Career and Technical Education TEKS Review, August 2021

Proposed New Texas Essential Knowledge and Skills for Career Development, Subchapter J, Hospitality and Tourism, and Subchapter M, Law and Public Service

Additional Courses that Satisfy a Graduation Requirement in Science

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The document reflects proposed new CTE TEKS that the State Board of Education (SBOE) will consider for first reading and filing authorization at the August/September 2021 SBOE meeting for the following courses that can satisfy a graduation requirement in science: Food Science (Hospitality & Tourism Career Cluster) and Forensic Science (Law & Public Service Career Cluster).

Suggested adjustments where language warranted clarification are included in the document. Proposed additions are shown in bold, green font with double underline (**additions**). Proposed deletions are shown in bold, red font with strikethroughs (**~~deletions~~**). Text proposed to be moved from its current location is shown in purple italicized font with strikethrough (***~~moved text~~***) and is shown in the proposed new location in purple italicized font with double underlines (***new location***).

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§127.482. Food Science (One Credit), Adopted 2021.

(a) General requirements. This course is recommended for students in Grades 11 and 12. Prerequisites: one credit in biology and one credit in chemistry. Recommended prerequisite: Principles of Hospitality and Tourism. This course satisfies a high school science graduation requirement. Students shall be awarded one credit for successful completion of this course.

(b) Introduction.

(1) Career and technical education instruction provides content aligned with challenging academic standards, industry-relevant technical knowledge, and college and career readiness skills for students to further their education and succeed in current and emerging professions.

(2) The Hospitality and Tourism Career Cluster focuses on the management, marketing, and operations of restaurants and other food/beverage services, lodging, attractions, recreation events, and travel-related services.

(3) In Food Science, students examine the nature and properties of foods, food microbiology, and the principles of science in food production, processing, preparation, and preservation; use scientific methods to conduct laboratory and field investigations; and make informed decisions using critical thinking and scientific problem solving. This course provides students a foundation for further study that leads to occupations in food and beverage services; the health sciences; agriculture, food, and natural resources; and human services.

(4) Science, as defined by the National Academy of Sciences, is the "use of evidence to construct testable explanations and predictions of natural phenomena, as well as the knowledge generated through this process." This vast body of changing and increasing knowledge is described by physical, mathematical, and conceptual models. Students should know that some questions are outside the realm of science because they deal with phenomena that are not currently scientifically testable.

(5) Scientific hypotheses and theories. Students are expected to know that:

(A) hypotheses are tentative and testable statements that must be capable of being supported or not supported by observational evidence. Hypotheses of durable explanatory power that have been tested over a wide variety of conditions are incorporated into theories; and

(B) scientific theories are based on natural and physical phenomena and are capable of being tested by multiple independent researchers. Unlike hypotheses, scientific theories are well established and highly reliable explanations, but they may be subject to change as new areas of science and new technologies are developed.

(6) Scientific inquiry is the planned and deliberate investigation of the natural world using scientific and engineering practices. Scientific methods of investigation are descriptive, comparative, or experimental. The method chosen should be appropriate to the question being asked. Student learning for different types of investigations include descriptive investigations, which involve collecting data and recording observations without making comparisons; comparative investigations, which involve collecting data with variables that are manipulated to compare results; and experimental investigations, which involve processes similar to comparative investigations but in which a control is identified.

(A) Scientific practices. Students should be able to ask questions, plan and conduct investigations to answer questions, and explain phenomena using appropriate tools and models.

(B) Engineering practices. Students should be able to identify problems and design solutions using appropriate tools and models.

(7) Scientific decision making is a way of answering questions about the natural world involving its own set of ethical standards about how the process of science should be carried out. Students should be able to distinguish between scientific decision-making methods (scientific methods) and ethical and social decisions that involve science (the application of scientific information).

