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Text of Adopted 19 TAC

Chapter 130. Texas Essential Knowledge and Skills for Career and Technical Education

Subchapter H. Health Science

§130.201. Implementation of Texas Essential Knowledge and Skills for Health Science.

The provisions of this subchapter shall be implemented by school districts beginning with the 2010-2011 school year.

§130.202. Principles of Health Science (One-Half to One Credit).

(a) General requirements. This course is recommended for students in Grades 9-11.

(b) Introduction.

(1) The Principles of Health Science provides an overview of the therapeutic, diagnostic, health informatics, support services, and biotechnology research and development systems of the health care industry.

(2) To pursue a career in the health science industry, students should learn to reason, think critically, make decisions, solve problems, and communicate effectively. Students should recognize that quality health care depends on the ability to work well with others.

(3) The health science industry is comprised of diagnostic, therapeutic, health informatics, support services, and biotechnology research and development systems that function individually and collaboratively to provide comprehensive health care. Students should identify the employment opportunities, technology, and safety requirements of each system. Students are expected to apply the knowledge and skills necessary to pursue a health science career through further education and employment.

(4) Professional integrity in the health science industry is dependent on acceptance of ethical and legal responsibilities. Students are expected to employ their ethical and legal responsibilities and limitations and understand the implications of their actions.

(c) Knowledge and skills.

(1) The student applies mathematics, science, English language arts, and social studies in health science. The student is expected to:

(A) convert units between systems of measurement;

(B) apply data from tables, charts, and graphs to provide solutions to health-related problems;

(C) interpret technical material related to the health science industry;

(D) organize, compile, and write ideas into reports and summaries;

(E) plan and prepare effective oral presentations;

(F) formulate responses using precise language to communicate ideas;

(G) describe biological and chemical processes that maintain homeostasis;

(H) identify and analyze principles of body mechanics and movement such as forces and the effects of movement, torque, tension, and elasticity on the human body;

(I) identify human needs according to Maslow's Hierarchy of Human Needs;

(J) describe the stages of development related to the life span;

(K) identify the concepts of health and wellness throughout the life span;

(L) analyze and evaluate communication skills for maintaining healthy relationships throughout the life span;

(M) research the historical significance of health care;

(N) describe the impact of health services on the economy;

(O) analyze the impact of local, state, and national government on the health science industry;

(P) identify diverse and cultural influences that have impacted contemporary aspects of health care delivery; and

(Q) compare and contrast practices used by various cultures and societies to solve problems related to health.

(2) The student uses verbal and nonverbal communication skills. The student is expected to:

(A) identify components of effective and non-effective communication;

(B) demonstrate effective communication skills for responding to the needs of individuals in a diverse society;

(C) evaluate the effectiveness of conflict resolution techniques in various situations; and

(D) accurately interpret, transcribe, and communicate medical vocabulary using appropriate technology.

(3) The student implements the leadership skills necessary to function in a democratic society. The student is expected to:

(A) identify traits of a leader;

(B) demonstrate leadership skills, characteristics, and responsibilities of leaders such as goal setting and team building; and

(C) demonstrate the ability to effectively conduct and participate in meetings.

(4) The student assesses career options and the preparation necessary for employment in the health science industry. The student is expected to:

(A) locate, evaluate, and interpret career options and employment information; and

(B) recognize the impact of career decisions, including cause and effect of changing employment situations.

(5) The student identifies professional characteristics, academic preparation, and skills necessary for employment as defined by the health science industry. The student is expected to:

(A) identify employer expectations such as punctuality, attendance, time management, communication, organizational skills, and productive work habits; and

(B) identify academic requirements for professional advancement such as certification, licensure, registration, continuing education, and advanced degrees.

(6) The student identifies the systems related to health science. The student is expected to:

(A) compare health science careers within the diagnostic, therapeutic, health informatics, support services, and biotechnology research and development systems; and

(B) identify the collaborative role of team members between systems to deliver quality health care.

(7) The student examines the role of the multidisciplinary team in providing health care. The student is expected to:

(A) explain the concept of teaming to provide quality health care; and

(B) examine the role of professional organizations in the preparation and governance of credentialing and certification.

(8) The student interprets ethical behavior standards and legal responsibilities. The student is expected to:

(A) compare published professional codes of ethics and scope of practice;

(B) explain principles of confidentiality and ethical behavior, including the consequences of breech of confidentiality;

(C) discuss ethical issues related to health care, including implications of technological advances;

(D) examine issues related to malpractice, negligence, and liability; and

(E) research laws governing the health science industry.

