Inquiry Investigations™
Forensic Science MODULE – 1013062
Grades: 7-10

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Massachusetts Curriculum Frameworks
Science
Grade 7

DOMAIN / GENERAL STANDARD	MA.2.	Life Science
LEARNING STANDARD / OUTCOME	2.3.	Structure and Function of Cells: Compare and contrast plant and animal cells, including major organelles (cell membrane, cell wall, nucleus, cytoplasm, chloroplasts, mitochondria, vacuoles). • Teacher Resource CD: Simulating DNA Analysis
LEARNING STANDARD / OUTCOME	2.4.	Structure and Function of Cells: Recognize that within cells, many of the basic functions of organisms (e.g., extracting energy from food and getting rid of waste) are carried out. The way in which cells function is similar in all living organisms. • Teacher Resource CD: Simulating DNA Analysis
LEARNING STANDARD / OUTCOME	2.5.	Systems in Living Things: Describe the hierarchical organization of multicellular organisms from cells to tissues to organs to systems to organisms. • Forensic Science: Unit 2 Case Activity 3: The Telling Tissue
LEARNING STANDARD / OUTCOME	2.7.	Reproduction and Heredity: Recognize that every organism requires a set of instructions that specifies its traits. These instructions are stored in the organism's chromosomes. Heredity is the passage of these instructions from one generation to another. • Forensic Science: Unit 2 Case Activity 1: The Questioned Parentage • Forensic Science: Unit 2 Case Activity 2: The Uncommon Outlaw - Thomas Howard • Forensic Science: Unit 2 Case Activity 3: The Telling Tissue • Forensic Science: Unit 2 Case Activity 4: The Second Examination • Forensic Science: Unit 2 Skill Learning Activity 1: Modeling a DNA Profile • Forensic Science: Unit 2 Skill Learning Activity 2: The Discarded Cigarette - RFLP Profile Analysis • Forensic Science: Unit 2 Skill Learning Activity 3: The Bloody Cloth - DNA Profile Analysis • Forensic Science: Unit 2 Skill Learning Activity 4: A Closer Look at STR Polymorphisms • Forensic Science: Unit 2 Skill Learning Activity 5: Practicing Genetic Analysis using DNA Profile Frequency Calculations • Forensic Science: Unit 2 Skill Learning Activity 6: Genetic Analysis of DNA Profiles

		• Teacher Resource CD: Simulating DNA Analysis
LEARNING STANDARD / OUTCOME	**2.8.**	Reproduction and Heredity: Recognize that hereditary information is contained in genes located in the chromosomes of each cell. A human cell contains about 30,000 different genes on 23 different chromosomes. • Forensic Science: Unit 2 Case Activity 1: The Questioned Parentage • Forensic Science: Unit 2 Case Activity 2: The Uncommon Outlaw - Thomas Howard • Forensic Science: Unit 2 Case Activity 3: The Telling Tissue • Forensic Science: Unit 2 Case Activity 4: The Second Examination • Forensic Science: Unit 2 Skill Learning Activity 1: Modeling a DNA Profile • Forensic Science: Unit 2 Skill Learning Activity 2: The Discarded Cigarette - RFLP Profile Analysis • Forensic Science: Unit 2 Skill Learning Activity 3: The Bloody Cloth - DNA Profile Analysis • Forensic Science: Unit 2 Skill Learning Activity 4: A Closer Look at STR Polymorphisms • Forensic Science: Unit 2 Skill Learning Activity 5: Practicing Genetic Analysis using DNA Profile Frequency Calculations • Forensic Science: Unit 2 Skill Learning Activity 6: Genetic Analysis of DNA Profiles • Teacher Resource CD: Simulating DNA Analysis
DOMAIN / GENERAL STANDARD	**MA.3.**	**Physical Sciences**
LEARNING STANDARD / OUTCOME	**3.2.**	Properties of Matter: Differentiate between volume and mass. Define density. • Forensic Science: Unit 4 Case Activity 3: The Incriminating Headlamp
LEARNING STANDARD / OUTCOME	**3.3.**	Properties of Matter: Recognize that the measurement of volume and mass requires understanding of the sensitivity of measurement tools (e.g., rulers, graduated cylinders, balances) and knowledge and appropriate use of significant digits. • Forensic Science: Unit 4 Case Activity 3: The Incriminating Headlamp
LEARNING STANDARD / OUTCOME	**3.8.**	Elements, Compounds, and Mixtures: Differentiate between mixtures and pure substances. • Forensic Science: Unit 5 Skill Learning Activity 4: Analyzing Writing Inks • Forensic Science: Unit 6 Activity 2: Chromatographic Analysis • Teacher Resource CD: Analyzing Writing Inks
LEARNING STANDARD / OUTCOME	**3.10.**	Elements, Compounds, and Mixtures: Differentiate between physical changes and chemical changes. • Forensic Science: Unit 1 Case Activity 5: The Black Plastic Bag • Forensic Science: Unit 1 Skill Learning Activity 6: Exposing Latent Fingerprints Using Vapors • Teacher Resource CD: Fingerprinting • Teacher Resource CD: Learning About Paper