(8) Science consists of recurring themes and making connections between overarching concepts. Recurring themes include systems, models, and patterns. All systems have basic properties that can be described in space, time, energy, and matter. Change and constancy occur in systems as patterns and can be observed, measured, and modeled. These patterns help to make predictions that can be scientifically tested, while models allow for boundary specification and provide a tool for understanding the ideas presented. Students should analyze a system in terms of its components and how these components relate to each other, to the whole, and to the external environment.

(9) Students are encouraged to participate in extended learning experiences such as career and technical student organizations and other leadership or extracurricular organizations.

(10) Statements that contain the word "including" reference content that must be mastered, while those containing the phrase "such as" are intended as possible illustrative examples.

(c) Knowledge and skills.

(1) The student demonstrates professional standards/employability skills as required by the food service business and industry. The student is expected to:

(A) apply interpersonal communication skills in the food service business and industry settings;

(B) explain and recognize the value of collaboration within the workplace;

(C) examine the importance of time management to succeed in the workforce;

(D) identify work ethics and professionalism in a job setting;

(E) describe problem-solving and critical-thinking skills used in the workplace; and

(F) explore careers and professions in food science.

(2) The student, for at least 40% of instructional time, asks questions, identifies problems, and plans and safely conducts classroom, laboratory, and field investigations to answer questions, explain phenomena, or design solutions using appropriate tools and models. The student is expected to:

(A) ask questions and define problems based on observations or information from text, phenomena, models, or investigations;

(B) apply scientific practices to plan and conduct descriptive, comparative, and experimental investigations and use engineering practices to design solutions to problems;

(C) use appropriate safety equipment and practices during laboratory, classroom, and field investigations as outlined in Texas Education Agency-approved safety standards;

(D) use appropriate tools such as calculators, spreadsheet software, data-collecting probes, computers, standard laboratory glassware, microscopes, various prepared slides, metric rulers, electronic balances, hand lenses, Celsius thermometers, hot plates, lab notebooks or journals, timing devices, cameras, Petri dishes, lab incubators, and models, diagrams, or samples of biological specimens or structures, vacuum sealer, oven, cook top, cookware, bakeware, cutlery, and measuring cups and spoons;

(E) collect quantitative data using the International System of Units (SI) and United States customary units and qualitative data as evidence;

(F) organize quantitative and qualitative data using lab reports, labeled drawings, graphic organizers, journals, summaries, oral reports, and technology-based reports;

(G) develop and use models to represent phenomena, systems, processes, or solutions to engineering problems; and

(H) distinguish between scientific hypotheses, theories, and laws.

(3) The student analyzes and interprets data to derive meaning, identify features and patterns, and discover relationships or correlations to develop evidence-based arguments or evaluate designs. The student is expected to:

(A) identify advantages and limitations of models such as their size, scale, properties, and materials;

(B) analyze data by identifying significant statistical features, patterns, sources of error, and limitations;

(C) use mathematical calculations to assess quantitative relationships in data; and

(D) evaluate experimental and engineering designs.

(4) The student develops evidence-based explanations and communicates findings, conclusions, and proposed solutions. The student is expected to:

(A) develop explanations and propose solutions supported by data and models consistent with scientific ideas, principles, and theories;

(B) communicate explanations and solutions individually and collaboratively in a variety of settings and formats; and

(C) engage respectfully in scientific argumentation using applied scientific explanations and empirical evidence.

(5) The student knows the contributions of scientists and engineers and recognizes the importance of scientific research and innovation on society. The student is expected to:

(A) analyze, evaluate, and critique scientific explanations and solutions by using empirical evidence, logical reasoning, and experimental and observational testing so as to encourage critical thinking by the student;

(B) relate the impact of past and current research on scientific thought and society, including research methodology, cost-benefit analysis, and contributions of diverse scientists and engineers as related to the content; and

(C) research and explore resources such as museums, libraries, professional organizations, private companies, online platforms, and mentors employed in a science, technology, engineering, and mathematics or food science field.

(6) The student analyzes household and commercial sustainability and regulatory practices in food production. The student is expected to:

(A) research and investigate resource use, sustainability, and conservation in food production such as with water, land, and oceans;

(B) analyze the effect of food on the decomposition cycle, including composting, recycling, and disposal; and

(C) demonstrate appropriate methods for sorting and disposing of food waste, including fats and oils, and packaging waste from food production.

