

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

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Maryland Content Standards
Science
Grade 7

| STRAND / STANDARD | MD.1.O. | Skills and Processes: Students will demonstrate the thinking and acting inherent in the practice of science. |
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| TOPIC | 1.A.1. | Constructing Knowledge: Design, analyze, or carry out simple investigations and formulate appropriate conclusions based on data obtained or provided. |
| INDICATOR | 1.A.1.a. | <p>Explain that scientists differ greatly in what phenomena they study and how they go about their work.</p> <ul style="list-style-type: none"> • Teacher Resource CD: Understanding DNA |
| INDICATOR | 1.A.1.b. | <p>Develop the ability to clarify questions and direct them toward objects and phenomena that can be described, explained, or predicted by scientific investigations.</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 |
| INDICATOR | 1.A.1.c. | <p>Explain and provide examples that all hypotheses are valuable, even if they turn out not to be true, if they lead to fruitful investigations.</p> <ul style="list-style-type: none"> • Biotechnology Techniques: Unit 1 Lab 1 Activity 1: DNA Structure and Replication |

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| | | <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 |
| INDICATOR | 1.A.1.h. | <p>Use mathematics to interpret and communicate data.</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 4 Lab 8 Activity 1: Discover How Plasmids Transfer Genes |
| STRAND / STANDARD | MD.1.0. | Skills and Processes: Students will demonstrate the thinking and acting inherent in the practice of science. |
| TOPIC | 1.B.1. | Applying Evidence and Reasoning: Review data from a simple experiment, summarize the data, and construct a logical argument about the cause-and-effect relationships in the experiment. |
| INDICATOR | 1.B.1.a. | <p>Verify the idea that there is no fixed set of steps all scientists follow, scientific investigations usually involve the collection of relevant evidence, the use of logical reasoning, and the application of imagination in devising hypotheses and explanations to make sense of the collected 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 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 |

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| | | <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 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 |
| INDICATOR | 1.B.1.b. | <p>Explain that what people expect to observe often affects what they actually do observe and that scientists know about this danger to objectivity and take steps to try to avoid it when designing investigations and examining data.</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 |
| INDICATOR | 1.B.1.d. | <p>Describe the reasoning that lead to the interpretation of data and conclusions drawn.</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 |

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| STRAND / STANDARD | MD.1.O. | Skills and Processes: Students will demonstrate the thinking and acting inherent in the practice of science. |
| TOPIC | 1.C.1. | Communicating Scientific Information: Develop explanations that explicitly link data from investigations conducted, selected readings and, when appropriate, contributions from historical discoveries. |
| INDICATOR | 1.C.1.a. | <p>Organize and present data in tables and graphs and identify relationships they reveal.</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 |
| INDICATOR | 1.C.1.b. | <p>Interpret tables and graphs produced by others and describe in words the relationships they show.</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 |
| INDICATOR | 1.C.1.e. | <p>Explain how different models can be used to represent the same thing. What kind of a model to use and how complex it should be depend on its purpose. Choosing a useful model is one of the instances in which intuition and creativity come into play in science, mathematics, and engineering</p> <ul style="list-style-type: none"> • Biotechnology Techniques: Unit 1 Lab 1 Activity 1: DNA Structure and Replication • 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 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 |
| INDICATOR | 1.C.1.f. | Participate in group discussions on scientific topics by restating or summarizing accurately what |

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| | | <p>others have said, asking for clarification or elaboration, and expressing alternative positions.</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 |
| INDICATOR | 1.C.1.g. | <p>Recognize that important contributions to the advancement of science, mathematics, and technology have been made by different kinds of people, in different cultures, at different times.</p> <ul style="list-style-type: none"> • Teacher Resource CD: Understanding DNA |
| STRAND / STANDARD | MD.1.0. | Skills and Processes: Students will demonstrate the thinking and acting inherent in the practice of science. |
| TOPIC | 1.D.1. | Technology: Explain that complex systems require control mechanisms. |
| INDICATOR | 1.D.1.a. | <p>Explain that the choice of materials for a job depends on their properties and on how they interact with other materials.</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 |

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| | | <ul style="list-style-type: none"> • 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 |
| INDICATOR | 1.D.1.b. | <p>Demonstrate that all control systems have inputs, outputs, and feedback.</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 |
| INDICATOR | 1.D.1.c. | <p>Realize that design usually requires taking constraints into account. (Some constraints, such as gravity or the properties of the materials to be used, are unavoidable. Other constraints, including economic, political, social, ethical, and aesthetic ones also limit choices.)</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 |
| INDICATOR | 1.D.1.d. | <p>Identify reasons that systems fail-they have faulty or poorly matched parts, are used in ways that exceed what was intended by the design, or were poorly designed to begin with.</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 |
| STRAND / STANDARD | MD.1.0. | Skills and Processes: Students will demonstrate the thinking and acting inherent in the practice of science. |
| TOPIC | 1.D.2. | Technology: Analyze, design, assemble and troubleshoot complex systems. |
| INDICATOR | 1.D.2.b. | <p>Explain that thinking about things as systems means looking for how every part relates to others. (The output from one part of a system (which can include material, energy, or information) can become the input to other parts. Such feedback can serve to control what goes on in the system as a whole.)</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 |
| INDICATOR | 1.D.2.c. | <p>Analyze any system to determine its connection, both internally and externally to other systems and explain that a system may be thought of as containing subsystems and as being a subsystem of a larger system.</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 |
| STRAND / STANDARD | MD.1.0. | Skills and Processes: Students will demonstrate the thinking and acting inherent in the practice of science. |
| TOPIC | 1.D.3. | Technology: Analyze the value and the limitations of different types of models in |