(9) The student recognizes the rights and choices of the individual. The student is expected to:

(A) recognize situations related to autonomy;

(B) identify wellness strategies for the prevention of disease;

(C) evaluate positive and negative effects of relationships on physical and emotional health such as peers, family, and friends and in promoting a healthy community;

(D) review documentation related to rights and choices; and

(E) recognize diversity and cultural practices influencing contemporary aspects of health care.

(10) The student recognizes the importance of maintaining a safe environment and eliminating hazardous situations. The student is expected to:

(A) identify governing regulatory agencies such as the World Health Organization, Centers for Disease Control, Occupational Safety and Health Administration, Food and Drug Administration, and National Institute for Occupational Safety and Health;

(B) relate industry safety standards such as standard precautions, fire prevention, safety practices, and appropriate actions to emergency situations; and

(C) identify safety practices in all aspects of the health science industry.

(11) The student identifies the technology used in the diagnostic, therapeutic, health informatics, support services, and biotechnology research and development systems. The student is expected to:

(A) identify technological equipment used in each of the five systems and relate findings to identified societal risk factors; and

(B) recognize and relate the process for reporting equipment or technology malfunctions.

§130.203. Medical Terminology (One-Half Credit).

(a) General requirements. This course is recommended for students in Grades 9-12.

(b) Introduction.

(1) This course is designed to introduce students to the structure of medical terms, including prefixes, suffixes, word roots, combining forms, and singular and plural forms, plus medical abbreviations and acronyms. The course allows students to achieve comprehension of medical vocabulary appropriate to medical procedures, human anatomy and physiology, and pathophysiology.

(2) To pursue a career in health science, students should learn to reason, think critically, make decisions, solve problems, and communicate effectively. Students should understand that quality health care depends on the ability to work well with others.

(3) The health science industry is comprised of diagnostic, therapeutic, health informatics, support services, and biotechnology research and development systems that function individually and collaboratively to provide comprehensive health care. Students should identify the employment opportunities, technology, and safety requirements of each system. Students are expected to learn the knowledge and skills necessary to pursue a health science career through further education and employment.

(4) Professional integrity in the health science industry is dependent on acceptance of ethical and legal responsibilities. Students are expected to employ their ethical and legal responsibilities and limitations and understand the implications of their actions.

(c) Knowledge and skills.

(1) The student recognizes the terminology related to the health science industry. The student is expected to:

(A) identify abbreviations, acronyms, and symbols;

(B) identify the basic structure of medical words;

(C) practice word-building skills;

(D) research the origins of eponyms;

(E) recall directional terms and anatomical planes related to body structure; and

(F) define and accurately spell occupationally specific terms such as those relating to the body systems, surgical and diagnostic procedures, diseases, and treatments.

(2) The student demonstrates communication skills using the terminology applicable to the health science industry. The student is expected to:

(A) demonstrate appropriate verbal and written strategies such as correct pronunciation of medical terms and spelling in a variety of health science scenarios;

(B) employ increasingly precise language to communicate; and

(C) translate technical material related to the health science industry.

(3) The student examines available resources. The student is expected to:

(A) examine medical and dental dictionaries and multimedia resources;

(B) integrate resources to interpret technical materials; and

(C) investigate electronic media such as the Internet with appropriate supervision.

(4) The student interprets medical abbreviations. The student is expected to:

(A) distinguish medical abbreviations used throughout the health science industry; and

(B) translate medical abbreviations in simulated technical material such as physician progress notes, radiological reports, and laboratory reports.

(5) The student appropriately translates health science industry terms. The student is expected to:

(A) interpret, transcribe, and communicate vocabulary related to the health science industry;

(B) translate medical terms to conversational language to facilitate communication;

(C) distinguish medical terminology associated with medical specialists such as geneticists, pathologists, and oncologists;

(D) summarize observations using medical terminology; and

(E) correctly interpret contents of medical scenarios.

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§130.204. Health Science (One to Two Credits).

(a) General requirements. This course is recommended for students in Grades 10-12. Recommended prerequisites: Principles of Health Science and Biology.

(b) Introduction.

(1) The Health Science course is designed to provide for the development of advanced knowledge and skills related to a wide variety of health careers. Students will have hands-on experiences for continued knowledge and skill development. The course may be taught by different methodologies such as clinical rotation and career preparation learning.

(2) To pursue a career in the health science industry, students should recognize, learn to reason, think critically, make decisions, solve problems, and communicate effectively. Students should recognize that quality health care depends on the ability to work well with others.

(3) The health science industry is comprised of diagnostic, therapeutic, health informatics, support services, and biotechnology research and development systems that function individually and collaboratively to provide comprehensive health care. Students should identify the employment opportunities, technology, and safety requirements of each system. Students are expected to apply the knowledge and skills necessary to pursue a health science career through further education and employment.

