ATTACHMENT II
Text of Proposed Revisions to 19 TAC

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

Subchapter B. Architecture and Construction

§130.64. Practicum in Construction Technology (Two Credits), Adopted 2015.

(a) General requirements. This course is recommended for students in Grade 12. Prerequisite: Construction Technology II , Building Maintenance Technology II; Electrical Technology II; Heating, Ventilation, and Air Conditioning (HVAC) and Refrigeration Technology II; Plumbing Technology I; or Mill and Cabinetmaking Technology . Students shall be awarded two credits for successful completion of this course. A student may repeat this course once for credit provided that the student is experiencing different aspects of the industry and demonstrating proficiency in additional and more advanced knowledge and skills.

(b) Introduction.

(1)-(2) (No change.)

(3) In Practicum in Construction Technology, students will be challenged with the application of [~~gained~~] knowledge and skills gained in previous construction-related coursework [~~from Construction Technology I and II~~] . In many cases students will be allowed to work at a job (paid or unpaid) outside of school or be involved in local projects the school has approved for this class.

(4)-(5) (No change.)

(c) (No change.)

§130.69. Extended Practicum in Construction Technology (One Credit), Adopted 2015.

(a) General requirements. This course is recommended for students in Grade 12. The practicum course is a paid or unpaid capstone experience for students participating in a coherent sequence of career and technical education courses in the Architecture and Construction Career Cluster. Prerequisite: Construction Technology II , Building Maintenance Technology II; Electrical Technology II; Heating, Ventilation, and Air Conditioning (HVAC) and Refrigeration Technology II; Plumbing Technology I; or Mill and Cabinetmaking Technology . Corequisite: Practicum in Construction Technology. This course must be taken concurrently with Practicum in Construction Technology and may not be taken as a stand-alone course. Students shall be awarded one credit for successful completion of this course. A student may repeat this course once for credit provided that the student is experiencing different aspects of the industry and demonstrating proficiency in additional and more advanced knowledge and skills.

(b) Introduction.

(1)-(2) (No change.)

(3) In Extended Practicum in Construction Technology, students will be challenged with the application of [~~gained~~] knowledge and skills gained in previous construction-related coursework [~~from Construction Technology I and II~~] . In many cases students will be allowed to work at a job (paid or unpaid) outside of school or be involved in local projects the school has approved for this class.

(4)-(5) (No change.)

(c) (No change.)

Subchapter H. Health Science

§130.226. World Health Research (One Credit), Adopted 2015.

(a) General requirements. This course is recommended for students in Grades 11 and 12. Prerequisites: Biology and Chemistry. Recommended prerequisite: a course in the Health Science Career Cluster. Students shall be awarded one credit for successful completion of this course.

(b) (No change.)

(c) Knowledge and skills.

(1)-(7) (No change.)

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

(A) facilitate [~~construct charts and graphs in facilitating~~] data analysis and communicate [~~in communicating~~] experimental results clearly and effectively using technology by constructing charts and graphs ; and

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

§130.230. Pharmacology (One Credit), Adopted 2015.

(a) General requirements. This course is recommended for students in Grades 11 and 12. Prerequisites: Biology and Chemistry. Recommended prerequisite: a course from the Health Science Career Cluster. Students shall be awarded one credit for successful completion of this course.

(b) (No change.)

(c) Knowledge and skills.

(1) (No change.)

(2) The student explores the field of pharmacology and foundation of pharmacology [~~identifies individuals associated with manufacturing, dispensing, and administrating pharmaceuticals as a valued member of a health care team~~] . The student is expected to:

(A) define pharmacology and its major subdivisions, including pharmacodynamics, pharmacokinetics, and pharmacotherapeutics;

(B) explain the difference between therapeutic effects, side effects, and toxic effects;

(C) identify a drug receptor in the human body;

(D) trace the interaction and antagonist receptors [~~receptor~~] ;

(E) explain the relationship among [~~between~~] drug dosage, drug response, and time;

(F) explain drug safety and therapeutic index;

(G) describe three names by which drugs are known; and

(H) list two common drug reference books.

(3) The student identifies individuals and careers associated with manufacturing, dispensing, and administering [~~administrating~~] pharmaceuticals [~~as a valued member of a health care team~~] . The student is expected to:

(A) identify career pathways related to pharmacology;

(B) define the role of the pharmacy team;

(C) research and describe emerging pharmacy career opportunities;

(D) analyze the impact of pharmaceuticals on the costs of health care; and

(E) evaluate the impact of pharmaceuticals on the costs of society.