		• Teacher Resource CD: The Case of the Silent Sentinel
DOMAIN / GENERAL STANDARD	**MA.4.**	**Technology/Engineering**
LEARNING STANDARD / OUTCOME	**4.2.**	Materials, Tools, and Machines: Identify and explain appropriate measuring tools, hand tools, and power tools used to hold, lift, carry, fasten, and separate, and explain their safe and proper use. • Forensic Science: Unit 1 Case Activity 1: The Solitary Fingerprint • Forensic Science: Unit 1 Case Activity 2: The Forged Fingerprint • Forensic Science: Unit 1 Case Activity 3: The Paper Mark • Forensic Science: Unit 1 Case Activity 4: The Confusing Fingerprint • Forensic Science: Unit 1 Case Activity 5: The Black Plastic Bag • Forensic Science: Unit 1 Skill Learning Activity 5: Latent Fingerprints on Paper • Forensic Science: Unit 1 Skill Learning Activity 6: Exposing Latent Fingerprints Using Vapors
LEARNING STANDARD / OUTCOME	**4.26.**	Bioengineering Technologies: Explain examples of adaptive or assistive devices, e.g., prosthetic devices, wheelchairs, eyeglasses, grab bars, hearing aids, lifts, braces. • Forensic Science: Unit 2 Case Activity 1: The Questioned Parentage • Forensic Science: Unit 2 Case Activity 2: The Uncommon Outlaw - Thomas Howard • Forensic Science: Unit 2 Case Activity 4: The Second Examination • Forensic Science: Unit 2 Skill Learning Activity 1: Modeling a DNA Profile • Forensic Science: Unit 2 Skill Learning Activity 2: The Discarded Cigarette - RFLP Profile Analysis • Forensic Science: Unit 2 Skill Learning Activity 3: The Bloody Cloth - DNA Profile Analysis • Forensic Science: Unit 2 Skill Learning Activity 4: A Closer Look at STR Polymorphisms • Forensic Science: Unit 2 Skill Learning Activity 6: Genetic Analysis of DNA Profiles
LEARNING STANDARD / OUTCOME	**4.27.**	Bioengineering Technologies: Describe and explain adaptive and assistive bioengineered products, e.g., food, bio-fuels, irradiation, integrated pest management. • Forensic Science: Unit 2 Case Activity 1: The Questioned Parentage • Forensic Science: Unit 2 Case Activity 2: The Uncommon Outlaw - Thomas Howard • Forensic Science: Unit 2 Case Activity 4: The Second Examination • Forensic Science: Unit 2 Skill Learning Activity 1: Modeling a DNA Profile • Forensic Science: Unit 2 Skill Learning Activity 2: The Discarded Cigarette - RFLP Profile Analysis • Forensic Science: Unit 2 Skill Learning Activity 3: The Bloody Cloth - DNA Profile Analysis • Forensic Science: Unit 2 Skill Learning Activity 4: A Closer Look at STR Polymorphisms • Forensic Science: Unit 2 Skill Learning Activity 6: Genetic Analysis of DNA Profiles

Massachusetts Curriculum Frameworks
Science
Grade 8

DOMAIN / GENERAL STANDARD	MA.2.	Life Science
LEARNING STANDARD / OUTCOME	2.3.	Structure and Function of Cells: Compare and contrast plant and animal cells, including major organelles (cell membrane, cell wall, nucleus, cytoplasm, chloroplasts, mitochondria, vacuoles). • Teacher Resource CD: Simulating DNA Analysis
LEARNING STANDARD / OUTCOME	2.4.	Structure and Function of Cells: Recognize that within cells, many of the basic functions of organisms (e.g., extracting energy from food and getting rid of waste) are carried out. The way in which cells function is similar in all living organisms. • Teacher Resource CD: Simulating DNA Analysis
LEARNING STANDARD / OUTCOME	2.5.	Systems in Living Things: Describe the hierarchical organization of multicellular organisms from cells to tissues to organs to systems to organisms. • Forensic Science: Unit 2 Case Activity 3: The Telling Tissue
LEARNING STANDARD / OUTCOME	2.7.	Reproduction and Heredity: Recognize that every organism requires a set of instructions that specifies its traits. These instructions are stored in the organism's chromosomes. Heredity is the passage of these instructions from one generation to another. • Forensic Science: Unit 2 Case Activity 1: The Questioned Parentage • Forensic Science: Unit 2 Case Activity 2: The Uncommon Outlaw - Thomas Howard • Forensic Science: Unit 2 Case Activity 3: The Telling Tissue • Forensic Science: Unit 2 Case Activity 4: The Second Examination • Forensic Science: Unit 2 Skill Learning Activity 1: Modeling a DNA Profile • Forensic Science: Unit 2 Skill Learning Activity 2: The Discarded Cigarette - RFLP Profile Analysis • Forensic Science: Unit 2 Skill Learning Activity 3: The Bloody Cloth - DNA Profile Analysis • Forensic Science: Unit 2 Skill Learning Activity 4: A Closer Look at STR Polymorphisms • Forensic Science: Unit 2 Skill Learning Activity 5: Practicing Genetic Analysis using DNA Profile Frequency Calculations • Forensic Science: Unit 2 Skill Learning Activity 6: Genetic Analysis of DNA Profiles • Teacher Resource CD: Simulating DNA Analysis
LEARNING STANDARD / OUTCOME	2.8.	Reproduction and Heredity: Recognize that hereditary information is contained in genes located in the chromosomes of each cell. A human cell contains about 30,000 different genes on 23 different chromosomes. • Forensic Science: Unit 2 Case Activity 1: The Questioned Parentage • Forensic Science: Unit 2 Case Activity 2: The Uncommon Outlaw - Thomas Howard • Forensic Science: Unit 2 Case Activity 3: The Telling Tissue • Forensic Science: Unit 2 Case Activity 4: The Second Examination

