unit 2 Lab 3 Activity 2: Sorting DNA Using Gel Electrophoresis • Biotechnology Techniques: Unit 2 Lab 4 Activity 1: Determining Molecular Mass and Charge • Biotechnology Techniques: Unit 2 Lab 4 Activity 2: Identifying DNA Fragments • Biotechnology Techniques: Unit 2 Lab 5 Activity 1: Restriction Site Mapping • Biotechnology Techniques: Unit 3 Lab 6 Activity 1: Engineering Recombinant DNA Molecules • Biotechnology Techniques: Unit 3 Lab 7 Activity 1: Turning Genes On and Off • Biotechnology Techniques: Unit 4 Lab 8 Activity 1: Discover How Plasmids Transfer Genes • Biotechnology Techniques: Unit 4 Lab 8 Activity 2: The DNA Chip and Gene Expression • Teacher Resource CD: Biotechnology Techniques I - Gel Electrophoresis • Virtual Laboratory: Restriction Enzyme Cleavage of DNA
GRADE LEVEL EXPECTATION	[8] SA1.2.	<p>The student demonstrates an understanding of the processes of science by collaborating to design and conduct repeatable investigations, in order to record, analyze (i.e., range, mean, median, mode), interpret data, and present findings. (L)</p> <ul style="list-style-type: none"> • Biotechnology Techniques: Unit 1 Lab 1 Activity 1: DNA Structure and Replication • Biotechnology Techniques: Unit 1 Lab 2 Activity 1: Preparing a Plant Tissue for DNA Extraction • Biotechnology Techniques: Unit 1 Lab 2 Activity 2: Extracting Cellular DNA • Biotechnology Techniques: Unit 2 Lab 3 Activity 1: Using Restriction Enzymes to Cut DNA Strands • Biotechnology Techniques: Unit 2 Lab 3 Activity 2: Sorting DNA Using Gel Electrophoresis • Biotechnology Techniques: Unit 2 Lab 4 Activity 1: Determining Molecular Mass and Charge • Biotechnology Techniques: Unit 2 Lab 4 Activity 2: Identifying DNA Fragments

		<ul style="list-style-type: none"> • Biotechnology Techniques: Unit 2 Lab 5 Activity 1: Restriction Site Mapping • Biotechnology Techniques: Unit 3 Lab 6 Activity 1: Engineering Recombinant DNA Molecules • Biotechnology Techniques: Unit 3 Lab 7 Activity 1: Turning Genes On and Off • Biotechnology Techniques: Unit 4 Lab 8 Activity 1: Discover How Plasmids Transfer Genes • Biotechnology Techniques: Unit 4 Lab 8 Activity 2: The DNA Chip and Gene Expression • Virtual Laboratory: Restriction Enzyme Cleavage of DNA
GRADE LEVEL EXPECTATION	[8] SA2.1.	<p>The student demonstrates an understanding of the attitudes and approaches to scientific inquiry by recognizing and analyzing differing scientific explanations and models.</p> <ul style="list-style-type: none"> • Biotechnology Techniques: Unit 1 Lab 1 Activity 1: DNA Structure and Replication • Biotechnology Techniques: Unit 1 Lab 2 Activity 1: Preparing a Plant Tissue for DNA Extraction • Biotechnology Techniques: Unit 1 Lab 2 Activity 2: Extracting Cellular DNA • Biotechnology Techniques: Unit 2 Lab 3 Activity 1: Using Restriction Enzymes to Cut DNA Strands • Biotechnology Techniques: Unit 2 Lab 3 Activity 2: Sorting DNA Using Gel Electrophoresis • Biotechnology Techniques: Unit 2 Lab 4 Activity 1: Determining Molecular Mass and Charge • Biotechnology Techniques: Unit 2 Lab 4 Activity 2: Identifying DNA Fragments • Biotechnology Techniques: Unit 2 Lab 5 Activity 1: Restriction Site Mapping • Biotechnology Techniques: Unit 3 Lab 6 Activity 1: Engineering Recombinant DNA Molecules • Biotechnology Techniques: Unit 3 Lab 7 Activity 1: Turning Genes On and Off • Biotechnology Techniques: Unit 4 Lab 8 Activity 1: Discover How Plasmids Transfer Genes • Biotechnology Techniques: Unit 4 Lab 8 Activity 2: The DNA Chip and Gene Expression • Virtual Laboratory: Restriction Enzyme Cleavage of DNA
PERFORMANCE / CONTENT STANDARD	AK.B1.	Concepts of Physical Science (SB1, SB2, SB3, SB4)
GRADE LEVEL EXPECTATION	[8] SB3.2.	<p>The student demonstrates an understanding of the interactions between matter and energy and the effects of these interactions on systems by exploring through a variety of models (e.g., gumdrops and toothpicks) how atoms may bond together into well defined molecules or bond together in large arrays. (L)</p> <ul style="list-style-type: none"> • Biotechnology Techniques: Unit 1 Lab 1 Activity 1: DNA Structure and Replication • Biotechnology Techniques: Unit 2 Lab 4 Activity 1: Determining Molecular Mass and Charge • Biotechnology Techniques: Unit 2 Lab 4 Activity 2: Identifying DNA

		Fragments
PERFORMANCE / CONTENT STANDARD	AK.C1.	Concepts of Life Science (SC1, SC2, SC3)
GRADE LEVEL EXPECTATION	[8] SC1.1.	<p>The student demonstrates an understanding of how science explains changes in life forms over time, including genetics, heredity, the process of natural selection and biological evolution by describing the role of genes in sexual reproduction (i.e., traits of the offspring).</p> <ul style="list-style-type: none"> • Biotechnology Techniques: Unit 2 Lab 5 Activity 1: Restriction Site Mapping • Biotechnology Techniques: Unit 3 Lab 6 Activity 1: Engineering Recombinant DNA Molecules • Biotechnology Techniques: Unit 3 Lab 7 Activity 1: Turning Genes On and Off • Biotechnology Techniques: Unit 4 Lab 8 Activity 1: Discover How Plasmids Transfer Genes • Teacher Resource CD: Biotechnology Techniques I - Gel Electrophoresis • Teacher Resource CD: Biotechnology Techniques II - Gene Expression • Teacher Resource CD: Understanding DNA
GRADE LEVEL EXPECTATION	[8] SC2.2.	<p>The student demonstrates an understanding of the structure, function, behavior, development, life cycles, and diversity of living organisms by explaining that most organisms utilize inherited and learned behaviors to meet the basic requirements of life.</p> <ul style="list-style-type: none"> • Biotechnology Techniques: Unit 3 Lab 7 Activity 1: Turning Genes On and Off
GRADE LEVEL EXPECTATION	[8] SC3.1.	<p>The student demonstrates an understanding that all organisms are linked to each other and their physical environments through the transfer and transformation of matter and energy by stating that energy flows and that matter cycles but is conserved within an ecosystem.</p> <ul style="list-style-type: none"> • Biotechnology Techniques: Unit 2 Lab 3 Activity 1: Using Restriction Enzymes to Cut DNA Strands • Biotechnology Techniques: Unit 2 Lab 3 Activity 2: Sorting DNA Using Gel Electrophoresis • Biotechnology Techniques: Unit 2 Lab 5 Activity 1: Restriction Site Mapping
GRADE LEVEL EXPECTATION	[8] SC3.2.	<p>The student demonstrates an understanding that all organisms are linked to each other and their physical environments through the transfer and transformation of matter and energy by organizing a food web that shows the cycling of matter.</p> <ul style="list-style-type: none"> • Biotechnology Techniques: Unit 2 Lab 3 Activity 1: Using Restriction Enzymes to Cut DNA Strands • Biotechnology Techniques: Unit 2 Lab 3 Activity 2: Sorting DNA Using Gel Electrophoresis • Biotechnology Techniques: Unit 2 Lab 5 Activity 1: Restriction Site Mapping
PERFORMANCE / CONTENT	AK.E1.	Science and Technology (SE1, SE2, SE3)