(4) The student explains the ethical and legal responsibilities of pharmacists and pharmacy technicians. The student is expected to:

(A) describe the legal terms and consequences associated with prescription errors;

[~~(B) analyze the six routes of medication administration;~~]

(B) [~~(C)~~]differentiate between negligence, product liability, contributory negligence, and regulatory law;

(C) [~~(D)~~] evaluate the effect of medication errors related to the pharmacy and the industry;

(D) [~~(E)~~]discuss the elements of a lawsuit; and

(E) [~~(F)~~] define professional liability.

(5)-(9) (No change.)

§130.231. Health Science Theory (One Credit), Adopted 2015.

(a) General requirements. This course is recommended for students in Grades 10-12. Prerequisite: [~~Prerequisites: Principles of Health Science and~~] Biology. Recommended corequisite: Health Science Clinical. Students shall be awarded one credit for successful completion of this course.

(b)-(c) (No change.)

§130.232. Health Science Clinical (One Credit), Adopted 2015.

(a) General requirements. This course is recommended for students in Grades 10-12. Prerequisite [~~Prerequisites~~] : Biology [~~and Principles of Health Science~~] . Corequisite: Health Science Theory. This course must be taken concurrently with Health Science Theory and may not be taken as a stand-alone course. Districts are encouraged to offer this course in a consecutive block with Health Science Theory to allow students sufficient time to master the content of both courses. Students shall be awarded one credit for successful completion of this course.

(b)-(c) (No change.)

§130.233. Practicum in Health Science (Two Credits), Adopted 2015.

(a) General requirements. This course is recommended for students in Grades 11 and 12. Prerequisites: [~~Principles of Health Science,~~] Health Science Theory [~~,~~] and Biology. Students shall be awarded two credits for successful completion of this course. A student may repeat this course once for credit provided that the student is experiencing different aspects of the industry and demonstrating proficiency in additional and more advanced knowledge and skills.

(b)-(c) (No change.)

§130.234. Extended Practicum in Health Science (One Credit), Adopted 2015.

(a) General requirements. This course is recommended for students in Grades 11 and 12. The practicum course is a paid or unpaid capstone experience for students participating in a coherent sequence of career and technical education courses in the Health Science Career Cluster. Prerequisites: [~~Principles of Health Science,~~] Health Science Theory [~~,~~] and Biology. Corequisite: Practicum in Health Science. This course must be taken concurrently with Practicum in Health Science and may not be taken as a stand-alone course. Students shall be awarded one credit for successful completion of this course. A student may repeat this course once for credit provided that the student is experiencing different aspects of the industry and demonstrating proficiency in additional and more advanced knowledge and skills.

(b)-(c) (No change.)

Subchapter J. Human Services

§130.283. Cosmetology I (Two Credits), Adopted 2015.

(a) General requirements. This course is recommended for students in Grades 10 and 11. Recommended prerequisite: Introduction to Cosmetology. Recommended corequisite: Cosmetology I Lab. Students shall be awarded two credits for successful completion of this course.

(b)-(c) (No change.)

§130.284. Cosmetology II (Two Credits), Adopted 2015.

(a) General requirements. This course is recommended for students in Grades 11 and 12. Prerequisite: Cosmetology I. Recommended corequisite: Cosmetology II Lab. Students shall be awarded two credits for successful completion of this course.

(b)-(c) (No change.)

§130.286. Cosmetology I Lab (One Credit), Adopted 2018.

(a) General requirements. This course is recommended for students in Grades 10 and 11. Recommended prerequisite: Introduction to Cosmetology. This course must be taken concurrently with Cosmetology I and may not be taken as a stand-alone course. Districts are encouraged to offer this lab in a consecutive block with Cosmetology I to allow students sufficient time to master the content of both courses. 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 and relevant technical knowledge and skills for students to further their education and succeed in current or emerging professions.

(2) The Human Services Career Cluster focuses on preparing individuals for employment in career pathways that relate to families and human needs such as early childhood development and services, counseling and mental health services, family and community services, personal care services, and consumer services.

(3) Cosmetology I Lab provides instruction and content directly aligned to the licensure requirements as established by the Texas Department of Licensing and Regulation (TDLR).

(4) Careers in cosmetology include all aspects of sterilization and sanitation procedures and personal care services, including hair care, nail care, and skin care. Students will be expected to develop an understanding of the technical knowledge and skills needed for success in the personal care services industry.

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

(6) 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:

(A) demonstrate professionalism in selecting appropriate attire for the profession and work site;

(B) demonstrate effective oral and written communication with diverse individuals, including coworkers, management, and clients;

(C) demonstrate personal ownership over the quality of individual performance;

(D) explore employment opportunities, including entrepreneurship; and

(E) create appropriate document information for employment such as a resume.