(4) Professional integrity in the health science industry is dependent on acceptance of ethical and legal responsibilities. Students are expected to employ their ethical and legal responsibilities, recognize limitations, and understand the implications of their actions.

(c) Knowledge and skills.

(1) The student applies mathematics, science, English language arts, and social studies in health science. The student is expected to:

(A) solve mathematical calculations appropriate to situations in a health-related environment;

(B) communicate using medical terminology;

(C) express ideas in writing and develop skills in documentation;

(D) interpret complex technical material related to the health science industry;

(E) summarize biological and chemical processes that maintain homeostasis;

(F) explain the changes in structure and function due to trauma and disease; and

(G) research the global impact of disease prevention and cost containment.

(2) The student displays verbal and non-verbal communication skills. The student is expected to:

(A) demonstrate therapeutic communication appropriate to the situation;

(B) execute verbal and nonverbal skills when communicating with persons with sensory loss and language barriers; and

(C) apply electronic communication with appropriate supervision.

(3) The student analyzes and evaluates communication skills for maintaining healthy relationships throughout the life span. The student is expected to:

(A) evaluate how a healthy relationship influences career goals;

(B) demonstrate communication skills in building and maintaining healthy relationships;

(C) demonstrate strategies for communicating needs, wants, and emotions; and

(D) evaluate the effectiveness of conflict resolution techniques in various situations.

(4) The student relates appropriate information to the proper authority. The student is expected to:

(A) identify and retrieve reportable information; and

(B) report information according to facility policy.

(5) The student identifies documents integrated into the permanent record of the health informatics system. The student is expected to:

(A) describe document formats; and

(B) compile and record data according to regulatory agency policy.

(6) The student describes academic requirements necessary for employment in the health science industry. The student is expected to:

(A) research specific health science careers; and

(B) review employment procedures for a specific health science career.

(7) The student identifies problems and participates in the decision-making process. The student is expected to:

(A) analyze systematic procedures for problem solving;

(B) evaluate the impact of decisions; and

(C) suggest modifications based on decision outcomes.

(8) The student implements the knowledge and skills of a health science professional in the clinical setting. The student is expected to:

(A) comply with specific industry standards related to safety and substance abuse;

(B) model industry expectations of professional conduct such as attendance, punctuality, personal appearance, hygiene, and time management;

(C) articulate comprehension of assignment;

(D) employ medical vocabulary specific to the health-care setting;

(E) perform admission, discharge, and transfer functions in a simulated setting;

(F) demonstrate skills related to activities of daily living in rehabilitative care such as range of motion, positioning, and ambulation according to the health science industry standards, regulatory agency standards, and professional guidelines;

(G) role play techniques used in stressful situations such as trauma, chronic, and terminal illness;

(H) demonstrate first aid, vital signs, cardiopulmonary resuscitation, and automated external defibrillator skills in a laboratory setting; and

(I) perform skills specific to a health science professional such as medical assistant, dental assistant, emergency medical technician-basic, phlebotomy technician, and pharmacy technician.

(9) The student evaluates ethical behavioral standards and legal responsibilities. The student is expected to:

(A) research and describe the role of professional associations and regulatory agencies;

(B) examine legal and ethical behavior standards such as Patient Bill of Rights, Advanced Directives, and the Health Insurance Portability and Accountability Act;

(C) investigate the legal and ethical ramifications of unacceptable behavior; and

(D) perform within the designated scope of practice.

(10) The student exhibits the leadership skills necessary to function in a democratic society. The student is expected to:

(A) identify leadership skills of health science professionals;

(B) participate in group dynamics; and

(C) integrate consensus-building techniques.

(11) The student maintains a safe environment. The student is expected to:

(A) conform to governmental regulations and guidelines from entities such as the World Health Organization, Centers for Disease Control, Occupational Safety and Health Administration, Food and Drug Administration, and National Institute for Occupational Safety and Health;

(B) explain protocol related to hazardous materials and situations such as material safety data sheets;

(C) observe and report unsafe conditions; and

(D) practice recycling and waste management for cost containment and environmental protection.

(12) The student assesses wellness strategies for the prevention of disease. The student is expected to:

(A) research wellness strategies for the prevention of disease;

(B) evaluate positive and negative effects of relationships on physical and emotional health such as peers, family, and friends;

(C) explain the benefits of positive relationships among community health professionals in promoting a healthy community;

(D) examine access to quality health care; and

(E) research alternative health practices and therapies.

§130.205. Practicum in Health Science (Two to Three Credits).

(a) General requirements. This course is recommended for students in Grades 11-12. Recommended prerequisites: Health Science and Biology.

(b) Introduction.

(1) The Practicum is designed to give students practical application of previously studied knowledge and skills. Practicum experiences can occur in a variety of locations appropriate to the nature and level of experience.