		• Forensic Science: Unit 2 Skill Learning Activity 1: Modeling a DNA Profile • Forensic Science: Unit 2 Skill Learning Activity 2: The Discarded Cigarette - RFLP Profile Analysis • Forensic Science: Unit 2 Skill Learning Activity 3: The Bloody Cloth - DNA Profile Analysis • Forensic Science: Unit 2 Skill Learning Activity 4: A Closer Look at STR Polymorphisms • Forensic Science: Unit 2 Skill Learning Activity 5: Practicing Genetic Analysis using DNA Profile Frequency Calculations • Forensic Science: Unit 2 Skill Learning Activity 6: Genetic Analysis of DNA Profiles • Teacher Resource CD: Simulating DNA Analysis
DOMAIN / GENERAL STANDARD	**MA.3.**	**Physical Sciences**
LEARNING STANDARD / OUTCOME	**3.2.**	Properties of Matter: Differentiate between volume and mass. Define density. • Forensic Science: Unit 4 Case Activity 3: The Incriminating Headlamp
LEARNING STANDARD / OUTCOME	**3.3.**	Properties of Matter: Recognize that the measurement of volume and mass requires understanding of the sensitivity of measurement tools (e.g., rulers, graduated cylinders, balances) and knowledge and appropriate use of significant digits. • Forensic Science: Unit 4 Case Activity 3: The Incriminating Headlamp
LEARNING STANDARD / OUTCOME	**3.8.**	Elements, Compounds, and Mixtures: Differentiate between mixtures and pure substances. • Forensic Science: Unit 5 Skill Learning Activity 4: Analyzing Writing Inks • Forensic Science: Unit 6 Activity 2: Chromatographic Analysis • Teacher Resource CD: Analyzing Writing Inks
LEARNING STANDARD / OUTCOME	**3.10.**	Elements, Compounds, and Mixtures: Differentiate between physical changes and chemical changes. • Forensic Science: Unit 1 Case Activity 5: The Black Plastic Bag • Forensic Science: Unit 1 Skill Learning Activity 6: Exposing Latent Fingerprints Using Vapors • Teacher Resource CD: Fingerprinting • Teacher Resource CD: Learning About Paper • Teacher Resource CD: The Case of the Silent Sentinel
DOMAIN / GENERAL STANDARD	**MA.4.**	**Technology/Engineering**
LEARNING STANDARD / OUTCOME	**4.2.**	Materials, Tools, and Machines: Identify and explain appropriate measuring tools, hand tools, and power tools used to hold, lift, carry, fasten, and separate, and explain their safe and proper use. • Forensic Science: Unit 1 Case Activity 1: The Solitary Fingerprint • Forensic Science: Unit 1 Case Activity 2: The Forged Fingerprint • Forensic Science: Unit 1 Case Activity 3: The Paper Mark • Forensic Science: Unit 1 Case Activity 4: The Confusing Fingerprint

		• Forensic Science: Unit 1 Case Activity 5: The Black Plastic Bag • Forensic Science: Unit 1 Skill Learning Activity 5: Latent Fingerprints on Paper • Forensic Science: Unit 1 Skill Learning Activity 6: Exposing Latent Fingerprints Using Vapors
LEARNING STANDARD / OUTCOME	**4.26.**	Bioengineering Technologies: Explain examples of adaptive or assistive devices, e.g., prosthetic devices, wheelchairs, eyeglasses, grab bars, hearing aids, lifts, braces. • Forensic Science: Unit 2 Case Activity 1: The Questioned Parentage • Forensic Science: Unit 2 Case Activity 2: The Uncommon Outlaw - Thomas Howard • Forensic Science: Unit 2 Case Activity 4: The Second Examination • Forensic Science: Unit 2 Skill Learning Activity 1: Modeling a DNA Profile • Forensic Science: Unit 2 Skill Learning Activity 2: The Discarded Cigarette - RFLP Profile Analysis • Forensic Science: Unit 2 Skill Learning Activity 3: The Bloody Cloth - DNA Profile Analysis • Forensic Science: Unit 2 Skill Learning Activity 4: A Closer Look at STR Polymorphisms • Forensic Science: Unit 2 Skill Learning Activity 6: Genetic Analysis of DNA Profiles
LEARNING STANDARD / OUTCOME	**4.27.**	Bioengineering Technologies: Describe and explain adaptive and assistive bioengineered products, e.g., food, bio-fuels, irradiation, integrated pest management. • Forensic Science: Unit 2 Case Activity 1: The Questioned Parentage • Forensic Science: Unit 2 Case Activity 2: The Uncommon Outlaw - Thomas Howard • Forensic Science: Unit 2 Case Activity 4: The Second Examination • Forensic Science: Unit 2 Skill Learning Activity 1: Modeling a DNA Profile • Forensic Science: Unit 2 Skill Learning Activity 2: The Discarded Cigarette - RFLP Profile Analysis • Forensic Science: Unit 2 Skill Learning Activity 3: The Bloody Cloth - DNA Profile Analysis • Forensic Science: Unit 2 Skill Learning Activity 4: A Closer Look at STR Polymorphisms • Forensic Science: Unit 2 Skill Learning Activity 6: Genetic Analysis of DNA Profiles

Massachusetts Curriculum Frameworks

Science

Grade 9

DOMAIN / GENERAL STANDARD	**MA.B.1.**	**Biology: The Chemistry of Life: Chemical elements form organic molecules that interact to perform the basic functions of life.**
LEARNING STANDARD / OUTCOME	**1.3.**	Explain the role of enzymes as catalysts that lower the activation energy of biochemical reactions. Identify factors, such as pH and temperature, which have an effect on enzymes. • Forensic Science: Unit 2 Skill Learning Activity 1: Modeling a DNA Profile • Forensic Science: Unit 2 Skill Learning Activity 2: The Discarded Cigarette - RFLP Profile Analysis