(2) The student demonstrates knowledge of rules and regulations related to sanitation, disinfection, and health and safety as established by TDLR. The student is expected to:

(A) apply knowledge of health and safety policies and procedures in a work setting in compliance with TDLR requirements;

(B) demonstrate cleaning and disinfecting of the work environment, including implements and equipment;

(C) demonstrate techniques to avoid risks and potentially hazardous situations in compliance with TDLR requirements; and

(D) demonstrate industry best practices when disposing of hazardous materials in compliance with TDLR requirements.

(3) The student demonstrates knowledge of appropriate use of tools, equipment, technologies, and materials used in cosmetology. The student is expected to:

(A) demonstrate safe and effective use of tools to enhance client services;

(B) practice and promote professional efficiency by using ergonomically designed equipment; and

(C) critique, select, and operate effective technology resources in a professional salon as available.

(4) The student applies the practical management skills in simulated and actual work situations. The student is expected to:

(A) apply client consultation skills to guide individuals in recognizing concerns and making future appointments;

(B) select and implement a client management system appropriate for a professional work situation; and

(C) document client satisfaction, procedures, and products to facilitate ease of consultation in future appointments.

(5) The student demonstrates proficiency in executing basic cosmetology services as required for the state practical examination. The student is expected to:

(A) demonstrate proficiency of basic haircuts such as zero degree, forty-five degree, ninety degree, and one hundred eighty degree;

(B) demonstrate basic manicure skills and techniques;

(C) demonstrate basic facial service skills and techniques;

(D) demonstrate basic chemical service applications;

(E) demonstrate basic shampooing techniques;

(F) demonstrate basic permanent waving techniques;

(G) demonstrate basic curling techniques;

(H) demonstrate basic blow drying techniques; and

(I) demonstrate basic thermal styling techniques.

§130.287. Cosmetology II Lab (One Credit), Adopted 2018.

(a) General requirements. This course is recommended for students in Grades 11 and12. Prerequisite: Cosmetology I. This course must be taken concurrently with Cosmetology II and may not be taken as a stand-alone course. Districts are encouraged to offer this lab in a consecutive block with Cosmetology II to allow students sufficient time to master the content of both courses. 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 and relevant technical knowledge and skills for students to further their education and succeed in current or emerging professions.

(2) The Human Services Career Cluster focuses on preparing individuals for employment in career pathways that relate to families and human needs such as early childhood development and services, counseling and mental health services, family and community services, personal care services, and consumer services.

(3) Cosmetology II Lab provides instruction and content directly aligned to the licensure requirements as established by the Texas Department of Licensing and Regulation (TDLR).

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

(5) 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:

(A) demonstrate professionalism in selecting appropriate attire for the profession and work site;

(B) demonstrate professionalism by practicing the use of effective oral and written communication with diverse individuals, including coworkers, management, and clients;

(C) demonstrate personal ownership over the quality of individual performance;

(D) explore employment opportunities, including entrepreneurship; and

(E) collect and compile mastery-level work samples and evaluations to be included in an employment portfolio as appropriate.

(2) The student demonstrates knowledge of rules and regulations related to sanitation, disinfection, and health and safety as established by TDLR. The student is expected to:

(A) apply knowledge of health and safety policies and procedures in a work setting in compliance with TDLR requirements;

(B) demonstrate cleaning and disinfecting of the work environment, including implements and equipment;

(C) demonstrate techniques to avoid risks and potentially hazardous situations in compliance with TDLR requirements; and

(D) demonstrate industry best practices when disposing hazardous materials in compliance with TDLR requirements.

(3) The students demonstrates mastery in the use of tools, equipment, technologies, and materials used in cosmetology. The student is expected to:

(A) apply with increased fluency proficient, safe, and effective use of tools in a simulated or actual work setting to enhance client services;

(B) demonstrate with increased fluency professional efficiency by using ergonomically designed equipment; and

(C) demonstrate with increased fluency effective integration of technology sources in a professional salon as available.

(4) The student executes proficient managerial and practical skills in diverse work and professional situations with minimal direction. The student is expected to:

(A) resolve client concerns with little to no guidance by using appropriate consultation skills;

(B) practice consultation skills to guide individuals in selecting future appointments and services;

(C) assess and document client satisfaction in a simulated and actual work situation;

(D) assess and document client products to inform future client consultations; and

(E) operate a client management system in diverse work and professional situations.