(2) To pursue a career in the health science industry, students should learn to reason, think critically, make decisions, solve problems, and communicate effectively. Students should recognize that quality health care depends on the ability to work well with others.

(3) The health science industry is comprised of diagnostic, therapeutic, health informatics, support services, and biotechnology research and development systems that function individually and collaboratively to provide comprehensive health care. Students should identify the employment opportunities, technology, and safety requirements of each system. Students are expected to apply the knowledge and skills necessary to pursue a health science career through further education and employment.

(4) Professional integrity in the health science industry is dependent on acceptance of ethical and legal responsibilities. Students are expected to employ their ethical and legal responsibilities and limitations and understand the implications of their actions.

(c) Knowledge and skills.

(1) The student applies mathematics, science, English language arts, and social sciences in health science. The student is expected to:

(A) interpret data from various sources in formulating conclusions;

(B) compile information from a variety of sources to create a technical report;

(C) plan, prepare, and deliver a presentation;

(D) examine the environmental factors that affect homeostasis;

(E) relate anatomical structure to physiological functions;

(F) distinguish atypical anatomy and physiology in the human body systems;

(G) implement scientific methods in preparing clinical case studies; and

(H) compare and contrast health issues in the global society.

(2) The student uses verbal and non-verbal communication skills. The student is expected to:

(A) accurately describe and report information, according to facility policy, observations, and procedures;

(B) demonstrate therapeutic communication skills to provide quality care; and

(C) employ therapeutic measures to minimize communication barriers.

(3) The student implements the knowledge and skills of a health science professional necessary to acquire and retain employment. The student is expected to:

(A) demonstrate proficiency in medical terminology and skills related to the health care of an individual;

(B) research academic requirements for professional advancement such as certification, licensure, registration, continuing education, and advanced degrees;

(C) describe the steps necessary for entrepreneurship in a free enterprise system;

(D) develop new problem-solving strategies based on previous knowledge and skills; and

(E) evaluate performance for continuous improvement and advancement in health science.

(4) The student employs ethical behavior standards and legal responsibilities. The student is expected to:

(A) appraise individual ethical and legal behavior standards according to professional regulatory agencies;

(B) integrate legal and ethical behavior standards such as Patient Bill of Rights, Advanced Directives, and the Health Insurance Portability and Accountability Act into the scope of practice; and

(C) critique court cases related to professional liability and ethics.

(5) The student analyzes the role of a health science team member. The student is expected to:

(A) participate in team teaching and conflict management such as peer mediation, problem solving, and negotiation skills;

(B) refine consensus-building techniques; and

(C) engage in leadership opportunities in the community.

(6) The student employs a safe environment to prevent hazardous situations. The student is expected to:

(A) integrate regulatory standards such as standard precautions and safe patient handling;

(B) respond to emergencies consistent with the student's level of training such as fire and disaster drills;

(C) evaluate hazardous materials according to the material safety data sheets; and

(D) apply principles of infection control and body mechanics in all aspects of the health science industry.

(7) The student explores the knowledge and skill levels necessary for advancing in the health science professions. The student is expected to:

(A) interpret knowledge and skills that are transferable among health science professions;

(B) plan academic achievement for advancement in the health science industry; and

(C) analyze emerging technologies in the health science industry.

(8) The student implements skills in monitoring individual health status during therapeutic or diagnostic procedures. The student is expected to:

(A) describe pre-procedural preparations;

(B) observe therapeutic or diagnostic procedures;

(C) identify care indicators of health status; and

(D) record health status according to facility protocol.

(9) The student documents technical knowledge and skills. The student is expected to:

(A) update a professional portfolio to include:

(i) technical skill competencies;

(ii) licensures or certifications;

(iii) awards and scholarships;

(iv) extended learning experiences such as community service and active participation in career and technical student organizations and professional organizations;

(v) abstract of technical competencies mastered during the practicum;

(vi) resumé;

(vii) samples of work; and

(viii) evaluation from the practicum supervisor; and

(B) present the portfolio to all interested stakeholders such as in a poster presentation.

§130.206. Anatomy and Physiology (One Science Credit).

(a) General requirements. This course is recommended for students in Grades 10-12. Recommended prerequisites: three credits of science. To receive credit in science, students must meet the 40% laboratory and fieldwork requirement identified in §74.3(b)(2)(C) of this title (relating to Description of a Required Secondary Curriculum).

(b) Introduction.

(1) Anatomy and Physiology. In Anatomy and Physiology, students conduct laboratory and field investigations, use scientific methods during investigations, and make informed decisions using critical thinking and scientific problem solving. Students in Anatomy and Physiology study a variety of topics, including the structure and function of the human body and the interaction of body systems for maintaining homeostasis.