STANDARD		
GRADE LEVEL EXPECTATION	[8] SE1.1.	<p>The student demonstrates an understanding of how to integrate scientific knowledge and technology to address problems by describing how public policy affects their lives and participating diplomatically in evidence-based discussions relating to their community. (L)</p> <ul style="list-style-type: none"> • Biotechnology Techniques: Unit 1 Lab 2 Activity 2: Extracting Cellular DNA • Biotechnology Techniques: Unit 2 Lab 3 Activity 1: Using Restriction Enzymes to Cut DNA Strands • Biotechnology Techniques: Unit 2 Lab 3 Activity 2: Sorting DNA Using Gel Electrophoresis • Biotechnology Techniques: Unit 2 Lab 4 Activity 1: Determining Molecular Mass and Charge • Biotechnology Techniques: Unit 2 Lab 4 Activity 2: Identifying DNA Fragments • Biotechnology Techniques: Unit 2 Lab 5 Activity 1: Restriction Site Mapping • Biotechnology Techniques: Unit 3 Lab 6 Activity 1: Engineering Recombinant DNA Molecules • Biotechnology Techniques: Unit 3 Lab 7 Activity 1: Turning Genes On and Off • Biotechnology Techniques: Unit 4 Lab 8 Activity 1: Discover How Plasmids Transfer Genes • Biotechnology Techniques: Unit 4 Lab 8 Activity 2: The DNA Chip and Gene Expression
GRADE LEVEL EXPECTATION	[8] SE2.1.	<p>The student demonstrates an understanding that solving problems involves different ways of thinking by identifying, designing, testing, and revising solutions to a local problem. (L)</p> <ul style="list-style-type: none"> • Biotechnology Techniques: Unit 1 Lab 1 Activity 1: DNA Structure and Replication • Biotechnology Techniques: Unit 1 Lab 2 Activity 1: Preparing a Plant Tissue for DNA Extraction • Biotechnology Techniques: Unit 1 Lab 2 Activity 2: Extracting Cellular DNA • Biotechnology Techniques: Unit 2 Lab 3 Activity 1: Using Restriction Enzymes to Cut DNA Strands • Biotechnology Techniques: Unit 2 Lab 3 Activity 2: Sorting DNA Using Gel Electrophoresis • Biotechnology Techniques: Unit 2 Lab 4 Activity 1: Determining Molecular Mass and Charge • Biotechnology Techniques: Unit 2 Lab 4 Activity 2: Identifying DNA Fragments • Biotechnology Techniques: Unit 2 Lab 5 Activity 1: Restriction Site Mapping • Biotechnology Techniques: Unit 3 Lab 7 Activity 1: Turning Genes On and Off • Biotechnology Techniques: Unit 4 Lab 8 Activity 1: Discover How Plasmids Transfer Genes • Biotechnology Techniques: Unit 4 Lab 8 Activity 2: The DNA Chip and Gene Expression
GRADE LEVEL EXPECTATION	[8] SE3.1.	<p>The student demonstrates an understanding of how scientific discoveries and technological innovations affect our lives and society by predicting the possible</p>

		<p>effects of a recent scientific discovery, invention, or scientific breakthrough. (L)</p> <ul style="list-style-type: none"> • Teacher Resource CD: Biotechnology Techniques I - Gel Electrophoresis • Teacher Resource CD: Biotechnology Techniques II - Gene Expression
PERFORMANCE / CONTENT STANDARD	AK.F1.	Cultural, Social, Personal Perspectives, and Science (SF1, SF2, SF3)
GRADE LEVEL EXPECTATION	[8] SF1.1-SF3.1.	<p>The student demonstrates an understanding of the dynamic relationships among scientific, cultural, social, and personal perspectives by describing how local knowledge, culture, and the technologies of various activities (e.g., hunting, fishing, subsistence) influence the development of scientific knowledge. (L) Cross referenced with SA3.1, grade 8</p> <ul style="list-style-type: none"> • Biotechnology Techniques: Unit 1 Lab 2 Activity 2: Extracting Cellular DNA • Biotechnology Techniques: Unit 2 Lab 3 Activity 1: Using Restriction Enzymes to Cut DNA Strands • Biotechnology Techniques: Unit 2 Lab 3 Activity 2: Sorting DNA Using Gel Electrophoresis • Biotechnology Techniques: Unit 2 Lab 4 Activity 1: Determining Molecular Mass and Charge • Biotechnology Techniques: Unit 2 Lab 4 Activity 2: Identifying DNA Fragments • Biotechnology Techniques: Unit 2 Lab 5 Activity 1: Restriction Site Mapping • Biotechnology Techniques: Unit 3 Lab 6 Activity 1: Engineering Recombinant DNA Molecules • Biotechnology Techniques: Unit 3 Lab 7 Activity 1: Turning Genes On and Off • Biotechnology Techniques: Unit 4 Lab 8 Activity 1: Discover How Plasmids Transfer Genes • Biotechnology Techniques: Unit 4 Lab 8 Activity 2: The DNA Chip and Gene Expression
PERFORMANCE / CONTENT STANDARD	AK.SA.	Science as Inquiry and Process: A student should understand and be able to apply the processes and applications of scientific inquiry. A student who meets the content standard should:
GRADE LEVEL EXPECTATION	SA1.	<p>Develop an understanding of the processes of science used to investigate problems, design and conduct repeatable scientific investigations, and defend scientific arguments.</p> <ul style="list-style-type: none"> • Biotechnology Techniques: Unit 1 Lab 1 Activity 1: DNA Structure and Replication • Biotechnology Techniques: Unit 1 Lab 2 Activity 1: Preparing a Plant Tissue for DNA Extraction • Biotechnology Techniques: Unit 1 Lab 2 Activity 2: Extracting Cellular DNA • Biotechnology Techniques: Unit 2 Lab 3 Activity 1: Using Restriction Enzymes to Cut DNA Strands • Biotechnology Techniques: Unit 2 Lab 3 Activity 2: Sorting DNA Using Gel Electrophoresis • Biotechnology Techniques: Unit 2 Lab 4 Activity 1: Determining Molecular Mass and Charge • Biotechnology Techniques: Unit 2 Lab 4 Activity 2: Identifying DNA Fragments

		<ul style="list-style-type: none"> • Biotechnology Techniques: Unit 2 Lab 5 Activity 1: Restriction Site Mapping • Biotechnology Techniques: Unit 3 Lab 6 Activity 1: Engineering Recombinant DNA Molecules • Biotechnology Techniques: Unit 3 Lab 7 Activity 1: Turning Genes On and Off • Biotechnology Techniques: Unit 4 Lab 8 Activity 1: Discover How Plasmids Transfer Genes • Biotechnology Techniques: Unit 4 Lab 8 Activity 2: The DNA Chip and Gene Expression • Virtual Laboratory: Restriction Enzyme Cleavage of DNA
GRADE LEVEL EXPECTATION	SA2.	<p>Develop an understanding that the processes of science require integrity, logical reasoning, skepticism, openness, communication, and peer review.</p> <ul style="list-style-type: none"> • Biotechnology Techniques: Unit 4 Lab 8 Activity 1: Discover How Plasmids Transfer Genes • Biotechnology Techniques: Unit 4 Lab 8 Activity 2: The DNA Chip and Gene Expression
PERFORMANCE / CONTENT STANDARD	AK.SC.	<p>Concepts of Life Science: A student should understand and be able to apply the concepts, models, theories, facts, evidence, systems, and processes of life science. A student who meets the content standard should:</p>
GRADE LEVEL EXPECTATION	SC1.	<p>Develop an understanding of how science explains changes in life forms over time, including genetics, heredity, the process of natural selection, and biological evolution.</p> <ul style="list-style-type: none"> • Biotechnology Techniques: Unit 1 Lab 1 Activity 1: DNA Structure and Replication • Biotechnology Techniques: Unit 1 Lab 2 Activity 1: Preparing a Plant Tissue for DNA Extraction • Biotechnology Techniques: Unit 1 Lab 2 Activity 2: Extracting Cellular DNA • Biotechnology Techniques: Unit 2 Lab 3 Activity 1: Using Restriction Enzymes to Cut DNA Strands • Biotechnology Techniques: Unit 2 Lab 3 Activity 2: Sorting DNA Using Gel Electrophoresis • Biotechnology Techniques: Unit 2 Lab 4 Activity 1: Determining Molecular Mass and Charge • Biotechnology Techniques: Unit 2 Lab 4 Activity 2: Identifying DNA Fragments • Biotechnology Techniques: Unit 2 Lab 5 Activity 1: Restriction Site Mapping • Biotechnology Techniques: Unit 3 Lab 6 Activity 1: Engineering Recombinant DNA Molecules • Biotechnology Techniques: Unit 3 Lab 7 Activity 1: Turning Genes On and Off • Biotechnology Techniques: Unit 4 Lab 8 Activity 1: Discover How Plasmids Transfer Genes • Biotechnology Techniques: Unit 4 Lab 8 Activity 2: The DNA Chip and Gene Expression • Teacher Resource CD: Biotechnology Techniques II - Gene Expression • Teacher Resource CD: Understanding DNA
GRADE LEVEL EXPECTATION	SC2.	<p>Develop an understanding of the structure, function, behavior, development, life</p>