(5) The student performs cosmetology services with increased fluency as required for the state practical examination in a simulated and/or work setting with minimal guidance. The student is expected to:

(A) demonstrate mastery-level haircut skills and techniques;

(B) demonstrate mastery-level manicure skills and techniques;

(C) demonstrate mastery-level facial skills and techniques;

(D) demonstrate mastery-level knowledge of chemical applications;

(E) demonstrate mastery-level shampooing techniques;

(F) demonstrate mastery-level permanent waving techniques;

(G) perform curling services while demonstrating mastery-level curling techniques;

(H) perform blow drying services while demonstrating mastery-level blow drying techniques; and

(I) perform thermal styling services while demonstrating mastery-level thermal styling techniques.

Subchapter M. Manufacturing

§130.364. Welding II (Two Credits), Adopted 2015.

(a) General requirements. This course is recommended for students in Grades 11 and 12. Prerequisite: Welding I. Recommended prerequisites: Algebra I or Geometry. Recommended corequisite: Welding II Lab. Students shall be awarded two credits for successful completion of this course.

(b) Introduction.

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

(2) The Manufacturing Career Cluster focuses on planning, managing, and performing the processing of materials into intermediate or final products and related professional and technical support activities such as production planning and control, maintenance, and manufacturing/process engineering.

(3) Welding II builds on the knowledge and skills developed in Welding I. Students will develop advanced welding concepts and skills as related to personal and career development. Students will integrate academic and technical knowledge and skills. Students will have opportunities to reinforce, apply, and transfer knowledge and skills to a variety of settings and problems.

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

(5) 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:

(A) express ideas to others in a clear, concise, and effective manner through written and verbal communication;

(B) convey written information that is easily understandable to others;

(C) demonstrate acceptable work ethics in reporting for duty and performing assigned tasks as directed;

(D) conduct oneself in a manner acceptable for the profession and work site such as suitable dress and polite speech;

(E) choose the ethical course of action and comply with all applicable rules, laws, and regulations;

(F) review the fine, detailed aspects of both quantitative and qualitative work process and end products;

(G) evaluate systems and operations; identify causes, problems, patterns, or issues; and explore workable solutions or remedies to improve situations;

(H) follow written and oral instructions and adhere to established business practices, policies, and procedures, including health and safety rules;

(I) prioritize tasks, follow schedules, and work toward goal-relevant activities in an effective, efficient manner;

(J) analyze how teams function; and

(K) evaluate employers' work expectations to measure project success.

(2) The student explores the employability characteristics of a successful worker in the global economy. The student is expected to:

(A) determine academic knowledge and skills required for postsecondary education;

(B) identify employers' expectations to foster positive customer satisfaction;

(C) demonstrate the professional standards required in the workplace such as interviewing skills, flexibility, willingness to learn new skills and acquire knowledge, self-discipline, self-worth, positive attitude, and integrity in a work situation;

(D) evaluate progress toward personal career goals;

(E) communicate effectively with others in the workplace to clarify objectives; and

(F) apply knowledge and skills related to health and safety in the workplace as specified by appropriate governmental regulations.

(3) The student applies academic skills to the requirements of welding. The student is expected to:

(A) demonstrate mathematical skills to estimate costs;

(B) explain the impact of accurate readings of measuring devices on cost estimates;

(C) justify the selection of a tool to make accurate measurements;

(D) compute measurements such as area, surface area, volume, and perimeter;

(E) solve problems using whole numbers, fractions, mixed numbers, and decimals;

(F) apply right triangle relationships using the Pythagorean Theorem; and

(G) select a mathematical formula for estimation.

(4) The student knows the functions and applications of the tools, equipment, technologies, and materials used in welding. The student is expected to:

(A) use welding equipment according to safety standards;

(B) dispose of environmentally hazardous materials used in welding;

(C) explain the importance of recycling materials used in welding;

(D) evaluate the performance impact of emerging technologies in welding;

(E) use appropriate personal protective equipment to follow safety measures; and

(F) investigate the use of automated welding machines such as numerical control, computer numerical control, and robotics-controlled welding machines.

(5) The student illustrates welding joint design, symbols, and welds. The student is expected to:

(A) use knowledge of engineering drawings to complete an advanced project; and

(B) evaluate projects using engineering drawing specifications.

(6) The student applies the concepts and skills of welding to perform tasks. The student is expected to:

(A) work independently in fabricating welded projects;

(B) work collaboratively with other students to complete a real-world application item; and

(C) troubleshoot equipment.

(7) The student analyzes the concepts and intricacies of inspections related to welding codes. The student is expected to:

(A) inspect the welding projects of team members;

(B) select codes for weld inspections; and

(C) critique and evaluate the weldments of team members.