(2) Nature of science. 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 scientifically testable.

(3) Scientific inquiry. Scientific inquiry is the planned and deliberate investigation of the natural world. Scientific methods of investigation are experimental, descriptive, or comparative. The method chosen should be appropriate to the question being asked.

(4) Science and social ethics. Scientific decision making is a way of answering questions about the natural world. 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).

(5) Science, systems, and models. A system is a collection of cycles, structures, and processes that interact. 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. 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.

(c) Knowledge and skills.

(1) The student conducts investigations, for at least 40% of instructional time, using safe, environmentally appropriate, and ethical practices. These investigations must involve actively obtaining and analyzing data with physical equipment, but may also involve experimentation in a simulated environment as well as field observations that extend beyond the classroom. The student is expected to:

(A) demonstrate safe practices during laboratory and field investigations; and

(B) demonstrate an understanding of the use and conservation of resources and the proper disposal or recycling of materials.

(2) The student uses scientific methods and equipment during laboratory and field investigations. The student is expected to:

(A) know the definition of science and understand that it has limitations, as specified in subsection (b)(2) of this section;

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

(C) know 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;

(D) distinguish between scientific hypotheses and scientific theories;

(E) plan and implement descriptive, comparative, and experimental investigations, including asking questions, formulating testable hypotheses, and selecting equipment and technology;

(F) collect and organize qualitative and quantitative data and make measurements with accuracy and precision using tools such as calculators, spreadsheet software, data-collecting probes, computers, standard laboratory glassware, microscopes, various prepared slides, stereoscopes, metric rulers, electronic balances, hand lenses, Celsius thermometers, hot plates, lab notebooks or journals, timing devices, Petri dishes, lab incubators, dissection equipment, meter sticks, and models, diagrams, or samples of biological specimens or structures;

(G) analyze, evaluate, make inferences, and predict trends from data; and

(H) communicate valid conclusions supported by the data through methods such as lab reports, labeled drawings, graphic organizers, journals, summaries, oral reports, and technology-based reports.

(3) The student uses critical thinking, scientific reasoning, and problem solving to make informed decisions within and outside the classroom. The student is expected to:

(A) in all fields of science, analyze, evaluate, and critique scientific explanations by using empirical evidence, logical reasoning, and experimental and observational testing, including examining all sides of scientific evidence of those scientific explanations, so as to encourage critical thinking by the student;

(B) communicate and apply scientific information extracted from various sources such as current events, news reports, published journal articles, and marketing materials;

(C) draw inferences based on data related to promotional materials for products and services;

(D) evaluate the impact of scientific research on society and the environment;

(E) evaluate models according to their limitations in representing biological objects or events; and

(F) research and describe the history of science and contributions of scientists.

(4) The student evaluates the energy needs of the human body and the processes through which these needs are fulfilled. The student is expected to:

(A) analyze the chemical reactions that provide energy for the body;

(B) evaluate the means, including the structure and function of the digestive system, by which energy is processed and stored within the body;

(C) analyze the effects of energy deficiencies in malabsorption disorders such as diabetes, hypothyroidism, and Crohn's disease; and

(D) analyze the effects of energy excess in disorders such as obesity as it relates to cardiovascular and musculoskeletal systems.

(5) The student differentiates the responses of the human body to internal and external forces. The student is expected to:

(A) explain the coordination of muscles, bones, and joints that allows movement of the body;

(B) investigate and report the uses of various diagnostic and therapeutic technologies;

(C) interpret normal and abnormal contractility conditions such as in edema, glaucoma, aneurysms, and hemorrhage;

(D) analyze and describe the effects of pressure, movement, torque, tension, and elasticity on the human body; and

(E) perform an investigation to determine causes and effects of force variance and communicate findings.

(6) The student examines the body processes that maintain homeostasis. The student is expected to:

(A) investigate and describe the integration of the chemical and physical processes, including equilibrium, temperature, pH balance, chemical reactions, passive transport, active transport, and biofeedback, that contribute to homeostasis; and

(B) determine the consequences of the failure to maintain homeostasis.

(7) The student examines the electrical conduction processes and interactions. The student is expected to:

(A) illustrate conduction systems such as nerve transmission or muscle stimulation;

(B) investigate the therapeutic uses and effects of external sources of electricity on the body system; and

(C) evaluate the application of advanced technologies such as electroencephalogram, electrocardiogram, bionics, transcutaneous electrical nerve stimulation, and cardioversion.

(8) The student explores the body's transport systems. The student is expected to:

(A) analyze the physical, chemical, and biological properties of transport systems, including circulatory, respiratory, and excretory;

(B) determine the factors that alter the normal functions of transport systems; and

(C) contrast the interactions among the transport systems.