		• Teacher Resource CD: The Case of the Telling Blood Group
DOMAIN / GENERAL STANDARD	**MA.B.2.**	**Biology: Cell Biology: Cells have specific structures and functions that make them distinctive. Processes in a cell can be classified broadly as growth, maintenance, and reproduction.**
LEARNING STANDARD / OUTCOME	**2.1.**	Relate cell parts/organelles (plasma membrane, nuclear envelope, nucleus, nucleolus, cytoplasm, mitochondrion, endoplasmic reticulum, Golgi apparatus, lysosome, ribosome, vacuole, cell wall, chloroplast, cytoskeleton, centriole, cilium, flagellum, pseudopod) to their functions. Explain the role of cell membranes as a highly selective barrier (diffusion, osmosis, facilitated diffusion, and active transport). • Teacher Resource CD: Simulating DNA Analysis
DOMAIN / GENERAL STANDARD	**MA.B.3.**	**Biology: Genetics: Genes allow for the storage and transmission of genetic information. They are a set of instructions encoded in the nucleotide sequence of each organism. Genes code for the specific sequences of amino acids that comprise the proteins that are characteristic of that organism.**
LEARNING STANDARD / OUTCOME	**3.1.**	Describe the basic structure (double helix, sugar/phosphate backbone, linked by complementary nucleotide pairs) of DNA, and describe its function in genetic inheritance. • Forensic Science: Unit 2 Case Activity 1: The Questioned Parentage • Forensic Science: Unit 2 Case Activity 2: The Uncommon Outlaw - Thomas Howard • Forensic Science: Unit 2 Case Activity 3: The Telling Tissue • Forensic Science: Unit 2 Case Activity 4: The Second Examination • Forensic Science: Unit 2 Skill Learning Activity 1: Modeling a DNA Profile • Forensic Science: Unit 2 Skill Learning Activity 2: The Discarded Cigarette - RFLP Profile Analysis • Forensic Science: Unit 2 Skill Learning Activity 3: The Bloody Cloth - DNA Profile Analysis • Forensic Science: Unit 2 Skill Learning Activity 4: A Closer Look at STR Polymorphisms • Forensic Science: Unit 2 Skill Learning Activity 5: Practicing Genetic Analysis using DNA Profile Frequency Calculations • Forensic Science: Unit 2 Skill Learning Activity 6: Genetic Analysis of DNA Profiles • Teacher Resource CD: Simulating DNA Analysis
LEARNING STANDARD / OUTCOME	**3.2.**	Describe the basic process of DNA replication and how it relates to the transmission and conservation of the genetic code. Explain the basic processes of transcription and translation, and how they result in the expression of genes. Distinguish among the end products of replication, transcription, and translation. • Forensic Science: Unit 2 Skill Learning Activity 1: Modeling a DNA Profile • Teacher Resource CD: Simulating DNA Analysis
LEARNING STANDARD / OUTCOME	**3.3.**	Explain how mutations in the DNA sequence of a gene may or may not result in phenotypic change in an organism. Explain how mutations in gametes may result in phenotypic changes in offspring. • Forensic Science: Unit 2 Case Activity 1: The Questioned Parentage • Forensic Science: Unit 2 Case Activity 2: The Uncommon Outlaw -

		Thomas Howard • Forensic Science: Unit 2 Case Activity 3: The Telling Tissue • Forensic Science: Unit 2 Case Activity 4: The Second Examination • Forensic Science: Unit 2 Skill Learning Activity 1: Modeling a DNA Profile • Forensic Science: Unit 2 Skill Learning Activity 2: The Discarded Cigarette - RFLP Profile Analysis • Forensic Science: Unit 2 Skill Learning Activity 3: The Bloody Cloth - DNA Profile Analysis • Forensic Science: Unit 2 Skill Learning Activity 4: A Closer Look at STR Polymorphisms • Forensic Science: Unit 2 Skill Learning Activity 5: Practicing Genetic Analysis using DNA Profile Frequency Calculations • Forensic Science: Unit 2 Skill Learning Activity 6: Genetic Analysis of DNA Profiles • Teacher Resource CD: Simulating DNA Analysis
LEARNING STANDARD / OUTCOME	**3.4.**	Distinguish among observed inheritance patterns caused by several types of genetic traits (dominant, recessive, incomplete dominance, codominant, sex-linked, polygenic, and multiple alleles). • Forensic Science: Unit 2 Case Activity 1: The Questioned Parentage • Forensic Science: Unit 2 Case Activity 2: The Uncommon Outlaw - Thomas Howard • Forensic Science: Unit 2 Case Activity 3: The Telling Tissue • Forensic Science: Unit 2 Case Activity 4: The Second Examination • Forensic Science: Unit 2 Skill Learning Activity 1: Modeling a DNA Profile • Forensic Science: Unit 2 Skill Learning Activity 2: The Discarded Cigarette - RFLP Profile Analysis • Forensic Science: Unit 2 Skill Learning Activity 3: The Bloody Cloth - DNA Profile Analysis • Forensic Science: Unit 2 Skill Learning Activity 4: A Closer Look at STR Polymorphisms • Forensic Science: Unit 2 Skill Learning Activity 5: Practicing Genetic Analysis using DNA Profile Frequency Calculations • Forensic Science: Unit 2 Skill Learning Activity 6: Genetic Analysis of DNA Profiles • Teacher Resource CD: Simulating DNA Analysis
LEARNING STANDARD / OUTCOME	**3.6.**	Use a Punnett Square to determine the probabilities for genotype and phenotype combinations in monohybrid crosses. • Forensic Science: Unit 2 Case Activity 1: The Questioned Parentage • Teacher Resource CD: Simulating DNA Analysis
DOMAIN / GENERAL STANDARD	**MA.B.4.**	**Biology: Anatomy and Physiology: There is a relationship between the organization of cells into tissues, and tissues into organs. The structure and function of organs determine their relationships within body systems of an organism. Homeostasis allows the body to perform its normal functions.**
LEARNING STANDARD / OUTCOME	**4.2.**	Explain how the circulatory system (heart, arteries, veins, capillaries, red blood cells) transports nutrients and oxygen to cells and removes cell wastes. Describe how the kidneys and the liver are closely associated with the circulatory system as they perform the excretory function of removing waste from the blood. Recognize that kidneys remove nitrogenous wastes, and the liver removes many toxic compounds