(8) The student performs advanced cutting processes on carbon steels. The student is expected to:

(A) observe safe operating practices;

(B) apply safe handling of compressed gases; and

(C) perform cutting processes according to accepted welding standards.

(9) The student performs shielded metal arc welding on metals. The student is expected to:

(A) employ safe operating practices; and

(B) demonstrate skills required to make welds in all positions according to the American Welding Society (AWS) Schools Excelling through National Skills Education (SENSE) welding standards.

(10) The student performs flux cored metal arc welding. The student is expected to:

(A) use safe operating practices;

(B) perform fillet and groove welds; and

(C) perform welds in all appropriate positions according to the AWS SENSE welding standards.

(11) The student performs gas tungsten arc welding on metals. The student is expected to:

(A) employ safe operating practices;

(B) perform fillet and groove welds in all positions; and

(C) perform welds on metals such as carbon steel, stainless steel, pipe, and aluminum to the AWS SENSE welding standards.

§130.365. Welding II Lab (One Credit), Adopted 2015.

(a) General requirements. This lab course is recommended for students in Grades 11 and 12. Prerequisite: Welding I. Corequisite: Welding II. This course must be taken concurrently with Welding II and may not be taken as a stand-alone course. Districts are encouraged to offer this course in a consecutive block with Welding II to allow students sufficient time to master the content of both courses. 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 and relevant technical knowledge and skills for students to further their education and succeed in current or emerging professions.

(2) The Manufacturing Career Cluster focuses on planning, managing, and performing the processing of materials into intermediate or final products and related professional and technical support activities such as production planning and control, maintenance, and manufacturing/process engineering.

(3) Welding II Lab provides an introduction to welding technology with an emphasis on basic welding laboratory principles and operating procedures. Topics include: industrial safety and health practices, hand tool and power machine use, measurement, laboratory operating procedures, welding power sources, welding career potentials, and introduction to welding codes and standards. This course provides knowledge, skills, and technologies required for employment in welding industries. Students will develop knowledge and skills related to this system and apply them to personal career development. This course supports integration of academic and technical knowledge and skills. Students will reinforce, apply, and transfer knowledge and skills to a variety of settings and problems. Knowledge about career opportunities, requirements, and expectations and the development of workplace skills prepare students for future success.

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

(5) 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:

(A) express ideas to others in a clear, concise, and effective manner through written and verbal communication;

(B) convey written information that is easily understandable to others;

(C) demonstrate acceptable work ethics in reporting for duty and performing assigned tasks as directed;

(D) conduct oneself in a manner acceptable for the profession and work site such as suitable dress and polite speech;

(E) choose the ethical course of action and comply with all applicable rules, laws, and regulations;

(F) review the fine, detailed aspects of both quantitative and qualitative work process and end products;

(G) evaluate systems and operations; identify causes, problems, patterns, or issues; and explore workable solutions or remedies to improve situations;

(H) follow written and oral instructions and adhere to established business practices, policies, and procedures, including health and safety rules; and

(I) prioritize tasks, follow schedules, and work toward goal-relevant activities in an effective, efficient manner.

(2) The student demonstrates the functions and applications of the tools, equipment, technologies, and metals used in code welding. The student is expected to:

(A) use welding equipment according to safety standards;

(B) identify and properly dispose of environmentally hazardous materials used in welding;

(C) explain the importance of recycling materials used in welding; and

(D) use appropriate personal protective equipment.

(3) The student applies the concepts and skills of welding of actual work situations. The student is expected to:

(A) work independently to fabricate welded projects with minimal assistance;

(B) work collaboratively with other students to complete relevant projects; and

(C) troubleshoot equipment.

(4) The student analyzes the concepts and intricacies of inspections and related codes. The student is expected to:

(A) explain weld inspection processes; and

(B) produce acceptable weldments to standards related to industry codes such as the American Welding Society (AWS), American National Standards Institute, and Canadian Welding Bureau.

(5) The student performs oxy-fuel cutting processes. The student is expected to:

(A) use safe operating practices;

(B) perform safe handling of compressed gases;

(C) assemble components involved in setting up for oxy-fuel gas cutting processes;

(D) demonstrate proper set-up for cutting techniques such as piercing, straight line, and bevel; and

(E) evaluate acceptable and unacceptable cuts.

(6) The student performs plasma arc cutting on metals. The student is expected to:

(A) use safe operating practices;

(B) explain the difference between safe and unsafe storage and handling of compressed gas supply;

(C) employ proper set-up procedures for plasma arc cutting; and

(D) demonstrate proper cutting techniques, including straight line, piercing, and bevels.