(7) The student analyzes the role of acids and bases in food science. The student is expected to:

(A) evaluate physical and chemical properties of acids and bases; and

(B) analyze the relationship of pH to the properties, safety, and freshness of food.

(8) The student evaluates the principles of microbiology and food safety practices. The student is expected to:

(A) investigate the properties of microorganisms that cause food spoilage;

(B) compare food intoxication and food infection;

(C) examine methods to destroy or inactivate harmful pathogens in foods;

(D) compare beneficial and harmful microorganisms, including lactic acid bacteria, acetic acid bacteria, various baking and brewing yeasts, *E. coli*, *Staphylococcus*, *Clostridium botulinum*, *Clostridium perfringens*, *Salmonella*, *Listeria*, and *Shigella*;

(E) analyze sanitary food-handling practices such as personal hygiene or equipment sanitation; and

(F) prepare for a state or national food manager sanitation certification or alternative credential within the field of food science technology.

(9) The student examines the chemical properties of food. The student is expected to:

(A) describe acids, bases, salts, carbohydrates, lipids, proteins and other elements, compounds, and mixtures related to food science;

(B) compare heterogeneous and homogeneous mixtures;

(C) analyze chemical and physical changes in food; and

(D) use chemical symbols, formulas, and equations in food science such as oxidation of sugars in a cut apple or fermentation in the production of yogurt.

(10) The student analyzes solutions, colloids, solids, gels, foams, and emulsions in food science. The student is expected to:

(A) identify the solvent and solute in various solutions such as brines;

(B) compare unsaturated, saturated, and supersaturated solutions, including their effects on boiling and freezing points in food preparation such as when making candy or ice cream;

(C) calculate the concentration of a solution using mass percent such as the concentration of sugar needed for crystallization;

(D) describe the properties of colloidal dispersions such as gelatin, mayonnaise, or milk;

(E) differentiate between and give examples of temporary, semi-permanent, and permanent emulsions;

(F) investigate the relationships between the three parts of a permanent emulsion; and

(G) create temporary, semi-permanent, and permanent food emulsions.

(11) The student analyzes the functions of enzymes in food science. The student is expected to:

(A) describe the role of enzymes as catalysts in chemical reactions of food, including cheese-making, the enzymatic tenderization of meat, and oxidation of sugars in fruit;

(B) explain the relationship between an enzyme and a substrate;

(C) analyze the functions of enzymes in digestion, including the factors that influence enzyme activity, and relate enzymatic activity in digestion to dietary restrictions; and

(D) analyze enzyme reactions in food preparation, including cheese-making, the enzymatic tenderization of meat, and oxidation of sugars in fruit.

(12) The student evaluates the role of fermentation in food science. The student is expected to:

(A) analyze modern and historical reasons food is fermented;

(B) describe the conditions under which bacterial fermentation of food occurs and use chemical equations to describe the products of fermentation; and

(C) prepare various fermented food products.

(13) The student assesses the reaction of leavening agents in baked products. The student is expected to:

(A) describe the physical and chemical changes that occur in leavening;

(B) identify various leavening agents and describe their functions in food production;

(C) use chemical equations to describe how acids act as leavening agents;

(D) conduct laboratory experiments with various types and amounts of leavening agents to compare the doughs and batters produced; and

(E) create baked products using various leavening agents.

(14) The student explores the roles of food additives. The student is expected to:

(A) evaluate the various types of food additives such as incidental, intentional, natural, and artificial;

(B) investigate the various functions of food additives such as preserving food, increasing nutritive value, and enhancing sensory characteristics; and

(C) research local, state, national, and international agencies involved in regulating food additives.