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| | | explaining real things and processes. |
| INDICATOR | 1.D.3.a. | <p>Explain that the kind of model to use and how complex it should be depends on its purpose and that it is possible to have different models used to represent the same thing.</p> <ul style="list-style-type: none"> • Biotechnology Techniques: Unit 1 Lab 1 Activity 1: DNA Structure and Replication • 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 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 |
| INDICATOR | 1.D.3.b. | <p>Explain, using examples that models are often used to think about processes that happen too slowly, too quickly, or on too small a scale to observe directly, or that are too vast to be changed deliberately, or that are potentially dangerous.</p> <ul style="list-style-type: none"> • Biotechnology Techniques: Unit 1 Lab 1 Activity 1: DNA Structure and Replication • 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 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 |
| INDICATOR | 1.D.3.c. | <p>Explain that models may sometimes mislead by suggesting characteristics that are not really shared with what is being modeled.</p> <ul style="list-style-type: none"> • Biotechnology Techniques: Unit 1 Lab 1 Activity 1: DNA Structure and Replication • 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 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 |
| STRAND / STANDARD | MD.3.0. | Life Science: The students will use scientific skills and processes to explain the dynamic nature of living things, their interactions, and the results from the interactions that occur over time. |
| TOPIC | 3.B.1. | Cells: Gather and organize data to defend or argue the proposition that all living things are cellular (composed of cells) and that cells carry out the basic life functions. |
| INDICATOR | 3.B.1.a. | Use microscopes or other magnifying instruments to observe, describe, and compare the cellular |

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| | | <p>composition of different body tissues and organs in a variety of organisms (animals and plants).</p> <ul style="list-style-type: none"> • Biotechnology Techniques: Unit 4 Lab 8 Activity 1: Discover How Plasmids Transfer Genes |
| INDICATOR | 3.B.1.d. | <p>Collect data from investigations using single celled organisms, such as yeast or algae to explain that a single cell carries out all the basic life functions of a multicellular organism: Reproducing; Extracting energy from food; Getting rid of wastes.</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 |
| INDICATOR | 3.B.1.e. | <p>Based on data compiled from a number of lessons completed, take and defend a position on the statement 'The way in which cells function is the same in all organisms.'</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 |
| STRAND / STANDARD | MD.3.O. | Life Science: The students will use scientific skills and processes to explain the dynamic nature of living things, their interactions, and the results from the interactions that occur over time. |
| TOPIC | 3.C.1. | Genetics: Explain the ways that genetic information is passed from parent to offspring in different organisms. |
| INDICATOR | 3.C.1.d. | <p>Use information about how the transfer of traits from parent or parents to offspring occurs, to explain how selective breeding for particular traits has resulted in new varieties of cultivated plants and domestic animals.</p> <ul style="list-style-type: none"> • Biotechnology Techniques: Unit 3 Lab 6 Activity 1: Engineering Recombinant DNA Molecules • Teacher Resource CD: Biotechnology Techniques I - Gel Electrophoresis • Teacher Resource CD: Biotechnology Techniques II - Gene Expression |
| STRAND / STANDARD | MD.4.O. | Chemistry: Students will use scientific skills and processes to explain the composition, structure, and interactions of matter in order to support the predictability of structure and energy transformations. |
| TOPIC | 4.A.1. | Structure of Matter: Cite evidence to support the fact that all matter is made up of |

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| | | atoms, which are far too small to see directly through a microscope. |
| INDICATOR | 4.A.1.b. | Recognize and describe that different arrangements of atoms into groups compose all substances. <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 |
| STRAND / STANDARD | MD.6.O. | Environmental Science: Students will use scientific skills and processes to explain the interactions of environmental factors (living and non-living) and analyze their impact from a local to a global perspective. |
| TOPIC | 6.B.1. | Environmental Issues: Recognize and describe that environmental changes can have local, regional, and global consequences. |
| INDICATOR | 6.B.1.a. | Identify and describe a local, regional, or global environmental issue. <ul style="list-style-type: none"> • Teacher Resource CD: Biotechnology Techniques II - Gene Expression |
| INDICATOR | 6.B.1.b. | Identify and describe that different individuals or groups are affected by an issue in different ways. <ul style="list-style-type: none"> • Teacher Resource CD: Biotechnology Techniques II - Gene Expression |

**Maryland Content Standards
Science
Grade 8**

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| STRAND / STANDARD | MD.1.O. | Skills and Processes: Students will demonstrate the thinking and acting inherent in the practice of science. |
| TOPIC | 1.A.1. | Constructing Knowledge: Design, analyze, or carry out simple investigations and formulate appropriate conclusions based on data obtained or provided. |
| INDICATOR | 1.A.1.a. | Explain that scientists differ greatly in what phenomena they study and how they go about their work. <ul style="list-style-type: none"> • Teacher Resource CD: Understanding DNA |
| INDICATOR | 1.A.1.b. | Develop the ability to clarify questions and direct them toward objects and phenomena that can be described, explained, or predicted by scientific investigations. <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 |

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| INDICATOR | 1.A.1.c. | <p>Explain and provide examples that all hypotheses are valuable, even if they turn out not to be true, if they lead to fruitful investigations.</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 |
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| | | <p>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 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 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 |
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| | | <ul style="list-style-type: none"> • Biotechnology Techniques: Unit 1 Lab 1 Activity 1: DNA Structure and Replication • 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 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 |
| INDICATOR | 1.C.1.f. | <p>Participate in group discussions on scientific topics by restating or summarizing accurately what others have said, asking for clarification or elaboration, and expressing alternative positions.</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 |
| INDICATOR | 1.C.1.g. | <p>Recognize that important contributions to the advancement of science, mathematics, and technology have been made by different kinds of people, in different cultures, at different times.</p> <ul style="list-style-type: none"> • Teacher Resource CD: Understanding DNA |
| STRAND / STANDARD | MD.1.O. | Skills and Processes: Students will demonstrate the thinking and acting inherent in the practice of science. |
| TOPIC | 1.D.1. | Technology: Explain that complex systems require control mechanisms. |
| INDICATOR | 1.D.1.a. | <p>Explain that the choice of materials for a job depends on their properties and on how they interact with other materials.</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 |