		from blood. • Forensic Science: Unit 2 Skill Learning Activity 2: The Discarded Cigarette - RFLP Profile Analysis • Forensic Science: Unit 2 Skill Learning Activity 6: Genetic Analysis of DNA Profiles • Forensic Science: Unit 3 Case Activity 1: The Stain in Question • Forensic Science: Unit 3 Case Activity 2: The Glowing Light • Forensic Science: Unit 3 Case Activity 3: The False Positive • Forensic Science: Unit 3 Case Activity 4: The Telling Blood Group • Forensic Science: Unit 3 Case Activity 5: The Telling Trap Door • Forensic Science: Unit 3 Skill Learning Activity 1: Applying the Kastle-Meyer Test for the Presence of Blood • Forensic Science: Unit 3 Skill Learning Activity 2: Applying the Precipitin Test for the Presence of Human Blood • Forensic Science: Unit 3 Skill Learning Activity 3: Human Blood Group Analysis • Forensic Science: Unit 3 Skill Learning Activity 4: Detecting Trace Amounts of Blood • Forensic Science: Unit 3 Skill Learning Activity 5: Analyzing Bloodstain Patterns • Forensic Science: Unit 6 Activity 5: Blood Analysis • Teacher Resource CD: The Case of the Telling Blood Group • Virtual Laboratory: ABO-Rh Blood Typing
LEARNING STANDARD / OUTCOME	**4.6.**	Recognize that the sexual reproductive system allows organisms to produce offspring that receive half of their genetic information from their mother and half from their father and that sexually produced offspring resemble, but are not identical to, either of their parents. • Forensic Science: Unit 2 Case Activity 1: The Questioned Parentage • Forensic Science: Unit 2 Case Activity 2: The Uncommon Outlaw - Thomas Howard • Forensic Science: Unit 2 Case Activity 3: The Telling Tissue • Forensic Science: Unit 2 Case Activity 4: The Second Examination • Forensic Science: Unit 2 Skill Learning Activity 1: Modeling a DNA Profile • Forensic Science: Unit 2 Skill Learning Activity 2: The Discarded Cigarette - RFLP Profile Analysis • Forensic Science: Unit 2 Skill Learning Activity 3: The Bloody Cloth - DNA Profile Analysis • Forensic Science: Unit 2 Skill Learning Activity 4: A Closer Look at STR Polymorphisms • Forensic Science: Unit 2 Skill Learning Activity 5: Practicing Genetic Analysis using DNA Profile Frequency Calculations • Forensic Science: Unit 2 Skill Learning Activity 6: Genetic Analysis of DNA Profiles • Teacher Resource CD: Simulating DNA Analysis
DOMAIN / GENERAL STANDARD	**MA.B.5.**	**Biology: Evolution and Biodiversity: Evolution is the result of genetic changes that occur in constantly changing environments. Over many generations, changes in the genetic make-up of populations may affect biodiversity through speciation and extinction.**
LEARNING STANDARD / OUTCOME	**5.3.**	Explain how evolution through natural selection can result in changes in biodiversity through the increase or decrease of genetic diversity from a population.

		• Forensic Science: Unit 2 Skill Learning Activity 1: Modeling a DNA Profile
DOMAIN / GENERAL STANDARD	**MA.C.1.**	**Chemistry: Properties of Matter: Physical and chemical properties reflect the nature of the interactions between molecules or atoms and can be used to classify and describe matter.**
LEARNING STANDARD / OUTCOME	**1.1.**	Identify and explain physical properties (such as density, melting point, boiling point, conductivity, and malleability) and chemical properties (such as the ability to form new substances). Distinguish between chemical and physical changes. • Forensic Science: Unit 4 Case Activity 3: The Incriminating Headlamp
LEARNING STANDARD / OUTCOME	**1.2.**	Explain the difference between pure substances (elements and compounds) and mixtures. Differentiate between heterogeneous and homogeneous mixtures. • Forensic Science: Unit 5 Skill Learning Activity 4: Analyzing Writing Inks • Forensic Science: Unit 6 Activity 2: Chromatographic Analysis • Teacher Resource CD: Analyzing Writing Inks
DOMAIN / GENERAL STANDARD	**MA.C.7.**	**Chemistry: Solutions, Rates of Reaction, and Equilibrium: Solids, liquids, and gases dissolve to form solutions. Rates of reaction and chemical equilibrium are dynamic processes that are significant in many systems (biological, ecological, and geological).**
LEARNING STANDARD / OUTCOME	**7.1.**	Describe the process by which solutes dissolve in solvents. • Forensic Science: Unit 5 Skill Learning Activity 4: Analyzing Writing Inks • Forensic Science: Unit 6 Activity 2: Chromatographic Analysis • Teacher Resource CD: Analyzing Writing Inks
LEARNING STANDARD / OUTCOME	**7.4.**	Compare and contrast qualitatively the properties of solutions and pure solvents (colligative properties such as boiling point and freezing point). • Forensic Science: Unit 5 Skill Learning Activity 4: Analyzing Writing Inks • Forensic Science: Unit 6 Activity 2: Chromatographic Analysis • Teacher Resource CD: Analyzing Writing Inks
DOMAIN / GENERAL STANDARD	**MA.P.1.**	**Physics: Motion and Forces: Newton's laws of motion and gravitation describe and predict the motion of most objects.**
LEARNING STANDARD / OUTCOME	**1.3.**	Create and interpret graphs of 1-dimensional motion, such as position vs. time, distance vs. time, speed vs. time, velocity vs. time, and acceleration vs. time where acceleration is constant. • Forensic Science: Unit 2 Skill Learning Activity 2: The Discarded Cigarette - RFLP Profile Analysis
DOMAIN / GENERAL STANDARD	**MA.T/E.1.**	**Technology/Engineering: Engineering Design: Engineering design involves practical problem solving, research, development, and invention/innovation and requires designing, drawing, building, testing, and redesigning. Students should demonstrate the ability to use the engineering design process to solve a problem or meet a challenge.**
LEARNING STANDARD / OUTCOME	**1.3.**	Produce and analyze multi-view drawings (orthographic projections) and pictorial (isometric, oblique, perspective) drawings using various techniques.