(15) The student analyzes the effects of heat energy transfer in food production. The student is expected to:

(A) analyze the relationship between molecular motion and temperature;

(B) compare heat transfer processes, including conduction, convection, and radiation;

(C) investigate the role of phase changes in food production, including crystallization, coagulation, and reduction; and

(D) demonstrate rates of reaction using various temperatures and describe the effects of temperature on the characteristics of food products.

(16) The student evaluates the properties of carbohydrates in food and their effects on food production. The student is expected to:

(A) identify the physical properties and chemical structures of simple and complex carbohydrates;

(B) describe the functions of carbohydrates such as caramelization, crystallization, and thickening agents in food production;

(C) describe the processes of gelatinization and retrogradation in food production; and

(D) create food products using simple and complex carbohydrates.

(17) The student evaluates the properties of fats in food and their effects on food production. The student is expected to:

(A) identify the physical properties and chemical structures of saturated and unsaturated fats;

(B) describe the functions of different types of fats in food production;

(C) demonstrate methods for controlling fat oxidation;

(D) analyze the effects of temperature on fats in food preparation;

(E) conduct laboratory experiments using the scientific processes to explore the functions of fats in food production; and

(F) create food products using saturated and unsaturated fats.

(18) The student evaluates the properties of proteins and their effects on food production. The student is expected to:

(A) identify the physical properties and chemical structures of proteins;

(B) explain the processes of protein denaturation, coagulation, and syneresis;

(C) describe the functions and uses of proteins such as in emulsions, foams, and gluten formation;

(D) analyze the effects of moisture and temperature on protein in food production such as moist and dry heat methods for preparation; and

(E) create food products using protein.

(19) The student evaluates the properties of vitamins and minerals and their interrelationships in food production. The student is expected to compare the effects of food production on water- and fat-soluble vitamins and minerals.

(20) The student evaluates the properties of water and their effects on food production. The student is expected to:

(A) identify the properties of water, including as a solvent or medium, and its effects on food production; and

(B) compare the effects of hard and soft water on food production.

(21) The student explains nutritional aspects of food production. The student is expected to:

(A) describe how variations in human digestion and metabolism affect dietary modifications;

(B) identify common and special dietary modifications such as for food allergies, intolerances, or medical conditions;

(C) develop and modify recipes for dietary differences such as allergies and intolerances or for personal health preferences such as low-fat or sugar-free; and

(D) plan and create a dining experience using the most recent USDA dietary guidelines.

(22) The student analyzes processes that manage bacteria to safe levels during food production. The student is expected to investigate processes that manage food bacteria such as dehydration, pasteurization, and food irradiation.

(23) The student examines packaging and labeling guidelines. The student is expected to:

(A) research and evaluate federal food packaging regulations, including the information required on a food label;

(B) compare global food packaging regulations to those of the United States; and

(C) analyze the effectiveness of commercial food packaging for specific foods.

(24) The student analyzes food preservation processes. The student is expected to:

(A) describe the benefits of food preservation;

(B) compare various methods of household and commercial dehydration, canning, and freezing; and

(C) create a food product using a selected preservation method.

§127.651. Implementation of Texas Essential Knowledge and Skills for Law and Public Service, Adopted 2021.

(a) The provisions of this subchapter shall be implemented by school districts beginning with the 2022-2023 school year.

(b) No later than August 31, 2022, the commissioner of education shall determine whether instructional materials funding has been made available to Texas public schools for materials that cover the essential knowledge and skills for career and technical education as adopted in §127.652 of this subchapter.

(c) If the commissioner makes the determination that instructional materials funding has been made available under subsection (b) of this section, §127.652 of this subchapter shall be implemented beginning with the 2022-2023 school year and apply to the 2022-2023 and subsequent school years.

(d) If the commissioner does not make the determination that instructional materials funding has been made available under subsection (b) of this section, the commissioner shall determine no later than August 31 of each subsequent school year whether instructional materials funding has been made available. If the commissioner determines that instructional materials funding has been made available, the commissioner shall notify the State Board of Education and school districts that §127.652 of this subchapter shall be implemented for the following school year.

§127.652. Forensic Science (One Credit), Adopted 2021.