(7) The student performs shielded metal arc welding principles and practices on metals. The student is expected to:

(A) use safe operating practices;

(B) demonstrate shielded metal arc welding principles;

(C) demonstrate proper set-up procedures for shielded metal arc welding;

(D) select appropriate electrodes for base metal in shielded metal arc welding;

(E) perform welds such as fillet and groove according to the AWS Schools Excelling through National Skills Education (SENSE) welding standards;

(F) perform multiple pass welds;

(G) prepare joints for welding; and

(H) explain heating processes such as pre-heating and post-heating.

(8) The student demonstrates proper set-up procedure for gas metal arc welding. The student is expected to:

(A) use safe operating practices;

(B) demonstrate gas metal arc welding principles;

(C) demonstrate proper set-up for gas metal arc welding;

(D) select appropriate filler metals for base metal in gas metal arc welding; and

(E) perform fillet and groove welds in all positions according to the AWS SENSE welding standards.

(9) The student performs flux cored arc welding principles and practices on metals. The student is expected to:

(A) use safe operating practices;

(B) employ and appraise flux cored arc welding principles;

(C) demonstrate proper set-up procedures for flux cored arc welding;

(D) appraise appropriate filler metal for base metal in flux cored arc welding;

(E) perform fillet and groove welds; and

(F) perform welds in all appropriate positions according to the AWS SENSE welding standards.

(10) The student performs gas tungsten arc welding principles and practices on metals. The student is expected to:

(A) use safe operating practices;

(B) demonstrate gas tungsten arc welding principles;

(C) demonstrate proper set-up for gas tungsten arc welding;

(D) select appropriate use of filler metals for base metal in gas tungsten arc welding; and

(E) perform welds in all appropriate positions according to the AWS SENSE welding standards.

(11) The student performs weldment fabrications. The student is expected to:

(A) identify layout tools;

(B) perform a part layout on plate according to a blueprint;

(C) perform a layout of a pipe fitting according to a blueprint; and

(D) perform an assembly according to a blueprint.

Subchapter O. Science, Technology, Engineering, and Mathematics

§130.404. Principles of Technology (One Credit), Adopted 2015.

(a) General requirements. This course is recommended for students in Grades 10-12. Prerequisites: one credit of high school science and Algebra I. Students must meet the 40% laboratory and fieldwork requirement. 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 and relevant technical knowledge and skills for students to further their education and succeed in current or emerging professions.

(2) The Science, Technology, Engineering, and Mathematics (STEM) Career Cluster focuses on planning, managing, and providing scientific research and professional and technical services, including laboratory and testing services, and research and development services.

(3) In Principles of Technology, students will conduct laboratory and field investigations, use scientific practices [~~methods~~] during investigations, and make informed decisions using critical thinking and scientific problem solving. Various systems will be described in terms of space, time, energy, and matter. Students will study a variety of topics that include laws of motion, conservation of energy, momentum, electricity, magnetism, thermodynamics, and characteristics and behavior of waves. Students will apply physics concepts and perform laboratory experimentations for at least 40% of instructional time using safe practices.

(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 by empirical science .

(5) 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.

(6) 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).

(7) A system is a collection of cycles, structures, and processes that interact. All systems have basic properties that can be described in terms of 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.

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

(9) 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:

(A) demonstrate knowledge of how to dress appropriately, speak politely, and conduct oneself in a manner appropriate for the profession;

(B) show the ability to cooperate, contribute, and collaborate as a member of a group in an effort to achieve a positive collective outcome;

(C) present written and oral communication in a clear, concise, and effective manner;

(D) demonstrate time-management skills in prioritizing tasks, following schedules, and performing goal-relevant activities in a way that produces efficient results; and

(E) demonstrate punctuality, dependability, reliability, and responsibility in performing assigned tasks as directed.

(2) The student, for at least 40% of instructional time, conducts laboratory and field investigations using safe, environmentally appropriate, and ethical practices. 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.

(3) 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)(4) 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 that 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 may be subject to change as new areas of science and new technologies are developed;

(D) distinguish between scientific hypotheses and scientific theories;

(E) design and implement investigative procedures, including making observations, asking well-defined questions, formulating testable hypotheses, identifying variables, selecting appropriate equipment and technology, and evaluating numerical answers for reasonableness;