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| | | <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 |
| INDICATOR | 1.D.1.b. | <p>Demonstrate that all control systems have inputs, outputs, and feedback.</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 |
| INDICATOR | 1.D.1.c. | <p>Realize that design usually requires taking constraints into account. (Some constraints, such as gravity or the properties of the materials to be used, are unavoidable. Other constraints, including economic, political, social, ethical, and aesthetic ones also limit choices.)</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 |
| INDICATOR | 1.D.1.d. | <p>Identify reasons that systems fail-they have faulty or poorly matched parts, are used in ways that exceed what was intended by the design, or were poorly designed to begin with.</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 |
| STRAND / STANDARD | MD.1.0. | Skills and Processes: Students will demonstrate the thinking and acting inherent in the practice of science. |
| TOPIC | 1.D.2. | Technology: Analyze, design, assemble and troubleshoot complex systems. |
| INDICATOR | 1.D.2.b. | <p>Explain that thinking about things as systems means looking for how every part relates to others. (The output from one part of a system (which can include material, energy, or information) can become the input to other parts. Such feedback can serve to control what goes on in the system as a whole.)</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 |

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| | | Gene Expression |
| INDICATOR | 1.D.2.c. | Analyze any system to determine its connection, both internally and externally to other systems and explain that a system may be thought of as containing subsystems and as being a subsystem of a larger system. <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 |
| STRAND / STANDARD | MD.1.0. | Skills and Processes: Students will demonstrate the thinking and acting inherent in the practice of science. |
| TOPIC | 1.D.3. | Technology: Analyze the value and the limitations of different types of models in explaining real things and processes. |
| INDICATOR | 1.D.3.a. | Explain that the kind of model to use and how complex it should be depends on its purpose and that it is possible to have different models used to represent the same thing. <ul style="list-style-type: none"> • Biotechnology Techniques: Unit 1 Lab 1 Activity 1: DNA Structure and Replication • 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 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 |
| INDICATOR | 1.D.3.b. | Explain, using examples that models are often used to think about processes that happen too slowly, too quickly, or on too small a scale to observe directly, or that are too vast to be changed deliberately, or that are potentially dangerous. <ul style="list-style-type: none"> • Biotechnology Techniques: Unit 1 Lab 1 Activity 1: DNA Structure and Replication • 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 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 |
| INDICATOR | 1.D.3.c. | Explain that models may sometimes mislead by suggesting characteristics that are not really shared with what is being modeled. <ul style="list-style-type: none"> • Biotechnology Techniques: Unit 1 Lab 1 Activity 1: DNA Structure and Replication • 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 |

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| | | <p>Electrophoresis</p> <ul style="list-style-type: none"> • 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 |
| STRAND / STANDARD | MD.4.0. | Chemistry: Students will use scientific skills and processes to explain the composition, structure, and interactions of matter in order to support the predictability of structure and energy transformations. |
| TOPIC | 4.A.1. | Structure of Matter: Provide evidence to explain how compounds are produced. (No electron transfer) |
| INDICATOR | 4.A.1.a. | <p>Describe how elements form compounds and molecules.</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 |

Maryland Content Standards

Science

Grade 9

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| STRAND / STANDARD | MD.1. | Skills And Processes: The student will demonstrate ways of thinking and acting inherent in the practice of science. The student will use the language and instruments of science to collect, organize, interpret, calculate, and communicate information. |
| TOPIC | 1.1. | The student will explain why curiosity, honesty, openness, and skepticism are highly regarded in science. |
| INDICATOR | 1.1.1. | <p>The student will recognize that real problems have more than one solution and decisions to accept one solution over another are made on the basis of many issues.</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 |
| STRAND / STANDARD | MD.1. | Skills And Processes: The student will demonstrate ways of thinking and acting inherent in the practice of science. The student will use the language and instruments of science to collect, organize, interpret, calculate, and communicate information. |
| TOPIC | 1.2. | The student will pose scientific questions and suggest investigative approaches to provide |

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| | | answers to questions. |
| INDICATOR | 1.2.1. | <p>The student will identify meaningful, answerable scientific questions.</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 |
| INDICATOR | 1.2.2. | <p>The student will pose meaningful, answerable scientific questions. (NTB)</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 |
| INDICATOR | 1.2.4. | <p>The student will test a working hypothesis. (NTB)</p> |

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| | | <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 |
| INDICATOR | 1.2.5. | <p>The student will select appropriate instruments and materials to conduct an investigation.</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 |
| INDICATOR | 1.2.6. | <p>The student will identify appropriate methods for conducting an investigation (independent and dependent variables, proper controls, repeat trials, appropriate sample size, etc.).</p> <ul style="list-style-type: none"> • Biotechnology Techniques: Unit 4 Lab 8 Activity 1: Discover How Plasmids |

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| | | Transfer Genes |
| STRAND / STANDARD | MD.1. | Skills And Processes: The student will demonstrate ways of thinking and acting inherent in the practice of science. The student will use the language and instruments of science to collect, organize, interpret, calculate, and communicate information. |
| TOPIC | 1.3. | The student will carry out scientific investigations effectively and employ the instruments, systems of measurement, and materials of science appropriately. |
| INDICATOR | 1.3.1. | <p>The student will develop and demonstrate skills in using lab and field equipment to perform investigative techniques. (NTB)</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 |
| INDICATOR | 1.3.2. | <p>The student will recognize safe laboratory procedures.</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 |