		<p>cycles, and diversity of living organisms.</p> <ul style="list-style-type: none"> • Biotechnology Techniques: Unit 3 Lab 7 Activity 1: Turning Genes On and Off
GRADE LEVEL EXPECTATION	SC3.	<p>Develop an understanding that all organisms are linked to each other and their physical environments through the transfer and transformation of matter and energy.</p> <ul style="list-style-type: none"> • Biotechnology Techniques: Unit 2 Lab 3 Activity 1: Using Restriction Enzymes to Cut DNA Strands • Biotechnology Techniques: Unit 2 Lab 3 Activity 2: Sorting DNA Using Gel Electrophoresis • Biotechnology Techniques: Unit 2 Lab 5 Activity 1: Restriction Site Mapping
PERFORMANCE / CONTENT STANDARD	AK.SE.	<p>Science and Technology: A student should understand the relationships among science, technology, and society. A student who meets the content standard should:</p>
GRADE LEVEL EXPECTATION	SE1.	<p>Develop an understanding of how scientific knowledge and technology are used in making decisions about issues, innovations, and responses to problems and everyday events.</p> <ul style="list-style-type: none"> • Teacher Resource CD: Biotechnology Techniques I - Gel Electrophoresis • Teacher Resource CD: Biotechnology Techniques II - Gene Expression
GRADE LEVEL EXPECTATION	SE2.	<p>Develop an understanding that solving problems involves different ways of thinking, perspectives, and curiosity that lead to the exploration of multiple paths that are analyzed using scientific, technological, and social merits.</p> <ul style="list-style-type: none"> • Biotechnology Techniques: Unit 1 Lab 2 Activity 2: Extracting Cellular DNA • Biotechnology Techniques: Unit 2 Lab 3 Activity 1: Using Restriction Enzymes to Cut DNA Strands • Biotechnology Techniques: Unit 2 Lab 3 Activity 2: Sorting DNA Using Gel Electrophoresis • Biotechnology Techniques: Unit 2 Lab 4 Activity 1: Determining Molecular Mass and Charge • Biotechnology Techniques: Unit 2 Lab 4 Activity 2: Identifying DNA Fragments • Biotechnology Techniques: Unit 2 Lab 5 Activity 1: Restriction Site Mapping • Biotechnology Techniques: Unit 3 Lab 6 Activity 1: Engineering Recombinant DNA Molecules • Biotechnology Techniques: Unit 3 Lab 7 Activity 1: Turning Genes On and Off • Biotechnology Techniques: Unit 4 Lab 8 Activity 1: Discover How Plasmids Transfer Genes • Biotechnology Techniques: Unit 4 Lab 8 Activity 2: The DNA Chip and Gene Expression • Teacher Resource CD: Understanding DNA
GRADE LEVEL EXPECTATION	SE3.	<p>Develop an understanding of how scientific discoveries and technological</p>

		<p>innovations affect and are affected by our lives and cultures</p> <ul style="list-style-type: none"> • Teacher Resource CD: Biotechnology Techniques I - Gel Electrophoresis • Teacher Resource CD: Biotechnology Techniques II - Gene Expression
PERFORMANCE / CONTENT STANDARD	AK.SF.	Cultural, Social, Personal Perspectives and Science: A student should understand the dynamic relationships among scientific, cultural, social, and personal perspectives. A student who meets the content standard should:
GRADE LEVEL EXPECTATION	SF1.	<p>Develop an understanding of the interrelationships among individuals, cultures, societies, science, and technology.</p> <ul style="list-style-type: none"> • Biotechnology Techniques: Unit 1 Lab 2 Activity 2: Extracting Cellular DNA • Biotechnology Techniques: Unit 2 Lab 3 Activity 1: Using Restriction Enzymes to Cut DNA Strands • Biotechnology Techniques: Unit 2 Lab 3 Activity 2: Sorting DNA Using Gel Electrophoresis • Biotechnology Techniques: Unit 2 Lab 4 Activity 1: Determining Molecular Mass and Charge • Biotechnology Techniques: Unit 2 Lab 4 Activity 2: Identifying DNA Fragments • Biotechnology Techniques: Unit 2 Lab 5 Activity 1: Restriction Site Mapping • Biotechnology Techniques: Unit 3 Lab 6 Activity 1: Engineering Recombinant DNA Molecules • Biotechnology Techniques: Unit 3 Lab 7 Activity 1: Turning Genes On and Off • Biotechnology Techniques: Unit 4 Lab 8 Activity 1: Discover How Plasmids Transfer Genes • Biotechnology Techniques: Unit 4 Lab 8 Activity 2: The DNA Chip and Gene Expression • Teacher Resource CD: Understanding DNA
PERFORMANCE / CONTENT STANDARD	AK.SG.	History and Nature of Science: A student should understand the history and nature of science. A student who meets the content standard should:
GRADE LEVEL EXPECTATION	SG1.	<p>Develop an understanding that historical perspectives of scientific explanations demonstrate that scientific knowledge changes over time, building on prior knowledge.</p> <ul style="list-style-type: none"> • Biotechnology Techniques: Unit 1 Lab 2 Activity 2: Extracting Cellular DNA • Biotechnology Techniques: Unit 2 Lab 3 Activity 1: Using Restriction Enzymes to Cut DNA Strands • Biotechnology Techniques: Unit 2 Lab 3 Activity 2: Sorting DNA Using Gel Electrophoresis • Biotechnology Techniques: Unit 2 Lab 4 Activity 1: Determining Molecular Mass and Charge • Biotechnology Techniques: Unit 2 Lab 4 Activity 2: Identifying DNA Fragments • Biotechnology Techniques: Unit 2 Lab 5 Activity 1: Restriction Site Mapping • Biotechnology Techniques: Unit 3 Lab 6 Activity 1: Engineering Recombinant DNA Molecules • Biotechnology Techniques: Unit 3 Lab 7 Activity 1: Turning Genes On

		<p>and Off</p> <ul style="list-style-type: none"> • Biotechnology Techniques: Unit 4 Lab 8 Activity 1: Discover How Plasmids Transfer Genes • Biotechnology Techniques: Unit 4 Lab 8 Activity 2: The DNA Chip and Gene Expression • Teacher Resource CD: Understanding DNA
GRADE LEVEL EXPECTATION	SG2.	<p>Develop an understanding that the advancement of scientific knowledge embraces innovation and requires empirical evidence, repeatable investigations, logical arguments, and critical review in striving for the best possible explanations of the natural world.</p> <ul style="list-style-type: none"> • Biotechnology Techniques: Unit 4 Lab 8 Activity 1: Discover How Plasmids Transfer Genes • Biotechnology Techniques: Unit 4 Lab 8 Activity 2: The DNA Chip and Gene Expression • Teacher Resource CD: Understanding DNA
GRADE LEVEL EXPECTATION	SG3.	<p>Develop an understanding that scientific knowledge is ongoing and subject to change as new evidence becomes available through experimental and/or observational confirmation(s).</p> <ul style="list-style-type: none"> • Teacher Resource CD: Understanding DNA
GRADE LEVEL EXPECTATION	SG4.	<p>Develop an understanding that advancements in science depend on curiosity, creativity, imagination, and a broad knowledge base.</p> <ul style="list-style-type: none"> • Teacher Resource CD: Understanding DNA

**Alaska Content Standards
Science
Grade 9**

PERFORMANCE / CONTENT STANDARD	AK.A1.	Science as Inquiry and Process (SA1, SA2, SA3)
GRADE LEVEL EXPECTATION	[9] SA1.1.	<p>The student develops an understanding of the processes of science by asking questions, predicting, observing, describing, measuring, classifying, making generalizations, inferring and communicating.</p> <ul style="list-style-type: none"> • Biotechnology Techniques: Unit 1 Lab 1 Activity 1: DNA Structure and Replication • Biotechnology Techniques: Unit 1 Lab 2 Activity 1: Preparing a Plant Tissue for DNA Extraction • Biotechnology Techniques: Unit 1 Lab 2 Activity 2: Extracting Cellular DNA • Biotechnology Techniques: Unit 2 Lab 3 Activity 1: Using Restriction Enzymes to Cut DNA Strands • Biotechnology Techniques: Unit 2 Lab 3 Activity 2: Sorting DNA Using Gel Electrophoresis • Biotechnology Techniques: Unit 2 Lab 4 Activity 1: Determining Molecular Mass and Charge • Biotechnology Techniques: Unit 2 Lab 4 Activity 2: Identifying DNA Fragments • Biotechnology Techniques: Unit 2 Lab 5 Activity 1: Restriction Site Mapping