(a) General requirements. The course is recommended for students in Grades 11 and 12. Prerequisites: one credit in biology and one credit in chemistry. This course satisfies a high school science graduation requirement. Students shall be awarded one credit for successful completion of this course.

(b) Introduction.

(1) Career and technical education instruction provides content aligned with challenging academic standards, industry-relevant technical knowledge, and college and career readiness skills for students to further their education and succeed in current and emerging professions.

(2) The Law and Public Service Career Cluster focuses on planning, managing, and providing legal services, public safety, protective services, and homeland security, including professional and technical support services.

(3) Forensic Science is a survey course that introduces students to the application of science to law. Students learn terminology and procedures related to the collection and examination of physical evidence using scientific processes performed in a field or laboratory setting. Students also learn the history and the legal aspects of forensic science.

(4) Science, as defined by the National Academy of Sciences, is the "use of evidence to construct testable explanations and predictions of natural phenomena, as well as the knowledge generated through this process." This vast body of changing and increasing knowledge is described by physical, mathematical, and conceptual models. Students should know that some questions are outside the realm of science because they deal with phenomena that are not currently scientifically testable.

(5) Students are expected to know that:

(A) hypotheses are tentative and testable statements that must be capable of being supported or not supported by observational evidence. Hypotheses of durable explanatory power that have been tested over a wide variety of conditions are incorporated into theories; and

(B) scientific theories are based on natural and physical phenomena and are capable of being tested by multiple independent researchers. Unlike hypotheses, scientific theories are well established and highly reliable explanations, but they may be subject to change as new areas of science and new technologies are developed.

(6) Scientific inquiry is the planned and deliberate investigation of the natural world using scientific and engineering practices. Scientific methods of investigation are descriptive, comparative, or experimental. The method chosen should be appropriate to the question being asked. Student learning for different types of investigations include descriptive investigations, which involve collecting data and recording observations without making comparisons; comparative investigations, which involve collecting data with variables that are manipulated to compare results; and experimental investigations, which involve processes similar to comparative investigations but in which a control is identified.

(A) Scientific practices. Students should be able to ask questions, plan and conduct investigations to answer questions, and explain phenomena using appropriate tools and models.

(B) Engineering practices. Students should be able to identify problems and design solutions using appropriate tools and models.

(7) Scientific decision making is a way of answering questions about the natural world involving its own set of ethical standards about how the process of science should be carried out. Students should be able to distinguish between scientific decision-making methods (scientific methods) and ethical and social decisions that involve science (the application of scientific information).

(8) Science consists of recurring themes and making connections between overarching concepts. Recurring themes include systems, models, and patterns. All systems have basic properties that can be described in space, time, energy, and matter. Change and constancy occur in systems as patterns and can be observed, measured, and modeled. These patterns help to make predictions that can be scientifically tested, while models allow for boundary specification and provide a tool for understanding the ideas presented. Students should analyze a system in terms of its components and how these components relate to each other, to the whole, and to the external environment.

(9) Students are encouraged to participate in extended learning experiences such as career and technical student organizations and other leadership or extracurricular organizations.

(10) Statements that contain the word "including" reference content that must be mastered, while those containing the phrase "such as" are intended as possible illustrative examples.

(c) Knowledge and skills.

(1) The student demonstrates professional standards/employability skills as required by business and industry. The student is expected to demonstrate professional standards/employability skills such as **demonstrating good** attendance, punctuality, ***and ethical conduct*****;** meeting deadlines, **and** working toward personal and team goals ~~**every day**~~***, and ethical conduct***.