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| | | <ul style="list-style-type: none"> • Biotechnology Techniques: Unit 4 Lab 8 Activity 2: The DNA Chip and Gene Expression |
| INDICATOR | 1.3.3. | <p>The student will demonstrate safe handling of the chemicals and materials of science. (NTB)</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 |
| INDICATOR | 1.3.4. | <p>The student will learn the use of new instruments and equipment by following instructions in a manual or from oral direction. (NTB)</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 |

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| STRAND / STANDARD | MD.1. | Skills And Processes: The student will demonstrate ways of thinking and acting inherent in the practice of science. The student will use the language and instruments of science to collect, organize, interpret, calculate, and communicate information. |
| TOPIC | 1.4. | The student will demonstrate that data analysis is a vital aspect of the process of scientific inquiry and communication. |
| INDICATOR | 1.4.1. | <p>The student will organize data appropriately using techniques such as tables, graphs, and webs (for graphs: axes labeled with appropriate quantities, appropriate units on axes, axes labeled with appropriate intervals, independent and dependent variables on correct axes, appropriate title).</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 |
| INDICATOR | 1.4.2. | <p>The student will analyze data to make predictions, decisions, or draw 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 |
| INDICATOR | 1.4.4. | <p>The student will determine the relationships between quantities and develop the mathematical model that describes these relationships.</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 |

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| | | <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 • Virtual Laboratory: Restriction Enzyme Cleavage of DNA |
| INDICATOR | 1.4.5. | <p>The student will check graphs to determine that they do not misrepresent results.</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 |
| INDICATOR | 1.4.6. | <p>The student will describe trends revealed by data.</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 |

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| | | <p>DNA Molecules</p> <ul style="list-style-type: none"> • 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 |
| INDICATOR | 1.4.8. | <p>The student will use models and computer simulations to extend his/her understanding of scientific concepts. (NTB)</p> <ul style="list-style-type: none"> • Biotechnology Techniques: Unit 1 Lab 1 Activity 1: DNA Structure and Replication • 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 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 |
| STRAND / STANDARD | MD.1. | <p>Skills And Processes: The student will demonstrate ways of thinking and acting inherent in the practice of science. The student will use the language and instruments of science to collect, organize, interpret, calculate, and communicate information.</p> |
| TOPIC | 1.5. | <p>The student will use appropriate methods for communicating in writing and orally the processes and results of scientific investigation.</p> |
| INDICATOR | 1.5.1. | <p>The student will demonstrate the ability to summarize data (measurements/observations).</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 |

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| INDICATOR | 1.5.2. | <p>The student will explain scientific concepts and processes through drawing, writing, and/or oral communication.</p> <ul style="list-style-type: none"> • Biotechnology Techniques: Unit 2 Lab 4 Activity 2: Identifying DNA Fragments • Biotechnology Techniques: Unit 2 Lab 5 Activity 1: Restriction Site Mapping |
| INDICATOR | 1.5.3. | <p>The student will use computers and/or graphing calculators to produce the visual materials (tables, graphs, and spreadsheets) that will be used for communicating results. (NTB)</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 |
| INDICATOR | 1.5.4. | <p>The student will use tables, graphs, and displays to support arguments and claims in both written and oral communication.</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 |
| INDICATOR | 1.5.5. | <p>The student will create and/or interpret graphics. (scale drawings, photographs, digital images, field of view, etc.)</p> <ul style="list-style-type: none"> • Biotechnology Techniques: Unit 2 Lab 4 Activity 2: Identifying DNA Fragments • Biotechnology Techniques: Unit 2 Lab 5 Activity 1: Restriction Site Mapping |
| INDICATOR | 1.5.7. | <p>The student will use, explain, and/or construct various classification systems.</p> <ul style="list-style-type: none"> • Teacher Resource CD: Biotechnology Techniques I - Gel Electrophoresis |
| INDICATOR | 1.5.8. | <p>The student will describe similarities and differences when explaining concepts and/or principles.</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 |

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| | | <ul style="list-style-type: none"> • 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 |
| INDICATOR | 1.5.9. | <p>The student will communicate conclusions derived through a synthesis of ideas.</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 |
| STRAND / STANDARD | MD.1. | Skills And Processes: The student will demonstrate ways of thinking and acting inherent in the practice of science. The student will use the language and instruments of science to collect, organize, interpret, calculate, and communicate information. |
| TOPIC | 1.6. | The student will use mathematical processes. |
| INDICATOR | 1.6.1. | <p>The student will use ratio and proportion in appropriate situations to solve problems.</p> <ul style="list-style-type: none"> • Biotechnology Techniques: Unit 2 Lab 4 Activity 2: Identifying DNA Fragments • Biotechnology Techniques: Unit 2 Lab 5 Activity 1: Restriction Site Mapping |
| INDICATOR | 1.6.4. | <p>The student will manipulate quantities and/or numerical values in algebraic equations.</p> <ul style="list-style-type: none"> • Biotechnology Techniques: Unit 4 Lab 8 Activity 1: Discover How Plasmids Transfer Genes |
| STRAND / STANDARD | MD.1. | Skills And Processes: The student will demonstrate ways of thinking and acting inherent in the practice of science. The student will use the language and instruments of science to collect, organize, interpret, calculate, and communicate information. |
| TOPIC | 1.7. | The student will show that connections exist both within the various fields of science and among science and other disciplines including mathematics, social studies, language arts, fine arts, and technology. |
| INDICATOR | 1.7.1. | The student will apply the skills, processes, and concepts of biology, chemistry, physics, or earth science to societal issues. |