		<ul style="list-style-type: none"> • Biotechnology Techniques: Unit 3 Lab 6 Activity 1: Engineering Recombinant DNA Molecules • Biotechnology Techniques: Unit 3 Lab 7 Activity 1: Turning Genes On and Off • Biotechnology Techniques: Unit 4 Lab 8 Activity 1: Discover How Plasmids Transfer Genes • Biotechnology Techniques: Unit 4 Lab 8 Activity 2: The DNA Chip and Gene Expression • Teacher Resource CD: Biotechnology Techniques I - Gel Electrophoresis • Virtual Laboratory: Restriction Enzyme Cleavage of DNA
<p>GRADE LEVEL EXPECTATION</p>	<p>[9] SA1.2.</p>	<p>The student develops an understanding of the processes of science by hypothesizing, designing a controlled experiment, making qualitative and quantitative observations, interpreting data, and using this information to communicate conclusions.</p> <ul style="list-style-type: none"> • Biotechnology Techniques: Unit 1 Lab 1 Activity 1: DNA Structure and Replication • Biotechnology Techniques: Unit 1 Lab 2 Activity 1: Preparing a Plant Tissue for DNA Extraction • Biotechnology Techniques: Unit 1 Lab 2 Activity 2: Extracting Cellular DNA • Biotechnology Techniques: Unit 2 Lab 3 Activity 1: Using Restriction Enzymes to Cut DNA Strands • Biotechnology Techniques: Unit 2 Lab 3 Activity 2: Sorting DNA Using Gel Electrophoresis • Biotechnology Techniques: Unit 2 Lab 4 Activity 1: Determining Molecular Mass and Charge • Biotechnology Techniques: Unit 2 Lab 4 Activity 2: Identifying DNA Fragments • Biotechnology Techniques: Unit 2 Lab 5 Activity 1: Restriction Site Mapping • Biotechnology Techniques: Unit 3 Lab 6 Activity 1: Engineering Recombinant DNA Molecules • Biotechnology Techniques: Unit 3 Lab 7 Activity 1: Turning Genes On and Off • Biotechnology Techniques: Unit 4 Lab 8 Activity 1: Discover How Plasmids Transfer Genes • Biotechnology Techniques: Unit 4 Lab 8 Activity 2: The DNA Chip and Gene Expression • Virtual Laboratory: Restriction Enzyme Cleavage of DNA
<p>GRADE LEVEL EXPECTATION</p>	<p>[9] SA2.1.</p>	<p>The student will demonstrate an understanding of the attitudes and approaches to scientific inquiry by formulating conclusions that are logical and supported by evidence.</p> <ul style="list-style-type: none"> • Biotechnology Techniques: Unit 1 Lab 1 Activity 1: DNA Structure and Replication • Biotechnology Techniques: Unit 1 Lab 2 Activity 1: Preparing a Plant Tissue for DNA Extraction • Biotechnology Techniques: Unit 1 Lab 2 Activity 2: Extracting Cellular DNA • Biotechnology Techniques: Unit 2 Lab 3 Activity 1: Using Restriction Enzymes to Cut DNA Strands • Biotechnology Techniques: Unit 2 Lab 3 Activity 2: Sorting DNA Using

		<p>Gel Electrophoresis</p> <ul style="list-style-type: none"> • Biotechnology Techniques: Unit 2 Lab 4 Activity 1: Determining Molecular Mass and Charge • Biotechnology Techniques: Unit 2 Lab 4 Activity 2: Identifying DNA Fragments • Biotechnology Techniques: Unit 2 Lab 5 Activity 1: Restriction Site Mapping • Biotechnology Techniques: Unit 3 Lab 6 Activity 1: Engineering Recombinant DNA Molecules • Biotechnology Techniques: Unit 3 Lab 7 Activity 1: Turning Genes On and Off • Biotechnology Techniques: Unit 4 Lab 8 Activity 1: Discover How Plasmids Transfer Genes • Biotechnology Techniques: Unit 4 Lab 8 Activity 2: The DNA Chip and Gene Expression • Virtual Laboratory: Restriction Enzyme Cleavage of DNA
PERFORMANCE / CONTENT STANDARD	AK.C1.	Concepts of Life Science (SC1, SC2, SC3)
GRADE LEVEL EXPECTATION	[9] SC1.1.	<p>The student demonstrates an understanding of how science explains changes in life forms over time, including genetics, heredity, the process of natural selection and biological evolution by recognizing that all organisms have chromosomes made of DNA and that DNA determines traits.</p> <ul style="list-style-type: none"> • Biotechnology Techniques: Unit 1 Lab 1 Activity 1: DNA Structure and Replication • Biotechnology Techniques: Unit 1 Lab 2 Activity 1: Preparing a Plant Tissue for DNA Extraction • Biotechnology Techniques: Unit 1 Lab 2 Activity 2: Extracting Cellular DNA • Biotechnology Techniques: Unit 2 Lab 3 Activity 1: Using Restriction Enzymes to Cut DNA Strands • Biotechnology Techniques: Unit 2 Lab 3 Activity 2: Sorting DNA Using Gel Electrophoresis • Biotechnology Techniques: Unit 2 Lab 4 Activity 1: Determining Molecular Mass and Charge • Biotechnology Techniques: Unit 2 Lab 4 Activity 2: Identifying DNA Fragments • Biotechnology Techniques: Unit 2 Lab 5 Activity 1: Restriction Site Mapping • Biotechnology Techniques: Unit 3 Lab 6 Activity 1: Engineering Recombinant DNA Molecules • Biotechnology Techniques: Unit 3 Lab 7 Activity 1: Turning Genes On and Off • Biotechnology Techniques: Unit 4 Lab 8 Activity 1: Discover How Plasmids Transfer Genes • Biotechnology Techniques: Unit 4 Lab 8 Activity 2: The DNA Chip and Gene Expression • Teacher Resource CD: Biotechnology Techniques I - Gel Electrophoresis • Teacher Resource CD: Biotechnology Techniques II - Gene Expression • Teacher Resource CD: Understanding DNA
PERFORMANCE / CONTENT STANDARD	AK.E1.	Science and Technology (SE1, SE2, SE3)

<p>GRADE LEVEL EXPECTATION</p>	<p>[9] SE1.1.</p>	<p>The student demonstrates an understanding of how to integrate scientific knowledge and technology to address problems by recognizing that the value of any given technology may be different for different groups of people and at different points in time (e.g., different uses of snow machines in different regions of Alaska).</p> <ul style="list-style-type: none"> • Biotechnology Techniques: Unit 1 Lab 2 Activity 2: Extracting Cellular DNA • Biotechnology Techniques: Unit 2 Lab 3 Activity 1: Using Restriction Enzymes to Cut DNA Strands • Biotechnology Techniques: Unit 2 Lab 3 Activity 2: Sorting DNA Using Gel Electrophoresis • Biotechnology Techniques: Unit 2 Lab 4 Activity 1: Determining Molecular Mass and Charge • Biotechnology Techniques: Unit 2 Lab 4 Activity 2: Identifying DNA Fragments • Biotechnology Techniques: Unit 2 Lab 5 Activity 1: Restriction Site Mapping • Biotechnology Techniques: Unit 3 Lab 6 Activity 1: Engineering Recombinant DNA Molecules • Biotechnology Techniques: Unit 3 Lab 7 Activity 1: Turning Genes On and Off • Biotechnology Techniques: Unit 4 Lab 8 Activity 1: Discover How Plasmids Transfer Genes • Biotechnology Techniques: Unit 4 Lab 8 Activity 2: The DNA Chip and Gene Expression • Teacher Resource CD: Biotechnology Techniques I - Gel Electrophoresis • Teacher Resource CD: Biotechnology Techniques II - Gene Expression
<p>GRADE LEVEL EXPECTATION</p>	<p>[9] SE2.1.</p>	<p>The student demonstrates an understanding that solving problems involves different ways of thinking, by questioning, researching, modeling, simulating, and testing a solution to a problem. (L)</p> <ul style="list-style-type: none"> • Biotechnology Techniques: Unit 1 Lab 1 Activity 1: DNA Structure and Replication • Biotechnology Techniques: Unit 1 Lab 2 Activity 1: Preparing a Plant Tissue for DNA Extraction • Biotechnology Techniques: Unit 1 Lab 2 Activity 2: Extracting Cellular DNA • Biotechnology Techniques: Unit 2 Lab 3 Activity 1: Using Restriction Enzymes to Cut DNA Strands • Biotechnology Techniques: Unit 2 Lab 3 Activity 2: Sorting DNA Using Gel Electrophoresis • Biotechnology Techniques: Unit 2 Lab 4 Activity 1: Determining Molecular Mass and Charge • Biotechnology Techniques: Unit 2 Lab 4 Activity 2: Identifying DNA Fragments • Biotechnology Techniques: Unit 2 Lab 5 Activity 1: Restriction Site Mapping • Biotechnology Techniques: Unit 3 Lab 6 Activity 1: Engineering Recombinant DNA Molecules • Biotechnology Techniques: Unit 3 Lab 7 Activity 1: Turning Genes On and Off • Biotechnology Techniques: Unit 4 Lab 8 Activity 1: Discover How Plasmids Transfer Genes • Biotechnology Techniques: Unit 4 Lab 8 Activity 2: The DNA Chip and