(9) The student investigates environmental factors that affect the human body. The student is expected to:

(A) identify the effects of environmental factors such as climate, pollution, radioactivity, chemicals, electromagnetic fields, pathogens, carcinogens, and drugs on body systems; and

(B) explore measures to minimize harmful environmental factors on body systems.

(10) The student investigates structure and function of the human body. The student is expected to:

(A) analyze the relationships between the anatomical structures and physiological functions of systems, including the integumentary, nervous, skeletal, musculoskeletal, cardiovascular, respiratory, gastrointestinal, endocrine, and reproductive;

(B) evaluate the cause and effect of disease, trauma, and congenital defects on the structure and function of cells, tissues, organs, and systems;

(C) research technological advances and limitations in the treatment of system disorders; and

(D) examine characteristics of the aging process on body systems.

(11) The student describes the process of reproduction and growth and development. The student is expected to:

(A) explain embryological development of tissues, organs, and systems;

(B) identify the functions of the male and female reproductive systems; and

(C) summarize the human growth and development cycle.

(12) The student recognizes emerging technological advances in science. The student is expected to:

(A) recognize advances in stem cell research such as cord blood utilization; and

(B) recognize advances in bioengineering and transplant technology.

§130.207. Medical Microbiology (One-Half to One Science Credit).

(a) General requirements. This course is recommended for students in Grades 10-12. Recommended prerequisites: three credits of science. To receive credit in science, students must meet the 40% laboratory and fieldwork requirement identified in §74.3(b)(2)(C) of this title (relating to Description of a Required Secondary Curriculum).

(b) Introduction.

(1) Medical Microbiology. Students in Medical Microbiology explore the microbial world, studying topics such as pathogenic and non-pathogenic microorganisms, laboratory procedures, identifying microorganisms, drug resistant organisms, and emerging diseases.

(2) Nature of science. 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 scientifically testable.

(3) Scientific inquiry. Scientific inquiry is the planned and deliberate investigation of the natural world. Scientific methods of investigation are experimental, descriptive, or comparative. The method chosen should be appropriate to the question being asked.

(4) Science and social ethics. Scientific decision making is a way of answering questions about the natural world. 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).

(5) Science, systems, and models. A system is a collection of cycles, structures, and processes that interact. 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. 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.

(c) Knowledge and skills.

(1) The student conducts investigations, for at least 40% of instructional time, using safe, environmentally appropriate, and ethical practices. These investigations must involve actively obtaining and analyzing data with physical equipment, but may also involve experimentation in a simulated environment as well as field observations that extend beyond the classroom. The student is expected to:

(A) demonstrate safe practices during laboratory and field investigations; and

(B) demonstrate an understanding of the use and conservation of resources and the proper disposal or recycling of materials.

(2) The student uses scientific methods and equipment during laboratory and field investigations. The student is expected to:

(A) know the definition of science and understand that it has limitations, as specified in subsection (b)(2) of this section;

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

(C) know 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;

(D) distinguish between scientific hypotheses and scientific theories;

(E) plan and implement descriptive, comparative, and experimental investigations, including asking questions, formulating testable hypotheses, and selecting equipment and technology;

(F) collect and organize qualitative and quantitative data and make measurements with accuracy and precision using tools such as calculators, spreadsheet software, data-collecting probes, computers, standard laboratory glassware, microscopes, various prepared slides, stereoscopes, metric rulers, electronic balances, hand lenses, Celsius thermometers, hot plates, lab notebooks or journals, timing devices, Petri dishes, lab

incubators, dissection equipment, meter sticks, and models, diagrams, or samples of biological specimens or structures;

(G) analyze, evaluate, make inferences, and predict trends from data; and

(H) communicate valid conclusions supported by the data through methods such as lab reports, labeled drawings, graphic organizers, journals, summaries, oral reports, and technology-based reports.

(3) The student uses critical thinking, scientific reasoning, and problem solving to make informed decisions within and outside the classroom. The student is expected to:

(A) in all fields of science, analyze, evaluate, and critique scientific explanations by using empirical evidence, logical reasoning, and experimental and observational testing, including examining all sides of scientific evidence of those scientific explanations, so as to encourage critical thinking by the student;

(B) communicate and apply scientific information extracted from various sources such as current events, news reports, published journal articles, and marketing materials;

(C) draw inferences based on data related to promotional materials for products and services;

(D) evaluate the impact of scientific research on society and the environment;

(E) evaluate models according to their limitations in representing biological objects or events; and

(F) research and describe the history of science and contributions of scientists.