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| | | <ul style="list-style-type: none"> Teacher Resource CD: Biotechnology Techniques II - Gene Expression |
| INDICATOR | 1.7.2. | <p>The student will identify and evaluate the impact of scientific ideas and/or advancements in technology on society.</p> <ul style="list-style-type: none"> Teacher Resource CD: Biotechnology Techniques I - Gel Electrophoresis Teacher Resource CD: Biotechnology Techniques II - Gene Expression Teacher Resource CD: Understanding DNA |
| INDICATOR | 1.7.6. | <p>The student will explain how development of scientific knowledge leads to the creation of new technology and how technological advances allow for additional scientific accomplishments.</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 |
| STRAND / STANDARD | MD.2. | <p>Concepts Of Earth/Space Science: The student will demonstrate the ability to use scientific skills and processes (Core Learning Goal 1) to explain the physical behavior of the environment, Earth, and the universe.</p> |
| TOPIC | 2.1. | <p>The student will identify and describe techniques used to investigate the universe and Earth.</p> |
| INDICATOR | 2.1.1. | <p>The student will describe the purpose and advantage of current tools, delivery systems and techniques used to study the universe.</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 |
| STRAND / STANDARD | MD.3. | <p>Concepts Of Biology: The student will demonstrate the ability to use scientific skills and processes (Core Learning Goal 1) and major biological concepts to explain the uniqueness and interdependence of living organisms, their interactions with the environment, and the continuation of life on earth.</p> |
| TOPIC | 3.1. | <p>The student will be able to explain the correlation between the structure and function of biologically important molecules and their relationship to cell processes.</p> |
| INDICATOR | 3.1.1. | <p>The student will be able to describe the unique characteristics of chemical substances and macromolecules utilized by living systems.</p> <ul style="list-style-type: none"> Biotechnology Techniques: Unit 1 Lab 1 Activity 1: DNA Structure and |

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| | | <p>Replication</p> <ul style="list-style-type: none"> • Biotechnology Techniques: Unit 1 Lab 2 Activity 2: Extracting Cellular DNA • Teacher Resource CD: Biotechnology Techniques II - Gene Expression • Teacher Resource CD: Understanding DNA |
| STRAND / STANDARD | MD.3. | Concepts Of Biology: The student will demonstrate the ability to use scientific skills and processes (Core Learning Goal 1) and major biological concepts to explain the uniqueness and interdependence of living organisms, their interactions with the environment, and the continuation of life on earth. |
| TOPIC | 3.2. | The student will demonstrate an understanding that all organisms are composed of cells which can function independently or as part of multicellular organisms. |
| INDICATOR | 3.2.2. | <p>The student will conclude that cells exist within a narrow range of environmental conditions and changes to that environment, either naturally occurring or induced, may cause changes in the metabolic activity of the cell or organism.</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 |
| STRAND / STANDARD | MD.3. | Concepts Of Biology: The student will demonstrate the ability to use scientific skills and processes (Core Learning Goal 1) and major biological concepts to explain the uniqueness and interdependence of living organisms, their interactions with the environment, and the continuation of life on earth. |
| TOPIC | 3.3. | The student will analyze how traits are inherited and passed on from one generation to another. |
| INDICATOR | 3.3.1. | <p>The student will demonstrate that the sorting and recombination of genes during sexual reproduction has an effect on variation in offspring.</p> <ul style="list-style-type: none"> • 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 |
| INDICATOR | 3.3.2. | <p>The student will illustrate and explain how expressed traits are passed from parent to offspring.</p> <ul style="list-style-type: none"> • Teacher Resource CD: Biotechnology Techniques II - Gene Expression • Teacher Resource CD: Understanding DNA |
| INDICATOR | 3.3.3. | <p>The student will explain how a genetic trait is determined by the code in a DNA molecule.</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 |

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| | | <ul style="list-style-type: none"> • 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 |
| STRAND / STANDARD | MD.3. | Concepts Of Biology: The student will demonstrate the ability to use scientific skills and processes (Core Learning Goal 1) and major biological concepts to explain the uniqueness and interdependence of living organisms, their interactions with the environment, and the continuation of life on earth. |
| TOPIC | 3.6. | The student will investigate a biological issue and develop an action plan. |
| INDICATOR | 3.6.1. | The student will analyze the consequences and/or trade-offs between technological changes and their effect on the individual, society, and the environment. They may select topics such as bioethics, genetic engineering, endangered species, or food supply. (NTB) <ul style="list-style-type: none"> • Teacher Resource CD: Biotechnology Techniques I - Gel Electrophoresis • Teacher Resource CD: Biotechnology Techniques II - Gene Expression |
| INDICATOR | 3.6.2. | The student will investigate a biological issue and be able to defend their position on topics such as animal rights, drug and alcohol abuse, viral diseases (e.g., AIDS), genetic engineering, bioethics, biodiversity, population growth, global sustainability, or origin of life. (NTB) <ul style="list-style-type: none"> • Teacher Resource CD: Biotechnology Techniques II - Gene Expression |
| STRAND / STANDARD | MD.4. | Concepts Of Chemistry: The student will demonstrate the ability to use scientific skills and processes (Core Learning Goal 1) to explain composition and interactions of matter in the world in which we live. |
| TOPIC | 4.1. | The student will explain that atoms have structure and this structure serves as the basis for the properties of elements and the bonds that they form. |
| INDICATOR | 4.1.3. | The student will explain how atoms interact with other atoms through the transfer and sharing of electrons in the formation of chemical bonds. <ul style="list-style-type: none"> • Biotechnology Techniques: Unit 1 Lab 1 Activity 1: DNA Structure and Replication |
| STRAND / STANDARD | MD.6. | Environmental Science: The student will demonstrate the ability to use the scientific skills and processes (Core Learning Goal 1) and major environmental science concepts to understand interrelationships of the natural world and to analyze environmental issues and their solutions. |
| TOPIC | 6.2. | The student will investigate the interdependence of organisms within their biotic environment. |
| INDICATOR | 6.2.1. | The student will explain how organisms are linked by the transfer and transformation of matter and energy at the ecosystem level (At least - Photosynthesis/respiration; Producers, consumers, |