		<p>Gene Expression</p> <ul style="list-style-type: none"> Virtual Laboratory: Restriction Enzyme Cleavage of DNA
GRADE LEVEL EXPECTATION	[9] SE3.1.	<p>The student demonstrates an understanding of how scientific discoveries and technological innovations affect our lives and society by predicting and evaluating the possible effects of a recent scientific discovery, invention, or scientific breakthrough. (L)</p> <ul style="list-style-type: none"> Teacher Resource CD: Biotechnology Techniques I - Gel Electrophoresis Teacher Resource CD: Biotechnology Techniques II - Gene Expression
PERFORMANCE / CONTENT STANDARD	AK.G1.	History and Nature of Science (SG1, SG2,SG3, SG4)
GRADE LEVEL EXPECTATION	[9] SG2.1.	<p>The student demonstrates an understanding of the bases of the advancement of scientific knowledge by explaining the importance of innovations (i.e., microscope, immunization, computer).</p> <ul style="list-style-type: none"> Teacher Resource CD: Understanding DNA
GRADE LEVEL EXPECTATION	[9] SG3.1.	<p>The student demonstrates an understanding that scientific knowledge is ongoing and subject to change by describing the role of serendipity in scientific discoveries.</p> <ul style="list-style-type: none"> Teacher Resource CD: Understanding DNA
PERFORMANCE / CONTENT STANDARD	AK.SA.	Science as Inquiry and Process: A student should understand and be able to apply the processes and applications of scientific inquiry. A student who meets the content standard should:
GRADE LEVEL EXPECTATION	SA1.	<p>Develop an understanding of the processes of science used to investigate problems, design and conduct repeatable scientific investigations, and defend scientific arguments.</p> <ul style="list-style-type: none"> Biotechnology Techniques: Unit 1 Lab 1 Activity 1: DNA Structure and Replication Biotechnology Techniques: Unit 1 Lab 2 Activity 1: Preparing a Plant Tissue for DNA Extraction Biotechnology Techniques: Unit 1 Lab 2 Activity 2: Extracting Cellular DNA Biotechnology Techniques: Unit 2 Lab 3 Activity 1: Using Restriction Enzymes to Cut DNA Strands Biotechnology Techniques: Unit 2 Lab 3 Activity 2: Sorting DNA Using Gel Electrophoresis Biotechnology Techniques: Unit 2 Lab 4 Activity 1: Determining Molecular Mass and Charge Biotechnology Techniques: Unit 2 Lab 4 Activity 2: Identifying DNA Fragments Biotechnology Techniques: Unit 2 Lab 5 Activity 1: Restriction Site Mapping Biotechnology Techniques: Unit 3 Lab 6 Activity 1: Engineering Recombinant DNA Molecules Biotechnology Techniques: Unit 3 Lab 7 Activity 1: Turning Genes On and Off Biotechnology Techniques: Unit 4 Lab 8 Activity 1: Discover How Plasmids Transfer Genes

		<ul style="list-style-type: none"> • Biotechnology Techniques: Unit 4 Lab 8 Activity 2: The DNA Chip and Gene Expression • Virtual Laboratory: Restriction Enzyme Cleavage of DNA
GRADE LEVEL EXPECTATION	SA2.	<p>Develop an understanding that the processes of science require integrity, logical reasoning, skepticism, openness, communication, and peer review.</p> <ul style="list-style-type: none"> • Biotechnology Techniques: Unit 4 Lab 8 Activity 1: Discover How Plasmids Transfer Genes • Biotechnology Techniques: Unit 4 Lab 8 Activity 2: The DNA Chip and Gene Expression
PERFORMANCE / CONTENT STANDARD	AK.SC.	<p>Concepts of Life Science: A student should understand and be able to apply the concepts, models, theories, facts, evidence, systems, and processes of life science. A student who meets the content standard should:</p>
GRADE LEVEL EXPECTATION	SC1.	<p>Develop an understanding of how science explains changes in life forms over time, including genetics, heredity, the process of natural selection, and biological evolution.</p> <ul style="list-style-type: none"> • Biotechnology Techniques: Unit 1 Lab 1 Activity 1: DNA Structure and Replication • Biotechnology Techniques: Unit 1 Lab 2 Activity 1: Preparing a Plant Tissue for DNA Extraction • Biotechnology Techniques: Unit 1 Lab 2 Activity 2: Extracting Cellular DNA • Biotechnology Techniques: Unit 2 Lab 3 Activity 1: Using Restriction Enzymes to Cut DNA Strands • Biotechnology Techniques: Unit 2 Lab 3 Activity 2: Sorting DNA Using Gel Electrophoresis • Biotechnology Techniques: Unit 2 Lab 4 Activity 1: Determining Molecular Mass and Charge • Biotechnology Techniques: Unit 2 Lab 4 Activity 2: Identifying DNA Fragments • Biotechnology Techniques: Unit 2 Lab 5 Activity 1: Restriction Site Mapping • Biotechnology Techniques: Unit 3 Lab 6 Activity 1: Engineering Recombinant DNA Molecules • Biotechnology Techniques: Unit 3 Lab 7 Activity 1: Turning Genes On and Off • Biotechnology Techniques: Unit 4 Lab 8 Activity 1: Discover How Plasmids Transfer Genes • Biotechnology Techniques: Unit 4 Lab 8 Activity 2: The DNA Chip and Gene Expression • Teacher Resource CD: Biotechnology Techniques II - Gene Expression • Teacher Resource CD: Understanding DNA
GRADE LEVEL EXPECTATION	SC2.	<p>Develop an understanding of the structure, function, behavior, development, life cycles, and diversity of living organisms.</p> <ul style="list-style-type: none"> • Biotechnology Techniques: Unit 3 Lab 7 Activity 1: Turning Genes On and Off
GRADE LEVEL EXPECTATION	SC3.	<p>Develop an understanding that all organisms are linked to each other and their physical environments through the transfer and transformation of matter and</p>

		<p>energy.</p> <ul style="list-style-type: none"> • Biotechnology Techniques: Unit 2 Lab 3 Activity 1: Using Restriction Enzymes to Cut DNA Strands • Biotechnology Techniques: Unit 2 Lab 3 Activity 2: Sorting DNA Using Gel Electrophoresis • Biotechnology Techniques: Unit 2 Lab 5 Activity 1: Restriction Site Mapping
PERFORMANCE / CONTENT STANDARD	AK.SE.	Science and Technology: A student should understand the relationships among science, technology, and society. A student who meets the content standard should:
GRADE LEVEL EXPECTATION	SE1.	<p>Develop an understanding of how scientific knowledge and technology are used in making decisions about issues, innovations, and responses to problems and everyday events.</p> <ul style="list-style-type: none"> • Teacher Resource CD: Biotechnology Techniques I - Gel Electrophoresis • Teacher Resource CD: Biotechnology Techniques II - Gene Expression
GRADE LEVEL EXPECTATION	SE2.	<p>Develop an understanding that solving problems involves different ways of thinking, perspectives, and curiosity that lead to the exploration of multiple paths that are analyzed using scientific, technological, and social merits.</p> <ul style="list-style-type: none"> • Biotechnology Techniques: Unit 1 Lab 2 Activity 2: Extracting Cellular DNA • Biotechnology Techniques: Unit 2 Lab 3 Activity 1: Using Restriction Enzymes to Cut DNA Strands • Biotechnology Techniques: Unit 2 Lab 3 Activity 2: Sorting DNA Using Gel Electrophoresis • Biotechnology Techniques: Unit 2 Lab 4 Activity 1: Determining Molecular Mass and Charge • Biotechnology Techniques: Unit 2 Lab 4 Activity 2: Identifying DNA Fragments • Biotechnology Techniques: Unit 2 Lab 5 Activity 1: Restriction Site Mapping • Biotechnology Techniques: Unit 3 Lab 6 Activity 1: Engineering Recombinant DNA Molecules • Biotechnology Techniques: Unit 3 Lab 7 Activity 1: Turning Genes On and Off • Biotechnology Techniques: Unit 4 Lab 8 Activity 1: Discover How Plasmids Transfer Genes • Biotechnology Techniques: Unit 4 Lab 8 Activity 2: The DNA Chip and Gene Expression • Teacher Resource CD: Understanding DNA
GRADE LEVEL EXPECTATION	SE3.	<p>Develop an understanding of how scientific discoveries and technological innovations affect and are affected by our lives and cultures</p> <ul style="list-style-type: none"> • Teacher Resource CD: Biotechnology Techniques I - Gel Electrophoresis • Teacher Resource CD: Biotechnology Techniques II - Gene Expression
PERFORMANCE / CONTENT	AK.SF.	Cultural, Social, Personal Perspectives and Science: A student should understand the dynamic relationships among scientific, cultural, social, and