(2) The student, for at least 40% of instructional time, asks questions, identifies problems, and plans and safely conducts classroom, laboratory, and field investigations to answer questions, explain phenomena, or design solutions using appropriate tools and models. The student is expected to:

(A) ask questions and define problems based on observations or information from text, phenomena, models, or investigations;

(B) apply scientific practices to plan and conduct descriptive, comparative, and experimental investigations and use engineering practices to design solutions to problems;

(C) use appropriate safety equipment and practices during laboratory, classroom, and field investigations as outlined in Texas Education Agency-approved safety standards;

(D) use appropriate tools and equipment such as scientific calculators, computers, internet access, digital cameras, video recording devices, meter sticks, metric rulers, measuring tapes, digital range finders, protractors, calipers, light microscopes up to 100x magnification, hand lenses, stereoscopes, digital scales, dissection equipment, standard laboratory glassware, appropriate personal protective equipment (PPE), an adequate supply of consumable chemicals, biological specimens, prepared evidence slides and

samples, evidence packaging and tamper evident tape, evidence tents, crime scene tape, L-rulers, American Board of Forensic Odontology (ABFO) scales, alternate light sources (ALS) and ALS protective goggles, blood specimens, blood presumptive tests, glass samples of various chemical composition, human and non-human bones, fingerprint brushes and powders, lifting tapes and cards, ten-print cards and ink pads, swabs with containers, disposable gloves, and relevant and necessary kits;

(E) collect quantitative data with accuracy and precision using the International System of Units (SI) and United States customary units and qualitative data as evidence;

(F) organize quantitative and qualitative data using appropriate methods of communication such as reports, graphs, tables, or charts;

(G) develop and use models to represent phenomena, systems, processes, or solutions to engineering problems; and

(H) distinguish between scientific hypotheses, theories, and laws.

(3) The student analyzes and interprets data to derive meaning, identify features and patterns, and discover relationships or correlations to develop evidence-based arguments or evaluate designs. The student is expected to:

(A) identify advantages and limitations of models such as their size, scale, properties, and materials;

(B) analyze data by identifying significant statistical features, patterns, sources of error, and limitations;

(C) use mathematical calculations to assess quantitative relationships in data; and

(D) evaluate experimental and engineering designs.

(4) The student develops evidence-based explanations and communicates findings, conclusions, and proposed solutions. The student is expected to:

(A) develop explanations and propose solutions supported by data and models and consistent with scientific ideas, principles, and theories;

(B) communicate explanations and solutions individually and collaboratively in a variety of settings and formats; and

(C) engage respectfully in scientific argumentation using applied scientific explanations and empirical evidence.

(5) The student knows the contributions of scientists and engineers and recognizes the importance of scientific research and innovation on society. The student is expected to:

(A) analyze, evaluate, and critique scientific explanations and solutions by using empirical evidence, logical reasoning, and experimental and observational testing so as to encourage critical thinking by the student;

(B) relate the impact of past and current research on scientific thought and society, including research methodology, cost-benefit analysis, and contributions of diverse scientists and engineers as related to the content; and

(C) research and explore resources such as museums, libraries, professional organizations, private companies, online platforms, and mentors employed in a science, technology, engineering, and mathematics (STEM) field.

(6) The student explores the history of forensic science. The student is expected to:

(A) analyze the historical development and current advancements of different forensic science disciplines such as forensic biology, anthropology/odontology, forensic chemistry, trace evidence, ballistics, fingerprints, digital forensics, and questioned documents; and

(B) explain ~~the~~ significant historical and modern **contributions** ~~*contributors*~~ to the development and advancement of forensic science **made by** ~~*contributors*~~ such as Edmond Locard, Mathieu Orfila, Francis Galton, Edwin Henry, and Alec Jeffreys.

(7) The student analyzes legal aspects within forensic science. The student is expected to:

(A) summarize the ethical standards required of a forensic science professional;

(B) **identify and explain** ~~**demonstrate**~~ knowledge of terminology and procedures employed in the criminal justice system as they pertain to the chain of custody procedure for evidence;

(C) **identify and explain** ~~**demonstrate**~~ knowledge of terminology and procedures employed in the criminal justice system as they pertain to expert witness testimony;

(D) **research and discuss** ~~**explore**~~ the effect of biases such as confirmation bias and framing cognitive bias on evidence collection, forensic analysis, and expert testimony; and

(E) compare the admissibility of expert witness testimony in terms of the Frye Standard and the Daubert Standard under federal rules of evidence.