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| | | <p>decomposers; Trophic levels; Pyramid of energy/pyramid of biomass).</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 |
| STRAND / STANDARD | MD.6. | Environmental Science: The student will demonstrate the ability to use the scientific skills and processes (Core Learning Goal 1) and major environmental science concepts to understand interrelationships of the natural world and to analyze environmental issues and their solutions. |
| TOPIC | 6.4. | The student will develop and apply knowledge and skills gained from an environmental issue investigation to an action project which protects and sustains the environment. |
| INDICATOR | 6.4.1. | <p>Identify an environmental issue and formulate related research questions (Methods of gathering information may include: writing letters; performing a literature search; using the internet; interviewing experts).</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 • Virtual Laboratory: Restriction Enzyme Cleavage of DNA |
| INDICATOR | 6.4.2. | <p>Design and conduct the research (Methods of data collection may include: field or laboratory; questionnaire/opinionnaire).</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 |

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| | | <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 |
| INDICATOR | 6.4.3. | <p>Interpret the findings to draw conclusions and make recommendations to help resolve the issue.</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 |
| INDICATOR | 6.4.4. | <p>Apply the conclusions to develop and implement an action project (Methods of implementation may include: physical action; persuasion; consumer action; political action).</p> <ul style="list-style-type: none"> • Teacher Resource CD: Biotechnology Techniques II - Gene Expression |

Maryland Content Standards

Science

Grade 10

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| STRAND / STANDARD | MD.1. | Skills And Processes: The student will demonstrate ways of thinking and acting inherent in the practice of science. The student will use the language and instruments of science to collect, organize, interpret, calculate, and communicate information. |
| TOPIC | 1.1. | The student will explain why curiosity, honesty, openness, and skepticism are highly regarded in science. |
| INDICATOR | 1.1.1. | <p>The student will recognize that real problems have more than one solution and decisions to accept one solution over another are made on the basis of many issues.</p> <ul style="list-style-type: none"> • Biotechnology Techniques: Unit 1 Lab 1 Activity 1: DNA Structure and Replication |

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| | | <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 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 |
| STRAND / STANDARD | MD.1. | Skills And Processes: The student will demonstrate ways of thinking and acting inherent in the practice of science. The student will use the language and instruments of science to collect, organize, interpret, calculate, and communicate information. |
| TOPIC | 1.2. | The student will pose scientific questions and suggest investigative approaches to provide answers to questions. |
| INDICATOR | 1.2.1. | <p>The student will identify meaningful, answerable scientific questions.</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 |
| INDICATOR | 1.2.2. | <p>The student will pose meaningful, answerable scientific questions. (NTB)</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 |

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| | | <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 |
| INDICATOR | 1.2.4. | <p>The student will test a working hypothesis. (NTB)</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 |
| INDICATOR | 1.2.5. | <p>The student will select appropriate instruments and materials to conduct an investigation.</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 |

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| | | <ul style="list-style-type: none"> • 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 |
| INDICATOR | 1.2.6. | <p>The student will identify appropriate methods for conducting an investigation (independent and dependent variables, proper controls, repeat trials, appropriate sample size, etc.).</p> <ul style="list-style-type: none"> • Biotechnology Techniques: Unit 4 Lab 8 Activity 1: Discover How Plasmids Transfer Genes |
| STRAND / STANDARD | MD.1. | <p>Skills And Processes: The student will demonstrate ways of thinking and acting inherent in the practice of science. The student will use the language and instruments of science to collect, organize, interpret, calculate, and communicate information.</p> |
| TOPIC | 1.3. | <p>The student will carry out scientific investigations effectively and employ the instruments, systems of measurement, and materials of science appropriately.</p> |
| INDICATOR | 1.3.1. | <p>The student will develop and demonstrate skills in using lab and field equipment to perform investigative techniques. (NTB)</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 |

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| INDICATOR | 1.3.2. | <p>The student will recognize safe laboratory procedures.</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 |
| INDICATOR | 1.3.3. | <p>The student will demonstrate safe handling of the chemicals and materials of science. (NTB)</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 |
| INDICATOR | 1.3.4. | <p>The student will learn the use of new instruments and equipment by following instructions in a manual or from oral direction. (NTB)</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 |

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| | | <p>for DNA Extraction</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 |
| STRAND / STANDARD | MD.1. | Skills And Processes: The student will demonstrate ways of thinking and acting inherent in the practice of science. The student will use the language and instruments of science to collect, organize, interpret, calculate, and communicate information. |
| TOPIC | 1.4. | The student will demonstrate that data analysis is a vital aspect of the process of scientific inquiry and communication. |
| INDICATOR | 1.4.1. | <p>The student will organize data appropriately using techniques such as tables, graphs, and webs (for graphs: axes labeled with appropriate quantities, appropriate units on axes, axes labeled with appropriate intervals, independent and dependent variables on correct axes, appropriate title).</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 |
| INDICATOR | 1.4.2. | <p>The student will analyze data to make predictions, decisions, or draw 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 |

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| | | <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 • Virtual Laboratory: Restriction Enzyme Cleavage of DNA |
| INDICATOR | 1.4.4. | <p>The student will determine the relationships between quantities and develop the mathematical model that describes these relationships.</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 |
| INDICATOR | 1.4.5. | <p>The student will check graphs to determine that they do not misrepresent results.</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 |