STANDARD		personal perspectives. A student who meets the content standard should:
GRADE LEVEL EXPECTATION	SF1.	<p>Develop an understanding of the interrelationships among individuals, cultures, societies, science, and technology.</p> <ul style="list-style-type: none"> • Biotechnology Techniques: Unit 1 Lab 2 Activity 2: Extracting Cellular DNA • Biotechnology Techniques: Unit 2 Lab 3 Activity 1: Using Restriction Enzymes to Cut DNA Strands • Biotechnology Techniques: Unit 2 Lab 3 Activity 2: Sorting DNA Using Gel Electrophoresis • Biotechnology Techniques: Unit 2 Lab 4 Activity 1: Determining Molecular Mass and Charge • Biotechnology Techniques: Unit 2 Lab 4 Activity 2: Identifying DNA Fragments • Biotechnology Techniques: Unit 2 Lab 5 Activity 1: Restriction Site Mapping • Biotechnology Techniques: Unit 3 Lab 6 Activity 1: Engineering Recombinant DNA Molecules • Biotechnology Techniques: Unit 3 Lab 7 Activity 1: Turning Genes On and Off • Biotechnology Techniques: Unit 4 Lab 8 Activity 1: Discover How Plasmids Transfer Genes • Biotechnology Techniques: Unit 4 Lab 8 Activity 2: The DNA Chip and Gene Expression • Teacher Resource CD: Understanding DNA
PERFORMANCE / CONTENT STANDARD	AK.SG.	History and Nature of Science: A student should understand the history and nature of science. A student who meets the content standard should:
GRADE LEVEL EXPECTATION	SG1.	<p>Develop an understanding that historical perspectives of scientific explanations demonstrate that scientific knowledge changes over time, building on prior knowledge.</p> <ul style="list-style-type: none"> • Biotechnology Techniques: Unit 1 Lab 2 Activity 2: Extracting Cellular DNA • Biotechnology Techniques: Unit 2 Lab 3 Activity 1: Using Restriction Enzymes to Cut DNA Strands • Biotechnology Techniques: Unit 2 Lab 3 Activity 2: Sorting DNA Using Gel Electrophoresis • Biotechnology Techniques: Unit 2 Lab 4 Activity 1: Determining Molecular Mass and Charge • Biotechnology Techniques: Unit 2 Lab 4 Activity 2: Identifying DNA Fragments • Biotechnology Techniques: Unit 2 Lab 5 Activity 1: Restriction Site Mapping • Biotechnology Techniques: Unit 3 Lab 6 Activity 1: Engineering Recombinant DNA Molecules • Biotechnology Techniques: Unit 3 Lab 7 Activity 1: Turning Genes On and Off • Biotechnology Techniques: Unit 4 Lab 8 Activity 1: Discover How Plasmids Transfer Genes • Biotechnology Techniques: Unit 4 Lab 8 Activity 2: The DNA Chip and Gene Expression • Teacher Resource CD: Understanding DNA
GRADE LEVEL	SG2.	Develop an understanding that the advancement of scientific knowledge embraces

EXPECTATION		<p>innovation and requires empirical evidence, repeatable investigations, logical arguments, and critical review in striving for the best possible explanations of the natural world.</p> <ul style="list-style-type: none"> • Biotechnology Techniques: Unit 4 Lab 8 Activity 1: Discover How Plasmids Transfer Genes • Biotechnology Techniques: Unit 4 Lab 8 Activity 2: The DNA Chip and Gene Expression • Teacher Resource CD: Understanding DNA
GRADE LEVEL EXPECTATION	SG3.	<p>Develop an understanding that scientific knowledge is ongoing and subject to change as new evidence becomes available through experimental and/or observational confirmation(s).</p> <ul style="list-style-type: none"> • Teacher Resource CD: Understanding DNA
GRADE LEVEL EXPECTATION	SG4.	<p>Develop an understanding that advancements in science depend on curiosity, creativity, imagination, and a broad knowledge base.</p> <ul style="list-style-type: none"> • Teacher Resource CD: Understanding DNA

**Alaska Content Standards
Science
Grade 10**

PERFORMANCE / CONTENT STANDARD	AK.A1.	Science as Inquiry and Process (SA1, SA2, SA3)
GRADE LEVEL EXPECTATION	[10] SA1.1.	<p>The student develops an understanding of the processes of science by asking questions, predicting, observing, describing, measuring, classifying, making generalizations, analyzing data, developing models, inferring and communicating.</p> <ul style="list-style-type: none"> • Biotechnology Techniques: Unit 1 Lab 1 Activity 1: DNA Structure and Replication • Biotechnology Techniques: Unit 1 Lab 2 Activity 1: Preparing a Plant Tissue for DNA Extraction • Biotechnology Techniques: Unit 1 Lab 2 Activity 2: Extracting Cellular DNA • Biotechnology Techniques: Unit 2 Lab 3 Activity 1: Using Restriction Enzymes to Cut DNA Strands • Biotechnology Techniques: Unit 2 Lab 3 Activity 2: Sorting DNA Using Gel Electrophoresis • Biotechnology Techniques: Unit 2 Lab 4 Activity 1: Determining Molecular Mass and Charge • Biotechnology Techniques: Unit 2 Lab 4 Activity 2: Identifying DNA Fragments • Biotechnology Techniques: Unit 2 Lab 5 Activity 1: Restriction Site Mapping • Biotechnology Techniques: Unit 3 Lab 6 Activity 1: Engineering Recombinant DNA Molecules • Biotechnology Techniques: Unit 3 Lab 7 Activity 1: Turning Genes On and Off • Biotechnology Techniques: Unit 4 Lab 8 Activity 1: Discover How Plasmids Transfer Genes • Biotechnology Techniques: Unit 4 Lab 8 Activity 2: The DNA Chip and Gene Expression

		<ul style="list-style-type: none"> • Teacher Resource CD: Biotechnology Techniques I - Gel Electrophoresis • Virtual Laboratory: Restriction Enzyme Cleavage of DNA
<p>GRADE LEVEL EXPECTATION</p>	<p>[10] SA1.2.</p>	<p>The student develops an understanding of the processes of science by reviewing pertinent literature, hypothesizing, making qualitative and quantitative observations, controlling experimental variables, analyzing data statistically (i.e., mean, median, mode), and using this information to draw conclusions, compare results to others, suggest further experimentation, and apply their conclusions to other problems. (L)</p> <ul style="list-style-type: none"> • Biotechnology Techniques: Unit 1 Lab 1 Activity 1: DNA Structure and Replication • Biotechnology Techniques: Unit 1 Lab 2 Activity 1: Preparing a Plant Tissue for DNA Extraction • Biotechnology Techniques: Unit 1 Lab 2 Activity 2: Extracting Cellular DNA • Biotechnology Techniques: Unit 2 Lab 3 Activity 1: Using Restriction Enzymes to Cut DNA Strands • Biotechnology Techniques: Unit 2 Lab 3 Activity 2: Sorting DNA Using Gel Electrophoresis • Biotechnology Techniques: Unit 2 Lab 4 Activity 1: Determining Molecular Mass and Charge • Biotechnology Techniques: Unit 2 Lab 4 Activity 2: Identifying DNA Fragments • Biotechnology Techniques: Unit 2 Lab 5 Activity 1: Restriction Site Mapping • Biotechnology Techniques: Unit 3 Lab 6 Activity 1: Engineering Recombinant DNA Molecules • Biotechnology Techniques: Unit 3 Lab 7 Activity 1: Turning Genes On and Off • Biotechnology Techniques: Unit 4 Lab 8 Activity 1: Discover How Plasmids Transfer Genes • Biotechnology Techniques: Unit 4 Lab 8 Activity 2: The DNA Chip and Gene Expression • Virtual Laboratory: Restriction Enzyme Cleavage of DNA
<p>GRADE LEVEL EXPECTATION</p>	<p>[10] SA2.1.</p>	<p>The student will demonstrate an understanding of the attitudes and approaches to scientific inquiry by examining methodology and conclusions to identify bias and determining if evidence logically supports the conclusions.</p> <ul style="list-style-type: none"> • Biotechnology Techniques: Unit 1 Lab 1 Activity 1: DNA Structure and Replication • Biotechnology Techniques: Unit 1 Lab 2 Activity 1: Preparing a Plant Tissue for DNA Extraction • Biotechnology Techniques: Unit 1 Lab 2 Activity 2: Extracting Cellular DNA • Biotechnology Techniques: Unit 2 Lab 3 Activity 1: Using Restriction Enzymes to Cut DNA Strands • Biotechnology Techniques: Unit 2 Lab 3 Activity 2: Sorting DNA Using Gel Electrophoresis • Biotechnology Techniques: Unit 2 Lab 4 Activity 1: Determining Molecular Mass and Charge • Biotechnology Techniques: Unit 2 Lab 4 Activity 2: Identifying DNA Fragments • Biotechnology Techniques: Unit 2 Lab 5 Activity 1: Restriction Site