		• Forensic Science: Unit 1 Case Activity 1: The Solitary Fingerprint • Forensic Science: Unit 2 Case Activity 1: The Questioned Parentage • Forensic Science: Unit 2 Skill Learning Activity 2: The Discarded Cigarette - RFLP Profile Analysis • Forensic Science: Unit 4 Skill Learning Activity 2: Making an Impression Cast
DOMAIN / GENERAL STANDARD	**MA.T/E.2.**	**Technology/Engineering: Construction Technologies: The construction process is a series of actions completed to build a structure including: preparing a site, setting a foundation, erecting a structure, installing utilities, and finishing a site. Various materials, processes, and systems are used to build structures. Students should demonstrate and apply the concepts of construction technology through building and constructing either full-size models or scale models using various materials commonly used in construction. Students should demonstrate the ability to use the engineering design process to solve a problem or meet a challenge in construction technologies.**
LEARNING STANDARD / OUTCOME	**2.1.**	Identify and explain the engineering properties of materials used in structures, such as, elasticity, plasticity, R value, density, and strength. • Forensic Science: Unit 4 Case Activity 3: The Incriminating Headlamp

Massachusetts Curriculum Frameworks
Science
Grade 10

DOMAIN / GENERAL STANDARD	**MA.B.1.**	**Biology: The Chemistry of Life: Chemical elements form organic molecules that interact to perform the basic functions of life.**
LEARNING STANDARD / OUTCOME	**1.3.**	Explain the role of enzymes as catalysts that lower the activation energy of biochemical reactions. Identify factors, such as pH and temperature, which have an effect on enzymes. • Forensic Science: Unit 2 Skill Learning Activity 1: Modeling a DNA Profile • Forensic Science: Unit 2 Skill Learning Activity 2: The Discarded Cigarette - RFLP Profile Analysis • Teacher Resource CD: The Case of the Telling Blood Group
DOMAIN / GENERAL STANDARD	**MA.B.2.**	**Biology: Cell Biology: Cells have specific structures and functions that make them distinctive. Processes in a cell can be classified broadly as growth, maintenance, and reproduction.**
LEARNING STANDARD / OUTCOME	**2.1.**	Relate cell parts/organelles (plasma membrane, nuclear envelope, nucleus, nucleolus, cytoplasm, mitochondrion, endoplasmic reticulum, Golgi apparatus, lysosome, ribosome, vacuole, cell wall, chloroplast, cytoskeleton, centriole, cilium, flagellum, pseudopod) to their functions. Explain the role of cell membranes as a highly selective barrier (diffusion, osmosis, facilitated diffusion, and active transport). • Teacher Resource CD: Simulating DNA Analysis
DOMAIN / GENERAL STANDARD	**MA.B.3.**	**Biology: Genetics: Genes allow for the storage and transmission of genetic information. They are a set of instructions encoded in the nucleotide sequence of each organism. Genes code for the specific sequences of amino acids that comprise the proteins that are characteristic of that organism.**
LEARNING STANDARD / OUTCOME	**3.1.**	Describe the basic structure (double helix, sugar/phosphate backbone, linked by complementary nucleotide pairs) of DNA, and describe its function in genetic inheritance.