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| | | <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 |
| INDICATOR | 1.4.6. | <p>The student will describe trends revealed by data.</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 |
| INDICATOR | 1.4.8. | <p>The student will use models and computer simulations to extend his/her understanding of scientific concepts. (NTB)</p> <ul style="list-style-type: none"> • Biotechnology Techniques: Unit 1 Lab 1 Activity 1: DNA Structure and Replication • 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 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 |
| STRAND / STANDARD | MD.1. | <p>Skills And Processes: The student will demonstrate ways of thinking and acting inherent in the practice of science. The student will use the language and instruments of science to collect, organize, interpret, calculate, and communicate information.</p> |
| TOPIC | 1.5. | <p>The student will use appropriate methods for communicating in writing and orally the processes and results of scientific investigation.</p> |
| INDICATOR | 1.5.1. | <p>The student will demonstrate the ability to summarize data (measurements/observations).</p> <ul style="list-style-type: none"> • Biotechnology Techniques: Unit 1 Lab 1 Activity 1: DNA Structure and Replication |

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| | | <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 • Virtual Laboratory: Restriction Enzyme Cleavage of DNA |
| INDICATOR | 1.5.2. | <p>The student will explain scientific concepts and processes through drawing, writing, and/or oral communication.</p> <ul style="list-style-type: none"> • Biotechnology Techniques: Unit 2 Lab 4 Activity 2: Identifying DNA Fragments • Biotechnology Techniques: Unit 2 Lab 5 Activity 1: Restriction Site Mapping |
| INDICATOR | 1.5.3. | <p>The student will use computers and/or graphing calculators to produce the visual materials (tables, graphs, and spreadsheets) that will be used for communicating results. (NTB)</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 |
| INDICATOR | 1.5.4. | <p>The student will use tables, graphs, and displays to support arguments and claims in both written and oral communication.</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 |
| INDICATOR | 1.5.5. | <p>The student will create and/or interpret graphics. (scale drawings, photographs, digital images, field of view, etc.)</p> <ul style="list-style-type: none"> • Biotechnology Techniques: Unit 2 Lab 4 Activity 2: Identifying DNA Fragments • Biotechnology Techniques: Unit 2 Lab 5 Activity 1: Restriction Site Mapping |

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| INDICATOR | 1.5.7. | <p>The student will use, explain, and/or construct various classification systems.</p> <ul style="list-style-type: none"> • Teacher Resource CD: Biotechnology Techniques I - Gel Electrophoresis |
| INDICATOR | 1.5.8. | <p>The student will describe similarities and differences when explaining concepts and/or principles.</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 |
| INDICATOR | 1.5.9. | <p>The student will communicate conclusions derived through a synthesis of ideas.</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 |
| STRAND / STANDARD | MD.1. | <p>Skills And Processes: The student will demonstrate ways of thinking and acting inherent in the practice of science. The student will use the language and instruments</p> |

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| | | of science to collect, organize, interpret, calculate, and communicate information. |
| TOPIC | 1.6. | The student will use mathematical processes. |
| INDICATOR | 1.6.1. | The student will use ratio and proportion in appropriate situations to solve problems. <ul style="list-style-type: none"> • Biotechnology Techniques: Unit 2 Lab 4 Activity 2: Identifying DNA Fragments • Biotechnology Techniques: Unit 2 Lab 5 Activity 1: Restriction Site Mapping |
| INDICATOR | 1.6.4. | The student will manipulate quantities and/or numerical values in algebraic equations. <ul style="list-style-type: none"> • Biotechnology Techniques: Unit 4 Lab 8 Activity 1: Discover How Plasmids Transfer Genes |
| STRAND / STANDARD | MD.1. | Skills And Processes: The student will demonstrate ways of thinking and acting inherent in the practice of science. The student will use the language and instruments of science to collect, organize, interpret, calculate, and communicate information. |
| TOPIC | 1.7. | The student will show that connections exist both within the various fields of science and among science and other disciplines including mathematics, social studies, language arts, fine arts, and technology. |
| INDICATOR | 1.7.1. | The student will apply the skills, processes, and concepts of biology, chemistry, physics, or earth science to societal issues. <ul style="list-style-type: none"> • Teacher Resource CD: Biotechnology Techniques II - Gene Expression |
| INDICATOR | 1.7.2. | The student will identify and evaluate the impact of scientific ideas and/or advancements in technology on society. <ul style="list-style-type: none"> • Teacher Resource CD: Biotechnology Techniques I - Gel Electrophoresis • Teacher Resource CD: Biotechnology Techniques II - Gene Expression • Teacher Resource CD: Understanding DNA |
| INDICATOR | 1.7.6. | The student will explain how development of scientific knowledge leads to the creation of new technology and how technological advances allow for additional scientific accomplishments. <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 |
| STRAND / | MD.2. | Concepts Of Earth/Space Science: The student will demonstrate the ability to use |