(F) collect and organize qualitative and quantitative data and make measurements with accuracy and precision using tools such as multimeters (current, voltage, resistance), [~~triple beam~~] balances, batteries, [~~clamps,~~] dynamics demonstration equipment, collision apparatus, [~~data acquisition probes, discharge tubes with power supply (H, He, Ne, Ar), hand-held visual spectroscopes, hot plates, slotted and hooked~~] lab masses, [~~bar~~] magnets, [~~horseshoe magnets,~~] plane mirrors, convex lenses, [~~pendulum support, power supply, ring clamps, ring stands,~~] stopwatches, trajectory apparatus, [~~tuning forks, carbon paper,~~] graph paper, magnetic compasses, [~~polarized film, prisms,~~] protractors, [~~resistors, friction blocks, mini lamps (bulbs) and sockets, electrostatics kits, 90-degree rod clamps,~~] metric rulers, spring scales, [~~knife blade switches, Celsius~~] thermometers, [~~meter sticks, scientific calculators, graphing technology, computers, cathode ray tubes with horseshoe magnets, ballistic carts or equivalent, resonance tubes, spools of nylon thread or string, containers of iron filings, rolls of white craft paper, copper wire, Periodic Table, electromagnetic spectrum charts,~~] and slinky springs [~~, wave motion ropes, and laser pointers~~] ;

(G) use a wide variety of additional course equipment as appropriate such as ripple tank with wave generator, wave motion rope, tuning forks, hand-held visual spectroscopes, discharge tubes with power supply (H, He, Ne, Ar), electromagnetic spectrum charts, laser pointers, micrometer, caliper, [~~radiation monitor,~~] computer, data acquisition probes, scientific calculators, graphing technology, electrostatic kits, [~~ballistic~~

~~pendulum,~~] electroscope, inclined plane, optics bench, optics kit, polarized film, prisms, pulley with table clamp, motion detectors, photogates, friction blocks, ballistic carts or equivalent, resonance tube, [~~ring stand screen, four inch ring,~~] stroboscope, resistors, copper wire, switches, iron filings, and/or other equipment and materials that will produce the same results [~~graduated cylinders, and ticker timer~~] ;

(H) make measurements and record data with accuracy and precision using scientific notation and International System (SI) units;

[~~(I) identify and quantify causes and effects of uncertainties in measured data;~~]

(I) [~~(J)~~] organize, evaluate, and make inferences from data, including the use of tables, charts, and graphs;

(J) [~~(K)~~] communicate valid conclusions supported by the data through various methods such as lab reports, labeled drawings, graphic organizers, journals, summaries, oral reports, and technology-based reports; and

(K) [~~(L)~~]express [~~and manipulate~~] relationships among physical variables quantitatively, including the use of graphs, charts, and equations.

(4) 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;~~]

(C) [~~(D)~~] explain the impacts of the scientific contributions of a variety of historical and contemporary scientists on scientific thought and society;

(D) [~~(E)~~]research and describe the connections between physics and future careers; and

(E) [~~(F)~~] express , manipulate, and interpret relationships symbolically to make predictions and solve problems mathematically [~~, including problems requiring proportional reasoning and graphical vector addition~~] .

(5) The student uses the scientific process to investigate physical concepts. The student is expected to:

(A) demonstrate an understanding that scientific hypotheses are tentative and testable statements that must be capable of being supported by observational evidence;

(B) demonstrate an understanding that scientific theories are based on physical phenomena and are capable of being tested by multiple independent researchers;

(C) design and implement investigative procedures;

(D) demonstrate the appropriate use and care of laboratory equipment;

(E) demonstrate accurate measurement techniques using precision instruments;

(F) record data using scientific notation and International System (SI) of units;

(G) identify and quantify causes and effects of uncertainties in measured data;

(H) organize and evaluate data, including the use of tables, charts, and graphs;

(I) communicate conclusions supported through various methods such as laboratory reports, labeled drawings, graphic organizers, journals, summaries, oral reports, or technology-based reports; and

(J) record, express, and manipulate data using graphs, charts, and equations.

(6) The student demonstrates appropriate safety techniques in the field and laboratory environments. The student is expected to:

(A) master relevant safety procedures;

(B) comply with safety guidelines as described in various manuals, instructions, and regulations;

(C) identify and classify hazardous materials and wastes; and

(D) make prudent choices in the conservation and use of resources and the appropriate disposal of hazardous materials and wastes.