(8) The student explores career options within forensic science. The student is expected to:

(A) explore **and describe** discipline-specific requirements for careers in forensic science, including collegiate course requirements, licensure, certifications, and physical and mental capabilities;

(B) differentiate the roles and responsibilities of professionals in the criminal justice system, including forensic scientists, crime scene investigators, criminologists, court systems personnel, and medicolegal death investigations; and

(C) differentiate the functions of various forensic science disciplines such as forensic biology, forensic chemistry, trace evidence, ballistics, fingerprints, digital forensics, and questioned documents.

(9) The student recognizes the procedures of crime scene investigation while maintaining scene integrity. The student is expected to:

(A) **explain** ~~**demonstrate the ability to work as a member of a crime scene team and an understanding of**~~ the roles and tasks needed to complete a crime scene examination, which may require collaboration with outside experts and agencies**, and demonstrate the ability to work as a member of a crime scene team**;

(B) develop a detailed, technical written record based on observations and activities, documenting the crime scene examination;

(C) **discuss** ~~**demonstrate knowledge of**~~ the elements of criminal law that guide search and seizure of persons, property, and evidence;

(D) conduct a primary and secondary systematic search of a simulated crime scene for physical evidence utilizing search patterns such as spiral, line, grid, and zone;

(E) document a crime scene using photographic or audiovisual equipment;

(F) generate a physical or digital crime scene sketch, including coordinates or measurements from fixed points, compass directions, scale of proportion, legend-key, heading, and title block; and

(G) demonstrate proper techniques for collecting, packaging, and preserving physical evidence found at a crime scene while maintaining documentation, including chain of custody.

(10) The student analyzes fingerprint evidence in forensic science. The student is expected to:

(A) compare the three major fingerprint patterns of arches, loops, and whorls;

(B) identify the minutiae of fingerprints, including bifurcations, ending ridges, dots, short ridges, and enclosures/islands;

(C) distinguish between patent, plastic, and latent impressions;

(D) perform procedures for developing and lifting latent prints on nonporous surfaces using cyanoacrylate and fingerprint powders;

(E) perform procedures for developing latent prints using chemical processes on porous and adhesive surfaces with chemicals such as ninhydrin and crystal violet and documenting the results via photography; and

(F) explain the Integrated Automated Fingerprint Identification System (IAFIS) and describe the implications of Next Generation Identification (NGI) systems.

(11) The student collects and analyzes impression evidence in forensic science. The student is expected to:

(A) analyze the class and individual characteristics of tool mark impressions and the recovery and documentation of surface characteristics such as wood or metal;

(B) analyze the class and individual characteristics of footwear impressions and the recovery and documentation of surface characteristics such as soil or organic plant material;

(C) analyze the class and individual characteristics of tire tread impressions and the recovery documentation of surface characteristics such as soil or organic plant material; and

(D) compare impression evidence collected at a simulated crime scene with the known impression.

(12) The student recognizes the methods to process and analyze hair and fibers found in a crime scene. The student is expected to:

(A) demonstrate how to collect hair and fiber evidence at a simulated crime scene;

(B) perform the analysis of hair and fiber evidence **using methods** such as microscopy and flame testing;

(C) compare the microscopic characteristics of human hair and non-human hair, including medulla, pigment distribution, and scales;

(D) describe and illustrate the different microscopic characteristics used to determine the origin of a human hair sample; and

(E) differentiate between natural and synthetic fibers.

(13) The student recognizes the methods to process and analyze glass evidence. The student is expected to:

(A) demonstrate how to collect and preserve glass evidence;

(B) compare the composition of various types of glass such as soda lime, borosilicate, leaded, and tempered;

(C) determine the direction of a projectile by examining glass fractures; and

(D) define refractive index and explain how it is used in forensic glass analysis.