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| STANDARD | | scientific skills and processes (Core Learning Goal 1) to explain the physical behavior of the environment, Earth, and the universe. |
| TOPIC | 2.1. | The student will identify and describe techniques used to investigate the universe and Earth. |
| INDICATOR | 2.1.1. | The student will describe the purpose and advantage of current tools, delivery systems and techniques used to study the universe. <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 |
| STRAND / STANDARD | MD.3. | Concepts Of Biology: The student will demonstrate the ability to use scientific skills and processes (Core Learning Goal 1) and major biological concepts to explain the uniqueness and interdependence of living organisms, their interactions with the environment, and the continuation of life on earth. |
| TOPIC | 3.1. | The student will be able to explain the correlation between the structure and function of biologically important molecules and their relationship to cell processes. |
| INDICATOR | 3.1.1. | The student will be able to describe the unique characteristics of chemical substances and macromolecules utilized by living systems. <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 2: Extracting Cellular DNA • Teacher Resource CD: Biotechnology Techniques II - Gene Expression • Teacher Resource CD: Understanding DNA |
| STRAND / STANDARD | MD.3. | Concepts Of Biology: The student will demonstrate the ability to use scientific skills and processes (Core Learning Goal 1) and major biological concepts to explain the uniqueness and interdependence of living organisms, their interactions with the environment, and the continuation of life on earth. |
| TOPIC | 3.2. | The student will demonstrate an understanding that all organisms are composed of cells which can function independently or as part of multicellular organisms. |
| INDICATOR | 3.2.2. | The student will conclude that cells exist within a narrow range of environmental conditions and changes to that environment, either naturally occurring or induced, may cause changes in the metabolic activity of the cell or organism. <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 |
| STRAND / STANDARD | MD.3. | Concepts Of Biology: The student will demonstrate the ability to use scientific skills and processes (Core Learning Goal 1) and major biological concepts to explain the uniqueness and interdependence of living organisms, their interactions with the environment, and the continuation of life on earth. |
| TOPIC | 3.3. | The student will analyze how traits are inherited and passed on from one generation to another. |
| INDICATOR | 3.3.1. | The student will demonstrate that the sorting and recombination of genes during sexual reproduction |

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| | | <p>has an effect on variation in offspring.</p> <ul style="list-style-type: none"> • 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 |
| INDICATOR | 3.3.2. | <p>The student will illustrate and explain how expressed traits are passed from parent to offspring.</p> <ul style="list-style-type: none"> • Teacher Resource CD: Biotechnology Techniques II - Gene Expression • Teacher Resource CD: Understanding DNA |
| INDICATOR | 3.3.3. | <p>The student will explain how a genetic trait is determined by the code in a DNA molecule.</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 |
| STRAND / STANDARD | MD.3. | <p>Concepts Of Biology: The student will demonstrate the ability to use scientific skills and processes (Core Learning Goal 1) and major biological concepts to explain the uniqueness and interdependence of living organisms, their interactions with the environment, and the continuation of life on earth.</p> |
| TOPIC | 3.6. | <p>The student will investigate a biological issue and develop an action plan.</p> |
| INDICATOR | 3.6.1. | <p>The student will analyze the consequences and/or trade-offs between technological changes and their effect on the individual, society, and the environment. They may select topics such as bioethics, genetic engineering, endangered species, or food supply. (NTB)</p> <ul style="list-style-type: none"> • Teacher Resource CD: Biotechnology Techniques I - Gel Electrophoresis • Teacher Resource CD: Biotechnology Techniques II - Gene Expression |
| INDICATOR | 3.6.2. | <p>The student will investigate a biological issue and be able to defend their position on topics such as animal rights, drug and alcohol abuse, viral diseases (e.g., AIDS), genetic engineering, bioethics,</p> |

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| | | <p>biodiversity, population growth, global sustainability, or origin of life. (NTB)</p> <ul style="list-style-type: none"> Teacher Resource CD: Biotechnology Techniques II - Gene Expression |
| STRAND / STANDARD | MD.4. | Concepts Of Chemistry: The student will demonstrate the ability to use scientific skills and processes (Core Learning Goal 1) to explain composition and interactions of matter in the world in which we live. |
| TOPIC | 4.1. | The student will explain that atoms have structure and this structure serves as the basis for the properties of elements and the bonds that they form. |
| INDICATOR | 4.1.3. | <p>The student will explain how atoms interact with other atoms through the transfer and sharing of electrons in the formation of chemical bonds.</p> <ul style="list-style-type: none"> Biotechnology Techniques: Unit 1 Lab 1 Activity 1: DNA Structure and Replication |
| STRAND / STANDARD | MD.6. | Environmental Science: The student will demonstrate the ability to use the scientific skills and processes (Core Learning Goal 1) and major environmental science concepts to understand interrelationships of the natural world and to analyze environmental issues and their solutions. |
| TOPIC | 6.2. | The student will investigate the interdependence of organisms within their biotic environment. |
| INDICATOR | 6.2.1. | <p>The student will explain how organisms are linked by the transfer and transformation of matter and energy at the ecosystem level (At least - Photosynthesis/respiration; Producers, consumers, decomposers; Trophic levels; Pyramid of energy/pyramid of biomass).</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 |
| STRAND / STANDARD | MD.6. | Environmental Science: The student will demonstrate the ability to use the scientific skills and processes (Core Learning Goal 1) and major environmental science concepts to understand interrelationships of the natural world and to analyze environmental issues and their solutions. |
| TOPIC | 6.4. | The student will develop and apply knowledge and skills gained from an environmental issue investigation to an action project which protects and sustains the environment. |
| INDICATOR | 6.4.1. | <p>Identify an environmental issue and formulate related research questions (Methods of gathering information may include: writing letters; performing a literature search; using the internet; interviewing experts).</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 |

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| | | <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 • Virtual Laboratory: Restriction Enzyme Cleavage of DNA |
| INDICATOR | 6.4.2. | <p>Design and conduct the research (Methods of data collection may include: field or laboratory; questionnaire/opinionnaire).</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 |
| INDICATOR | 6.4.3. | <p>Interpret the findings to draw conclusions and make recommendations to help resolve the issue.</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 |

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| | | <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 |
| INDICATOR | 6.4.4. | <p>Apply the conclusions to develop and implement an action project (Methods of implementation may include: physical action; persuasion; consumer action; political action).</p> <ul style="list-style-type: none"> • Teacher Resource CD: Biotechnology Techniques II - Gene Expression |

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