		• Forensic Science: Unit 2 Case Activity 1: The Questioned Parentage • Forensic Science: Unit 2 Case Activity 2: The Uncommon Outlaw - Thomas Howard • Forensic Science: Unit 2 Case Activity 3: The Telling Tissue • Forensic Science: Unit 2 Case Activity 4: The Second Examination • Forensic Science: Unit 2 Skill Learning Activity 1: Modeling a DNA Profile • Forensic Science: Unit 2 Skill Learning Activity 2: The Discarded Cigarette - RFLP Profile Analysis • Forensic Science: Unit 2 Skill Learning Activity 3: The Bloody Cloth - DNA Profile Analysis • Forensic Science: Unit 2 Skill Learning Activity 4: A Closer Look at STR Polymorphisms • Forensic Science: Unit 2 Skill Learning Activity 5: Practicing Genetic Analysis using DNA Profile Frequency Calculations • Forensic Science: Unit 2 Skill Learning Activity 6: Genetic Analysis of DNA Profiles • Teacher Resource CD: Simulating DNA Analysis
LEARNING STANDARD / OUTCOME	**3.2.**	Describe the basic process of DNA replication and how it relates to the transmission and conservation of the genetic code. Explain the basic processes of transcription and translation, and how they result in the expression of genes. Distinguish among the end products of replication, transcription, and translation. • Forensic Science: Unit 2 Skill Learning Activity 1: Modeling a DNA Profile • Teacher Resource CD: Simulating DNA Analysis
LEARNING STANDARD / OUTCOME	**3.3.**	Explain how mutations in the DNA sequence of a gene may or may not result in phenotypic change in an organism. Explain how mutations in gametes may result in phenotypic changes in offspring. • Forensic Science: Unit 2 Case Activity 1: The Questioned Parentage • Forensic Science: Unit 2 Case Activity 2: The Uncommon Outlaw - Thomas Howard • Forensic Science: Unit 2 Case Activity 3: The Telling Tissue • Forensic Science: Unit 2 Case Activity 4: The Second Examination • Forensic Science: Unit 2 Skill Learning Activity 1: Modeling a DNA Profile • Forensic Science: Unit 2 Skill Learning Activity 2: The Discarded Cigarette - RFLP Profile Analysis • Forensic Science: Unit 2 Skill Learning Activity 3: The Bloody Cloth - DNA Profile Analysis • Forensic Science: Unit 2 Skill Learning Activity 4: A Closer Look at STR Polymorphisms • Forensic Science: Unit 2 Skill Learning Activity 5: Practicing Genetic Analysis using DNA Profile Frequency Calculations • Forensic Science: Unit 2 Skill Learning Activity 6: Genetic Analysis of DNA Profiles • Teacher Resource CD: Simulating DNA Analysis
LEARNING STANDARD / OUTCOME	**3.4.**	Distinguish among observed inheritance patterns caused by several types of genetic traits (dominant, recessive, incomplete dominance, codominant, sex-linked, polygenic, and multiple alleles).

		• Forensic Science: Unit 2 Case Activity 1: The Questioned Parentage • Forensic Science: Unit 2 Case Activity 2: The Uncommon Outlaw - Thomas Howard • Forensic Science: Unit 2 Case Activity 3: The Telling Tissue • Forensic Science: Unit 2 Case Activity 4: The Second Examination • Forensic Science: Unit 2 Skill Learning Activity 1: Modeling a DNA Profile • Forensic Science: Unit 2 Skill Learning Activity 2: The Discarded Cigarette - RFLP Profile Analysis • Forensic Science: Unit 2 Skill Learning Activity 3: The Bloody Cloth - DNA Profile Analysis • Forensic Science: Unit 2 Skill Learning Activity 4: A Closer Look at STR Polymorphisms • Forensic Science: Unit 2 Skill Learning Activity 5: Practicing Genetic Analysis using DNA Profile Frequency Calculations • Forensic Science: Unit 2 Skill Learning Activity 6: Genetic Analysis of DNA Profiles • Teacher Resource CD: Simulating DNA Analysis
LEARNING STANDARD / OUTCOME	**3.6.**	Use a Punnett Square to determine the probabilities for genotype and phenotype combinations in monohybrid crosses. • Forensic Science: Unit 2 Case Activity 1: The Questioned Parentage • Teacher Resource CD: Simulating DNA Analysis
DOMAIN / GENERAL STANDARD	**MA.B.4.**	**Biology: Anatomy and Physiology: There is a relationship between the organization of cells into tissues, and tissues into organs. The structure and function of organs determine their relationships within body systems of an organism. Homeostasis allows the body to perform its normal functions.**
LEARNING STANDARD / OUTCOME	**4.2.**	Explain how the circulatory system (heart, arteries, veins, capillaries, red blood cells) transports nutrients and oxygen to cells and removes cell wastes. Describe how the kidneys and the liver are closely associated with the circulatory system as they perform the excretory function of removing waste from the blood. Recognize that kidneys remove nitrogenous wastes, and the liver removes many toxic compounds from blood. • Forensic Science: Unit 2 Skill Learning Activity 2: The Discarded Cigarette - RFLP Profile Analysis • Forensic Science: Unit 2 Skill Learning Activity 6: Genetic Analysis of DNA Profiles • Forensic Science: Unit 3 Case Activity 1: The Stain in Question • Forensic Science: Unit 3 Case Activity 2: The Glowing Light • Forensic Science: Unit 3 Case Activity 3: The False Positive • Forensic Science: Unit 3 Case Activity 4: The Telling Blood Group • Forensic Science: Unit 3 Case Activity 5: The Telling Trap Door • Forensic Science: Unit 3 Skill Learning Activity 1: Applying the Kastle-Meyer Test for the Presence of Blood • Forensic Science: Unit 3 Skill Learning Activity 2: Applying the Precipitin Test for the Presence of Human Blood • Forensic Science: Unit 3 Skill Learning Activity 3: Human Blood Group Analysis • Forensic Science: Unit 3 Skill Learning Activity 4: Detecting Trace Amounts of Blood • Forensic Science: Unit 3 Skill Learning Activity 5: Analyzing Bloodstain Patterns • Forensic Science: Unit 6 Activity 5: Blood Analysis