(14) The student explores principles of questioned document analysis in the physical and digital form. The student is expected to:

(A) research **and explain** different types of examinations performed on digital and physical evidence in a forensic laboratory such as digital data recovery, counterfeiting, ink, and paper analysis;

(B) investigate **and describe** the security features incorporated in U.S. and foreign currency to prevent counterfeiting; and

(C) perform handwriting comparisons of an unknown sample with exemplars by analyzing characteristics such as letter, line, and formatting.

(15) The student evaluates firearms and ballistics evidence. The student is expected to:

(A) describe the mechanism of modern firearms such as long guns and handguns;

(B) identify ~~recognize~~ the components and characteristics of bullet and cartridge cases;

(C) describe the composition of and method of analysis for gunshot residue and primer residue;

(D) conduct and calculate trajectory analysis of bullet strikes within a simulated crime scene; and

(E) identify and recognize the type of information available through the National Integrated Ballistics Information Network.

(16) The student identifies controlled and illicit substances. The student is expected to:

(A) differentiate between toxicological analysis and controlled substance analysis as they relate to the method of collection and impact on the body;

(B) classify controlled substances using the schedules under the Controlled Substances Act; and

(C) identify unknown substances using presumptive and confirmatory procedures such as microchemical/color indicating reagent field tests, microscopy, chromatography, and spectrophotometry.

(17) The student explores toxicology in forensic science. The student is expected to:

(A) explain the absorption, distribution, metabolization, and elimination of toxins such as alcohol, prescription drugs, controlled substances, and carbon monoxide through the human body;

(B) describe presumptive and confirmatory laboratory procedures as they relate to toxicological analysis such as head space analysis, solid-phase extractions, gas chromatography-mass spectrometry (GC/MS), color tests, and immunoassays;

(C) interpret results from presumptive and confirmatory laboratory procedures, including GC/MS and their implications; and

(D) explain the precautions necessary in the forensic laboratory for proper preservation of biological samples.

(18) The student analyzes blood spatter at a simulated crime scene. The student is expected to:

(A) analyze blood stain patterns based on surface type and appearance such as size, shape, distribution and location in order to determine the mechanism by which the patterns are created;

(B) explain the methods of chemically enhancing latent blood patterns using reagents such as Blue Star or Amido Black; and

(C) conduct and interpret blood presumptive tests for various biologicals such as phenolphthalein and tetramethylbenzidine (TMB).

(19) The student analyzes the foundations and methodologies surrounding the processing of biological evidence for the purpose of identification. The student is expected to:

(A) identify different types of biological samples and practice proper collection and preservation techniques;

(B) identify the red blood cell antigens and antibodies as they relate to human blood types;

(C) describe the structure of a deoxyribonucleic acid (DNA) molecule and its function;

(D) explain the analytical procedure for generating a DNA profile, including extraction, quantification, amplification, and capillary electrophoresis;

(E) explain the different methodologies surrounding the different types of DNA analysis such as short tandem repeats (STRs), Y-STRs, mitochondrial DNA, and single nucleotide polymorphisms (SNPs);

(F) interpret the components of an electropherogram; and

(G) explore the databasing systems associated with DNA such as Combined DNA Index System (CODIS) and ancestry-based databasing systems.

(20) The student explores the principles surrounding medicolegal death investigations. The student is expected to:

(A) explain ~~and apply~~ the principles of rigor, algor, and livor mortis **and how they apply** to deceased persons;

(B) differentiate between the types of wound patterns such as lacerations and blunt force trauma resulting from stabbings, bludgeoning, gunshots, and strangulations;

(C) determine cause and manner of death from an autopsy report obtained through resources such as case studies, simulated autopsies, and dissections; and

(D) determine the approximate time of death using entomology.

(21) The student explores principles of anthropology and odontology relevant to forensic science. The student is expected to:

(A) identify the major bones of the human skeletal system;

(B) compare composition and structure of human and non-human bones;

(C) describe the collection and preservation methods for bone evidence;

(D) explain the characteristics of the human skeletal system indicative of specific biological sex and approximate range of age and height; and

(E) explain how human remains are identified through dental records such as dentures, x-rays, and implants.