(7) The student describes and applies the laws governing motion in a variety of situations. The student is expected to:

(A) generate and interpret relevant equations using graphs and charts for one- and two-dimensional motion, including:

(i) using and describing one-dimensional equations and graphical vector addition for displacement, distance, speed, velocity, average velocity, frames of reference, acceleration, and average acceleration;

(ii) using and describing two-dimensional equations for projectile and circular motion; and

(iii) using and describing vector forces and resolution; and

(B) describe and calculate the effects of forces on objects, including law of inertia and impulse and conservation of momentum , using methods, including free-body force diagrams. [~~:~~]

[~~(C) develop and interpret free-body force diagrams; and~~]

[~~(D) identify and describe motion relative to different frames of reference.~~]

(8) The student describes the nature of forces in the physical world. The student is expected to:

(A) [~~research and~~] describe the [~~historical development of the~~] concepts of gravitational, electromagnetic, weak nuclear, and strong nuclear forces;

(B) describe and calculate the magnitude of gravitational forces between two objects;

(C) describe and calculate the magnitude of electric [~~electrical~~] forces;

(D) describe the nature and identify everyday examples of magnetic forces and fields;

(E) describe the nature and identify everyday examples of electromagnetic forces and fields;

(F) characterize materials as conductors or insulators based on their electric [~~electrical~~] properties; and

(G) design and construct both series and parallel circuits and calculate current, potential difference, resistance, and power of various circuits . [~~:~~]

[~~(H) investigate and describe the relationship between electric and magnetic fields in applications such as generators, motors, and transformers; and~~]

[~~(I) describe technological applications of the strong and weak nuclear forces in nature.~~]

(9) The student describes and applies the laws of the conservation of energy and momentum. The student is expected to:

(A) describe the transformational process between work, potential energy, and kinetic energy (work-energy theorem);

(B) use examples to analyze and calculate the relationships among work, kinetic energy, and potential energy;

(C) describe and calculate the mechanical energy of, the power generated within, the impulse applied to, and the momentum of a physical system; and

(D) describe and apply the laws of conservation of energy and conservation of momentum.

(10) The student analyzes the concept of thermal energy. The student is expected to:

[~~(A) describe how the macroscopic properties of a thermodynamic system such as temperature, specific heat, and pressure are related to the molecular level of matter, including kinetic or potential energy of atoms;~~]

[~~(B) contrast and give examples of different processes of thermal energy transfer, including conduction, convection, and radiation; and~~]

[~~(C) analyze and~~] explain technological examples such as solar and wind energy that illustrate the four laws of thermodynamics and the processes of thermal energy transfer [~~, including the law of conservation of energy and the law of entropy~~] .

(11) The student analyzes the properties of wave motion and optics. The student is expected to:

(A) examine and describe oscillatory motion and wave propagation in various types of media;

(B) investigate and analyze characteristics of waves, including period, velocity, frequency, amplitude, and wavelength;

(C) investigate and calculate the relationship between wave speed, frequency, and wavelength;

(D) compare and contrast the characteristics and behaviors of transverse waves, including electromagnetic waves and the electromagnetic spectrum, and longitudinal waves, including sound waves;

(E) investigate behaviors of waves, including reflection, refraction, diffraction, interference, resonance, polarization, and the Doppler effect; and

(F) describe and predict image formation as a consequence of reflection from a plane mirror and refraction through a thin convex lens . [~~; and~~]

[~~(G) describe the role of wave characteristics and behaviors in medical and industrial technology applications.~~]

(12) The student analyzes the concepts of atomic, nuclear, and quantum phenomena. The student is expected to:

(A) describe the photoelectric effect and the dual nature of light;

(B) compare and explain emission spectra produced by various atoms;

(C) calculate and describe the applications [~~significance~~] of mass-energy equivalence [~~and apply it in explanations of phenomena such as nuclear stability, fission, and fusion~~] ;

(D) describe the process of radioactive decay given an isotope and half-life;

(E) describe the role of mass-energy equivalence for areas such as nuclear stability, fission, and fusion; and

(F) explore technology applications of atomic, nuclear, and quantum phenomena using the standard model such as nuclear stability, fission, and fusion, nanotechnology, radiation therapy, diagnostic imaging, semiconductors, superconductors, solar cells, and nuclear power.

§130.415. Biotechnology I (One Credit), Adopted 2015.

(a) General requirements. This course is recommended for students in Grades 11 and 12. Prerequisite: Biology [~~and Chemistry~~] . Recommended prerequisites [~~prerequisite~~] : Principles of Biosciences and Chemistry . Students must meet the 40% laboratory and fieldwork requirement. This course satisfies a high school science graduation requirement. Students shall be awarded one credit for successful completion of this course.

(b)-(c) (No change.)

§130.417. Scientific Research and Design (One Credit), Adopted 2015.

(a) General requirements. This course is recommended for students in Grades 11 and 12. Prerequisite: Biology, Chemistry, Integrated Physics and Chemistry (IPC), or Physics. Students must meet the 40% laboratory and fieldwork requirement. This course satisfies a high school science graduation requirement. Students shall be awarded one credit for successful completion of this course. Students may take this course with different course content for a maximum of three credits.

(b)-(c) (No change.)