		<p>Mapping</p> <ul style="list-style-type: none"> • Biotechnology Techniques: Unit 3 Lab 6 Activity 1: Engineering Recombinant DNA Molecules • Biotechnology Techniques: Unit 3 Lab 7 Activity 1: Turning Genes On and Off • Biotechnology Techniques: Unit 4 Lab 8 Activity 1: Discover How Plasmids Transfer Genes • Biotechnology Techniques: Unit 4 Lab 8 Activity 2: The DNA Chip and Gene Expression • Virtual Laboratory: Restriction Enzyme Cleavage of DNA
PERFORMANCE / CONTENT STANDARD	AK.C.1.	Concepts of Life Science (SC1, SC2, SC3)
GRADE LEVEL EXPECTATION	[10] SC2.2.	<p>The student demonstrates an understanding of the structure, function, behavior, development, life cycles, and diversity of living organisms by explaining that cells have specialized structures in which chemical reactions occur.</p> <ul style="list-style-type: none"> • Biotechnology Techniques: Unit 1 Lab 2 Activity 1: Preparing a Plant Tissue for DNA Extraction • Biotechnology Techniques: Unit 1 Lab 2 Activity 2: Extracting Cellular DNA
PERFORMANCE / CONTENT STANDARD	AK.E.1.	Science and Technology (SE1, SE2, SE3)
GRADE LEVEL EXPECTATION	[10] SE1.1.	<p>The student demonstrates an understanding of how to integrate scientific knowledge and technology to address problems by identifying that progress in science and invention is highly interrelated to what else is happening in society.</p> <ul style="list-style-type: none"> • Biotechnology Techniques: Unit 1 Lab 2 Activity 2: Extracting Cellular DNA • Biotechnology Techniques: Unit 2 Lab 3 Activity 1: Using Restriction Enzymes to Cut DNA Strands • Biotechnology Techniques: Unit 2 Lab 3 Activity 2: Sorting DNA Using Gel Electrophoresis • Biotechnology Techniques: Unit 2 Lab 4 Activity 1: Determining Molecular Mass and Charge • Biotechnology Techniques: Unit 2 Lab 4 Activity 2: Identifying DNA Fragments • Biotechnology Techniques: Unit 2 Lab 5 Activity 1: Restriction Site Mapping • Biotechnology Techniques: Unit 3 Lab 6 Activity 1: Engineering Recombinant DNA Molecules • Biotechnology Techniques: Unit 3 Lab 7 Activity 1: Turning Genes On and Off • Biotechnology Techniques: Unit 4 Lab 8 Activity 1: Discover How Plasmids Transfer Genes • Biotechnology Techniques: Unit 4 Lab 8 Activity 2: The DNA Chip and Gene Expression • Teacher Resource CD: Biotechnology Techniques II - Gene Expression
GRADE LEVEL EXPECTATION	[10] SE2.1.	<p>The student demonstrates an understanding that solving problems involves different ways of thinking by questioning, researching, modeling, simulating, and testing multiple solutions to a problem. (L)</p>

		<ul style="list-style-type: none"> • Biotechnology Techniques: Unit 1 Lab 1 Activity 1: DNA Structure and Replication • Biotechnology Techniques: Unit 1 Lab 2 Activity 1: Preparing a Plant Tissue for DNA Extraction • Biotechnology Techniques: Unit 1 Lab 2 Activity 2: Extracting Cellular DNA • Biotechnology Techniques: Unit 2 Lab 3 Activity 1: Using Restriction Enzymes to Cut DNA Strands • Biotechnology Techniques: Unit 2 Lab 3 Activity 2: Sorting DNA Using Gel Electrophoresis • Biotechnology Techniques: Unit 2 Lab 4 Activity 1: Determining Molecular Mass and Charge • Biotechnology Techniques: Unit 2 Lab 4 Activity 2: Identifying DNA Fragments • Biotechnology Techniques: Unit 2 Lab 5 Activity 1: Restriction Site Mapping • Biotechnology Techniques: Unit 3 Lab 6 Activity 1: Engineering Recombinant DNA Molecules • Biotechnology Techniques: Unit 3 Lab 7 Activity 1: Turning Genes On and Off • Biotechnology Techniques: Unit 4 Lab 8 Activity 1: Discover How Plasmids Transfer Genes • Biotechnology Techniques: Unit 4 Lab 8 Activity 2: The DNA Chip and Gene Expression • Virtual Laboratory: Restriction Enzyme Cleavage of DNA
GRADE LEVEL EXPECTATION	[10] SE3.1.	<p>The student demonstrates an understanding of how scientific discoveries and technological innovations affect our lives and society by researching a current problem, identifying possible solutions, and evaluating the impact of each solution. (L)</p> <ul style="list-style-type: none"> • Teacher Resource CD: Biotechnology Techniques I - Gel Electrophoresis • Teacher Resource CD: Biotechnology Techniques II - Gene Expression
PERFORMANCE / CONTENT STANDARD	AK.G1.	History and Nature of Science (SG1, SG2, SG3, SG4)
GRADE LEVEL EXPECTATION	[10] SG2.1.	<p>The student demonstrates an understanding of the bases of the advancement of scientific knowledge by using an account of an event to recognize the processes of science used by historically significant scientists (e.g., Goodall, Watson & Crick, Newton).</p> <ul style="list-style-type: none"> • Teacher Resource CD: Understanding DNA
GRADE LEVEL EXPECTATION	[10] SG4.1.	<p>The student will demonstrate an understanding that advancements in science depend on curiosity, creativity, imagination, and a broad knowledge base by recognizing the role of these factors on scientific advancements.</p> <ul style="list-style-type: none"> • Teacher Resource CD: Understanding DNA
PERFORMANCE / CONTENT STANDARD	AK.SA.	Science as Inquiry and Process: A student should understand and be able to apply the processes and applications of scientific inquiry. A student who meets the content standard should:
GRADE LEVEL EXPECTATION	SA1.	Develop an understanding of the processes of science used to investigate problems, design and conduct repeatable scientific investigations, and defend scientific

		<p>arguments.</p> <ul style="list-style-type: none"> • Biotechnology Techniques: Unit 1 Lab 1 Activity 1: DNA Structure and Replication • Biotechnology Techniques: Unit 1 Lab 2 Activity 1: Preparing a Plant Tissue for DNA Extraction • Biotechnology Techniques: Unit 1 Lab 2 Activity 2: Extracting Cellular DNA • Biotechnology Techniques: Unit 2 Lab 3 Activity 1: Using Restriction Enzymes to Cut DNA Strands • Biotechnology Techniques: Unit 2 Lab 3 Activity 2: Sorting DNA Using Gel Electrophoresis • Biotechnology Techniques: Unit 2 Lab 4 Activity 1: Determining Molecular Mass and Charge • Biotechnology Techniques: Unit 2 Lab 4 Activity 2: Identifying DNA Fragments • Biotechnology Techniques: Unit 2 Lab 5 Activity 1: Restriction Site Mapping • Biotechnology Techniques: Unit 3 Lab 6 Activity 1: Engineering Recombinant DNA Molecules • Biotechnology Techniques: Unit 3 Lab 7 Activity 1: Turning Genes On and Off • Biotechnology Techniques: Unit 4 Lab 8 Activity 1: Discover How Plasmids Transfer Genes • Biotechnology Techniques: Unit 4 Lab 8 Activity 2: The DNA Chip and Gene Expression • Virtual Laboratory: Restriction Enzyme Cleavage of DNA
GRADE LEVEL EXPECTATION	SA2.	<p>Develop an understanding that the processes of science require integrity, logical reasoning, skepticism, openness, communication, and peer review.</p> <ul style="list-style-type: none"> • Biotechnology Techniques: Unit 4 Lab 8 Activity 1: Discover How Plasmids Transfer Genes • Biotechnology Techniques: Unit 4 Lab 8 Activity 2: The DNA Chip and Gene Expression
PERFORMANCE / CONTENT STANDARD	AK.SC.	<p>Concepts of Life Science: A student should understand and be able to apply the concepts, models, theories, facts, evidence, systems, and processes of life science. A student who meets the content standard should:</p>
GRADE LEVEL EXPECTATION	SC1.	<p>Develop an understanding of how science explains changes in life forms over time, including genetics, heredity, the process of natural selection, and biological evolution.</p> <ul style="list-style-type: none"> • Biotechnology Techniques: Unit 1 Lab 1 Activity 1: DNA Structure and Replication • Biotechnology Techniques: Unit 1 Lab 2 Activity 1: Preparing a Plant Tissue for DNA Extraction • Biotechnology Techniques: Unit 1 Lab 2 Activity 2: Extracting Cellular DNA • Biotechnology Techniques: Unit 2 Lab 3 Activity 1: Using Restriction Enzymes to Cut DNA Strands • Biotechnology Techniques: Unit 2 Lab 3 Activity 2: Sorting DNA Using Gel Electrophoresis • Biotechnology Techniques: Unit 2 Lab 4 Activity 1: Determining Molecular Mass and Charge • Biotechnology Techniques: Unit 2 Lab 4 Activity 2: Identifying DNA