		• Teacher Resource CD: The Case of the Telling Blood Group • Virtual Laboratory: ABO-Rh Blood Typing
LEARNING STANDARD / OUTCOME	**4.6.**	Recognize that the sexual reproductive system allows organisms to produce offspring that receive half of their genetic information from their mother and half from their father and that sexually produced offspring resemble, but are not identical to, either of their parents. • Forensic Science: Unit 2 Case Activity 1: The Questioned Parentage • Forensic Science: Unit 2 Case Activity 2: The Uncommon Outlaw - Thomas Howard • Forensic Science: Unit 2 Case Activity 3: The Telling Tissue • Forensic Science: Unit 2 Case Activity 4: The Second Examination • Forensic Science: Unit 2 Skill Learning Activity 1: Modeling a DNA Profile • Forensic Science: Unit 2 Skill Learning Activity 2: The Discarded Cigarette - RFLP Profile Analysis • Forensic Science: Unit 2 Skill Learning Activity 3: The Bloody Cloth - DNA Profile Analysis • Forensic Science: Unit 2 Skill Learning Activity 4: A Closer Look at STR Polymorphisms • Forensic Science: Unit 2 Skill Learning Activity 5: Practicing Genetic Analysis using DNA Profile Frequency Calculations • Forensic Science: Unit 2 Skill Learning Activity 6: Genetic Analysis of DNA Profiles • Teacher Resource CD: Simulating DNA Analysis
DOMAIN / GENERAL STANDARD	**MA.B.5.**	**Biology: Evolution and Biodiversity: Evolution is the result of genetic changes that occur in constantly changing environments. Over many generations, changes in the genetic make-up of populations may affect biodiversity through speciation and extinction.**
LEARNING STANDARD / OUTCOME	**5.3.**	Explain how evolution through natural selection can result in changes in biodiversity through the increase or decrease of genetic diversity from a population. • Forensic Science: Unit 2 Skill Learning Activity 1: Modeling a DNA Profile
DOMAIN / GENERAL STANDARD	**MA.C.1.**	**Chemistry: Properties of Matter: Physical and chemical properties reflect the nature of the interactions between molecules or atoms and can be used to classify and describe matter.**
LEARNING STANDARD / OUTCOME	**1.1.**	Identify and explain physical properties (such as density, melting point, boiling point, conductivity, and malleability) and chemical properties (such as the ability to form new substances). Distinguish between chemical and physical changes. • Forensic Science: Unit 4 Case Activity 3: The Incriminating Headlamp
LEARNING STANDARD / OUTCOME	**1.2.**	Explain the difference between pure substances (elements and compounds) and mixtures. Differentiate between heterogeneous and homogeneous mixtures. • Forensic Science: Unit 5 Skill Learning Activity 4: Analyzing Writing Inks • Forensic Science: Unit 6 Activity 2: Chromatographic Analysis • Teacher Resource CD: Analyzing Writing Inks
DOMAIN / GENERAL	**MA.C.7.**	**Chemistry: Solutions, Rates of Reaction, and Equilibrium: Solids, liquids, and gases dissolve to form solutions. Rates of reaction and chemical equilibrium are**

STANDARD		**dynamic processes that are significant in many systems (biological, ecological, and geological).**
LEARNING STANDARD / OUTCOME	**7.1.**	Describe the process by which solutes dissolve in solvents. • Forensic Science: Unit 5 Skill Learning Activity 4: Analyzing Writing Inks • Forensic Science: Unit 6 Activity 2: Chromatographic Analysis • Teacher Resource CD: Analyzing Writing Inks
LEARNING STANDARD / OUTCOME	**7.4.**	Compare and contrast qualitatively the properties of solutions and pure solvents (colligative properties such as boiling point and freezing point). • Forensic Science: Unit 5 Skill Learning Activity 4: Analyzing Writing Inks • Forensic Science: Unit 6 Activity 2: Chromatographic Analysis • Teacher Resource CD: Analyzing Writing Inks
DOMAIN / GENERAL STANDARD	**MA.P.1.**	**Physics: Motion and Forces: Newton's laws of motion and gravitation describe and predict the motion of most objects.**
LEARNING STANDARD / OUTCOME	**1.3.**	Create and interpret graphs of 1-dimensional motion, such as position vs. time, distance vs. time, speed vs. time, velocity vs. time, and acceleration vs. time where acceleration is constant. • Forensic Science: Unit 2 Skill Learning Activity 2: The Discarded Cigarette - RFLP Profile Analysis
DOMAIN / GENERAL STANDARD	**MA.T/E.1.**	**Technology/Engineering: Engineering Design: Engineering design involves practical problem solving, research, development, and invention/innovation and requires designing, drawing, building, testing, and redesigning. Students should demonstrate the ability to use the engineering design process to solve a problem or meet a challenge.**
LEARNING STANDARD / OUTCOME	**1.3.**	Produce and analyze multi-view drawings (orthographic projections) and pictorial (isometric, oblique, perspective) drawings using various techniques. • Forensic Science: Unit 1 Case Activity 1: The Solitary Fingerprint • Forensic Science: Unit 2 Case Activity 1: The Questioned Parentage • Forensic Science: Unit 2 Skill Learning Activity 2: The Discarded Cigarette - RFLP Profile Analysis • Forensic Science: Unit 4 Skill Learning Activity 2: Making an Impression Cast
DOMAIN / GENERAL STANDARD	**MA.T/E.2.**	**Technology/Engineering: Construction Technologies: The construction process is a series of actions completed to build a structure including: preparing a site, setting a foundation, erecting a structure, installing utilities, and finishing a site. Various materials, processes, and systems are used to build structures. Students should demonstrate and apply the concepts of construction technology through building and constructing either full-size models or scale models using various materials commonly used in construction. Students should demonstrate the ability to use the engineering design process to solve a problem or meet a challenge in construction technologies.**
LEARNING STANDARD / OUTCOME	**2.1.**	Identify and explain the engineering properties of materials used in structures, such as, elasticity, plasticity, R value, density, and strength. • Forensic Science: Unit 4 Case Activity 3: The Incriminating Headlamp