(4) The student describes the relationships between microorganisms and health and wellness in the human body. The student is expected to:

(A) research and describe the historical development of microbiology as it relates to health care of an individual;

(B) identify chemical processes of microorganisms;

(C) recognize the factors required for microbial reproduction and growth;

(D) explain pathogenic and non-pathogenic microbes in the human body;

(E) describe the morphology and characteristics of microorganisms using a variety of microbiological techniques;

(F) discuss the results of laboratory procedures that are used to identify microorganisms;

(G) explain how pathogens affect the human body systems; and

(H) research roles, functions, and responsibilities of agencies governing infectious disease control.

(5) The student examines the role of pathogens in infectious diseases. The student is expected to:

(A) outline the infectious process;

(B) classify microorganisms using a dichotomous key;

(C) categorize diseases caused by bacteria, fungi, viruses, protozoa, rickettsias, arthropods, and helminths;

(D) explain the body's immune response and defenses against infection;

(E) evaluate the effects of anti-microbial agents;

(F) examine reemergence of diseases such as malaria, tuberculosis, and polio;

(G) investigate drug-resistant microorganisms, including methicillin-resistant *Staphylococcus aureus*, vancomycin-resistant enterococci, and superbugs; and

(H) outline the role of the governing agencies in monitoring and establishing guidelines based on the spread of infectious diseases.

§130.208. Pathophysiology (One-Half to One Science Credit).

(a) General requirements. This course is recommended for students in Grades 11-12. Recommended prerequisites: three credits of science. To receive credit in science, students must meet the 40% laboratory and fieldwork requirement identified in §74.3(b)(2)(C) of this title (relating to Description of a Required Secondary Curriculum).

(b) Introduction.

(1) Pathophysiology. In Pathophysiology, students conduct laboratory and field investigations, use scientific methods during investigations, and make informed decisions using critical thinking and scientific problem solving. Students in Pathophysiology study disease processes and how humans are affected. Emphasis is placed on prevention and treatment of disease. Students will differentiate between normal and abnormal physiology.

(2) Nature of science. 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 scientifically testable.

(3) Scientific inquiry. Scientific inquiry is the planned and deliberate investigation of the natural world. Scientific methods of investigation are experimental, descriptive, or comparative. The method chosen should be appropriate to the question being asked.

(4) Science and social ethics. Scientific decision making is a way of answering questions about the natural world. 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).

(5) Science, systems, and models. A system is a collection of cycles, structures, and processes that interact. 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. 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.

(c) Knowledge and skills.

(1) The student conducts investigations, for at least 40% of instructional time, using safe, environmentally appropriate, and ethical practices. These investigations must involve actively obtaining and analyzing data with physical equipment, but may also involve experimentation in a simulated environment as well as field observations that extend beyond the classroom. The student is expected to:

(A) demonstrate safe practices during laboratory and field investigations; and

(B) demonstrate an understanding of the use and conservation of resources and the proper disposal or recycling of materials.

(2) The student uses scientific methods and equipment during laboratory and field investigations. The student is expected to:

(A) know the definition of science and understand that it has limitations, as specified in subsection (b)(2) of this section;

(B) know that hypotheses are tentative and testable statements that must be capable of being supported or not supported by observational evidence. Hypotheses of durable explanatory

power which have been tested over a wide variety of conditions are incorporated into theories;

(C) know 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;

(D) distinguish between scientific hypotheses and scientific theories;

(E) plan and implement descriptive, comparative, and experimental investigations, including asking questions, formulating testable hypotheses, and selecting equipment and technology;

(F) collect and organize qualitative and quantitative data and make measurements with accuracy and precision using tools such as calculators, spreadsheet software, data-collecting probes, computers, standard laboratory glassware, microscopes, various prepared slides, stereoscopes, metric rulers, electronic balances, hand lenses, Celsius thermometers, hot plates, lab notebooks or journals, timing devices, Petri dishes, lab incubators, dissection equipment, meter sticks, and models, diagrams, or samples of biological specimens or structures;

(G) analyze, evaluate, make inferences, and predict trends from data; and

(H) communicate valid conclusions supported by the data through methods such as lab reports, labeled drawings, graphic organizers, journals, summaries, oral reports, and technology-based reports.

(3) The student uses critical thinking, scientific reasoning, and problem solving to make informed decisions within and outside the classroom. The student is expected to:

(A) in all fields of science, analyze, evaluate, and critique scientific explanations by using empirical evidence, logical reasoning, and experimental and observational testing, including examining all sides of scientific evidence of those scientific explanations, so as to encourage critical thinking by the student;

(B) communicate and apply scientific information extracted from various sources such as current events, news reports, published journal articles, and marketing materials;

(C) draw inferences based on data related to promotional materials for products and services;

(D) evaluate the impact of scientific research on society and the environment;

(E) evaluate models according to their limitations in representing biological objects or events; and

(F) research and describe the history of science and contributions of scientists.