		<p>Fragments</p> <ul style="list-style-type: none"> • Biotechnology Techniques: Unit 2 Lab 5 Activity 1: Restriction Site Mapping • Biotechnology Techniques: Unit 3 Lab 6 Activity 1: Engineering Recombinant DNA Molecules • Biotechnology Techniques: Unit 3 Lab 7 Activity 1: Turning Genes On and Off • Biotechnology Techniques: Unit 4 Lab 8 Activity 1: Discover How Plasmids Transfer Genes • Biotechnology Techniques: Unit 4 Lab 8 Activity 2: The DNA Chip and Gene Expression • Teacher Resource CD: Biotechnology Techniques II - Gene Expression • Teacher Resource CD: Understanding DNA
GRADE LEVEL EXPECTATION	SC2.	<p>Develop an understanding of the structure, function, behavior, development, life cycles, and diversity of living organisms.</p> <ul style="list-style-type: none"> • Biotechnology Techniques: Unit 3 Lab 7 Activity 1: Turning Genes On and Off
GRADE LEVEL EXPECTATION	SC3.	<p>Develop an understanding that all organisms are linked to each other and their physical environments through the transfer and transformation of matter and energy.</p> <ul style="list-style-type: none"> • Biotechnology Techniques: Unit 2 Lab 3 Activity 1: Using Restriction Enzymes to Cut DNA Strands • Biotechnology Techniques: Unit 2 Lab 3 Activity 2: Sorting DNA Using Gel Electrophoresis • Biotechnology Techniques: Unit 2 Lab 5 Activity 1: Restriction Site Mapping
PERFORMANCE / CONTENT STANDARD	AK.SE.	<p>Science and Technology: A student should understand the relationships among science, technology, and society. A student who meets the content standard should:</p>
GRADE LEVEL EXPECTATION	SE1.	<p>Develop an understanding of how scientific knowledge and technology are used in making decisions about issues, innovations, and responses to problems and everyday events.</p> <ul style="list-style-type: none"> • Teacher Resource CD: Biotechnology Techniques I - Gel Electrophoresis • Teacher Resource CD: Biotechnology Techniques II - Gene Expression
GRADE LEVEL EXPECTATION	SE2.	<p>Develop an understanding that solving problems involves different ways of thinking, perspectives, and curiosity that lead to the exploration of multiple paths that are analyzed using scientific, technological, and social merits.</p> <ul style="list-style-type: none"> • Biotechnology Techniques: Unit 1 Lab 2 Activity 2: Extracting Cellular DNA • Biotechnology Techniques: Unit 2 Lab 3 Activity 1: Using Restriction Enzymes to Cut DNA Strands • Biotechnology Techniques: Unit 2 Lab 3 Activity 2: Sorting DNA Using Gel Electrophoresis • Biotechnology Techniques: Unit 2 Lab 4 Activity 1: Determining Molecular Mass and Charge • Biotechnology Techniques: Unit 2 Lab 4 Activity 2: Identifying DNA

		<p>Fragments</p> <ul style="list-style-type: none"> • Biotechnology Techniques: Unit 2 Lab 5 Activity 1: Restriction Site Mapping • Biotechnology Techniques: Unit 3 Lab 6 Activity 1: Engineering Recombinant DNA Molecules • Biotechnology Techniques: Unit 3 Lab 7 Activity 1: Turning Genes On and Off • Biotechnology Techniques: Unit 4 Lab 8 Activity 1: Discover How Plasmids Transfer Genes • Biotechnology Techniques: Unit 4 Lab 8 Activity 2: The DNA Chip and Gene Expression • Teacher Resource CD: Understanding DNA
GRADE LEVEL EXPECTATION	SE3.	<p>Develop an understanding of how scientific discoveries and technological innovations affect and are affected by our lives and cultures</p> <ul style="list-style-type: none"> • Teacher Resource CD: Biotechnology Techniques I - Gel Electrophoresis • Teacher Resource CD: Biotechnology Techniques II - Gene Expression
PERFORMANCE / CONTENT STANDARD	AK.SF.	<p>Cultural, Social, Personal Perspectives and Science: A student should understand the dynamic relationships among scientific, cultural, social, and personal perspectives. A student who meets the content standard should:</p>
GRADE LEVEL EXPECTATION	SF1.	<p>Develop an understanding of the interrelationships among individuals, cultures, societies, science, and technology.</p> <ul style="list-style-type: none"> • Biotechnology Techniques: Unit 1 Lab 2 Activity 2: Extracting Cellular DNA • Biotechnology Techniques: Unit 2 Lab 3 Activity 1: Using Restriction Enzymes to Cut DNA Strands • Biotechnology Techniques: Unit 2 Lab 3 Activity 2: Sorting DNA Using Gel Electrophoresis • Biotechnology Techniques: Unit 2 Lab 4 Activity 1: Determining Molecular Mass and Charge • Biotechnology Techniques: Unit 2 Lab 4 Activity 2: Identifying DNA Fragments • Biotechnology Techniques: Unit 2 Lab 5 Activity 1: Restriction Site Mapping • Biotechnology Techniques: Unit 3 Lab 6 Activity 1: Engineering Recombinant DNA Molecules • Biotechnology Techniques: Unit 3 Lab 7 Activity 1: Turning Genes On and Off • Biotechnology Techniques: Unit 4 Lab 8 Activity 1: Discover How Plasmids Transfer Genes • Biotechnology Techniques: Unit 4 Lab 8 Activity 2: The DNA Chip and Gene Expression • Teacher Resource CD: Understanding DNA
PERFORMANCE / CONTENT STANDARD	AK.SG.	<p>History and Nature of Science: A student should understand the history and nature of science. A student who meets the content standard should:</p>
GRADE LEVEL EXPECTATION	SG1.	<p>Develop an understanding that historical perspectives of scientific explanations demonstrate that scientific knowledge changes over time, building on prior knowledge.</p> <ul style="list-style-type: none"> • Biotechnology Techniques: Unit 1 Lab 2 Activity 2: Extracting Cellular

		<p>DNA</p> <ul style="list-style-type: none"> • Biotechnology Techniques: Unit 2 Lab 3 Activity 1: Using Restriction Enzymes to Cut DNA Strands • Biotechnology Techniques: Unit 2 Lab 3 Activity 2: Sorting DNA Using Gel Electrophoresis • Biotechnology Techniques: Unit 2 Lab 4 Activity 1: Determining Molecular Mass and Charge • Biotechnology Techniques: Unit 2 Lab 4 Activity 2: Identifying DNA Fragments • Biotechnology Techniques: Unit 2 Lab 5 Activity 1: Restriction Site Mapping • Biotechnology Techniques: Unit 3 Lab 6 Activity 1: Engineering Recombinant DNA Molecules • Biotechnology Techniques: Unit 3 Lab 7 Activity 1: Turning Genes On and Off • Biotechnology Techniques: Unit 4 Lab 8 Activity 1: Discover How Plasmids Transfer Genes • Biotechnology Techniques: Unit 4 Lab 8 Activity 2: The DNA Chip and Gene Expression • Teacher Resource CD: Understanding DNA
GRADE LEVEL EXPECTATION	SG2.	<p>Develop an understanding that the advancement of scientific knowledge embraces innovation and requires empirical evidence, repeatable investigations, logical arguments, and critical review in striving for the best possible explanations of the natural world.</p> <ul style="list-style-type: none"> • Biotechnology Techniques: Unit 4 Lab 8 Activity 1: Discover How Plasmids Transfer Genes • Biotechnology Techniques: Unit 4 Lab 8 Activity 2: The DNA Chip and Gene Expression • Teacher Resource CD: Understanding DNA
GRADE LEVEL EXPECTATION	SG3.	<p>Develop an understanding that scientific knowledge is ongoing and subject to change as new evidence becomes available through experimental and/or observational confirmation(s).</p> <ul style="list-style-type: none"> • Teacher Resource CD: Understanding DNA
GRADE LEVEL EXPECTATION	SG4.	<p>Develop an understanding that advancements in science depend on curiosity, creativity, imagination, and a broad knowledge base.</p> <ul style="list-style-type: none"> • Teacher Resource CD: Understanding DNA