(4) The student analyzes the mechanisms of pathology. The student is expected to:

(A) identify biological and chemical processes at the cellular level;

(B) detect changes resulting from mutations and neoplasms by examining cells, tissues, organs, and systems;

(C) identify factors that contribute to disease such as age, gender, environment, lifestyle, and heredity;

(D) examine the body's compensating mechanisms occurring under various conditions; and

(E) analyze how the body attempts to maintain homeostasis when changes occur.

(5) The student examines the process of pathogenesis. The student is expected to:

(A) identify pathogenic organisms using microbiological techniques;

(B) differentiate the stages of pathogenesis, including incubation period, prodromal period, and exacerbation or remission;

(C) analyze the body's natural defense systems against infection such as barriers, the inflammatory response, and the immune response;

(D) evaluate the effects of chemical agents, environmental pollution, and trauma on the disease process; and

(E) research stages in the progression of disease.

(6) The student examines a variety of human diseases. The student is expected to:

(A) describe on the nature of diseases according to etiology, signs and symptoms, diagnosis, prognosis, and treatment options;

(B) explore advanced technologies for the diagnosis and treatment of disease;

(C) examine reemergence of diseases such as malaria, tuberculosis, and polio;

(D) describe drug-resistant diseases;

(E) differentiate between congenital disorders and childhood diseases; and

(F) investigate ways diseases affect multiple body systems.

(7) The student integrates the effects of disease prevention and control. The student is expected to:

(A) evaluate public health issues related to asepsis, isolation, immunization, and quarantine;

(B) analyze the effects of stress and aging on the body;

(C) evaluate treatment options for diseases;

(D) investigate diseases that threaten world health and propose intervention strategies; and

(E) develop a plan for personal health and wellness.

§130.209. World Health Research (One Credit).

(a) General requirements. This course is recommended for students in Grades 11-12. Recommended prerequisites: Biology and Chemistry.

(b) Introduction. This course examines major world health problems and emerging technologies as solutions to these medical concerns. The course is designed to improve students' understanding of the cultural, infrastructural, political, educational, and technological constraints and inspire ideas for appropriate technological solutions to global medical care issues.

(c) Knowledge and skills.

(1) The student explores and discusses current major human health problems in the world. The student is expected to:

(A) describe the pathophysiology of the three leading causes of death in developing and developed countries;

(B) discuss history of diseases and the evolution of medical technology over time;

(C) contrast health problems in developing and developed countries;

(D) describe the function of the World Health Organization;

(E) define and calculate incidence, morbidity, and mortality; and

(F) identify and describe the challenges in global health, which can have the greatest impact on health in developing nations.

(2) The student explains who pays for health care in the world today. The student is expected to:

(A) compare the availability of health care in developing and developed countries;

(B) discuss and contrast the four basic health care system models such as the Beveridge Model, Bismarck Model, National Health Insurance Model, and the Out-of-Pocket Model;

(C) explain how countries such as the United Kingdom, Japan, Germany, Taiwan, Switzerland, and the United States of America pay for health care;

(D) describe how health care expenditures have changed over time; and

(E) identify the major contributors to the rising health science industry costs.

(3) The student describes the engineering technologies developed to address clinical needs. The student is expected to:

(A) describe technologies that support the prevention and treatment of infectious diseases;

(B) explain the implication of vaccines on the immune system;

(C) investigate technologies used for the early detection of cancer;

(D) investigate technologies used for the treatment of several different types of cancers;

(E) explain the cardiovascular system and the technologies used in the diagnosis and treatment of heart disease; and

(F) describe and discuss technologies developed to support vital organ failure.

(4) The student explores how human clinical trials are designed, conducted, and evaluated. The student is expected to:

(A) identify types of clinical trials;

(B) define and calculate a sample size; and

(C) analyze quantitative methods used to describe clinical trials.

(5) The student recognizes the ethics involved in clinical research. The student is expected to:

(A) define informed consent;

(B) explain who can give informed consent;

(C) identify issues in research that influence the development of ethical principles and legal requirements currently governing research with human subjects; and

(D) explain the ethical guidelines for the conduct of research involving human subjects.

(6) The student explains how medical technologies are managed. The student is expected to:

(A) describe how health science research is funded;

(B) explain the role of the Food and Drug Administration in approving new drugs and medical devices; and

(C) analyze factors that affect the dissemination of new medical technologies.

(7) The student applies research principles to create a project that addresses a major health problem. The student is expected to:

(A) construct charts and graphs in facilitating data analysis and in communicating experimental results clearly and effectively using technology; and

(B) present the project to classmates, health professionals, parents, or instructors.