Pathophysiology

Subject: Career Development and Career and Technical Education
Grade: 11
Expectations: 42
Breakouts: 189

(a) Introduction.

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

2. The Health Science Career Cluster focuses on planning, managing, and providing therapeutic services, diagnostic services, health informatics, support services, and biotechnology research and development.

3. The Pathophysiology course is designed for students to conduct laboratory and field investigations, use scientific methods during investigations, and make informed decisions using critical thinking and scientific problem solving. Students in Pathophysiology will study disease processes and how humans are affected. Emphasis is placed on prevention and treatment of disease.

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

5. Students are expected to know that:

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

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

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

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

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

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

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

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

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

(b) Knowledge and Skills Statements

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

(A) demonstrate verbal and non-verbal communication in a clear, concise, and effective manner; and

(i) demonstrate verbal communication in a clear manner

(ii) demonstrate verbal communication in a concise manner

(iii) demonstrate verbal communication in a[n] effective manner

(iv) demonstrate non-verbal communication in a clear manner

(v) demonstrate non-verbal communication in a concise manner

(vi) demonstrate non-verbal communication in a[n] effective manner

(B) demonstrate the ability to cooperate, contribute, and collaborate as a member of a team.

(i) demonstrate the ability to cooperate as a member of a team

(ii) demonstrate the ability to contribute as a member of a team

(iii) demonstrate the ability to collaborate as a member of a team

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

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

(i) ask questions based on observations or information from text, phenomena, models, or investigations

(ii) define problems based on observations or information from text, phenomena, models, or investigations

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

(i) apply scientific practices to plan descriptive investigations

(ii) apply scientific practices to plan comparative investigations

(iii) apply scientific practices to plan experimental investigations

(iv) apply scientific practices to conduct descriptive investigations

(v) apply scientific practices to conduct comparative investigations

(vi) apply scientific practices to conduct experimental investigations

(vii) use engineering practices to design solutions to problems

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

(i) use appropriate safety equipment during laboratory investigations as outlined in Texas Education Agency-approved safety standards

(ii) use appropriate safety equipment during classroom investigations as outlined in Texas Education Agency-approved safety standards

(iii) use appropriate safety equipment during field investigations as outlined in Texas Education Agency-approved safety standards

(iv) use appropriate safety practices during laboratory investigations as outlined in Texas Education Agency-approved safety standards

(v) use appropriate safety practices during classroom investigations as outlined in Texas Education Agency-approved safety standards

(vi) use appropriate safety practices during field investigations as outlined in Texas Education Agency-approved safety standards

(D) use appropriate tools such as calculators, spreadsheet software, data-collecting probes, computers, standard laboratory glassware, microscopes, various prepared slides, stereoscopes, metric rulers, electronic balances, gel electrophoresis apparatuses, micro pipettors, hand lenses, Celsius thermometers, hot plates, timing devices, Petri dishes, lab incubators, biochemical media and stains dissection equipment, meter sticks, and models, diagrams, or samples of biological specimens or structures;

(i) use appropriate tools

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

(i) collect quantitative data using the International System of Units (SI) as evidence

(ii) collect quantitative data using United States customary units as evidence

(iii) collect qualitative data as evidence

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

(i) organize quantitative data using lab notebooks or journals

(ii) organize quantitative data using lab reports

(iii) organize quantitative using labeled drawings

(iv) organize quantitative using graphic organizers

(v) organize quantitative using peer reviewed medical journals

(vi) organize quantitative using summaries

(vii) organize quantitative using oral reports

(viii) organize quantitative using technology-based reports

(ix) organize qualitative data using lab notebooks or journals

(x) organize qualitative data using lab reports

(xi) organize qualitative using labeled drawings

(xii) organize qualitative using graphic organizers

(xiii) organize qualitative using peer reviewed medical journals

(xiv) organize qualitative using summaries

(xv) organize qualitative using oral reports

(xvi) organize qualitative using technology-based reports

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

(i) develop models to represent phenomena, systems, processes, or solutions to engineering problems

(ii) use models to represent phenomena, systems, processes, or solutions to engineering problems

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

(i) distinguish between scientific hypotheses, theories, and laws

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

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

(i) identify advantages of models

(ii) identify limitations of models

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

(i) analyze data by identifying significant statistical features

(ii) analyze data by identifying patterns

(iii) analyze data by identifying sources of error

(iv) analyze data by identifying limitations

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

(i) use mathematical calculations to assess quantitative relationships in data

(D) evaluate experimental and engineering designs.

(i) evaluate experimental designs

(ii) evaluate engineering designs

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

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

(i) develop explanations supported by data and consistent with scientific ideas

(ii) develop explanations supported by data and consistent with scientific principles

(iii) develop explanations supported by data and consistent with scientific theories

(iv) develop explanations supported by models and consistent with scientific ideas

(v) develop explanations supported by models and consistent with scientific principles

(vi) develop explanations supported by models and consistent with scientific theories

(vii) propose solutions supported by data and consistent with scientific ideas

(viii) propose solutions supported by data and consistent with scientific principles

(ix) propose solutions supported by data and consistent with scientific theories

(x) propose solutions supported by models and consistent with scientific ideas

(xi) propose solutions supported by models and consistent with scientific principles

(xii) propose solutions supported by models and consistent with scientific theories

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

(i) communicate explanations individually in a variety of settings

(ii) communicate explanations individually in a variety of formats

(iii) communicate explanations collaboratively in a variety of settings

(iv) communicate explanations collaboratively in a variety of formats

(v) communicate solutions individually in a variety of settings

(vi) communicate solutions individually in a variety of formats

(vii) communicate solutions collaboratively in a variety of settings

(viii) communicate solutions collaboratively in a variety of formats

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

(i) engage respectfully in scientific argumentation using applied scientific explanations

(ii) engage respectfully in scientific argumentation using empirical evidence

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

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

(i) analyze scientific explanations and solutions by using empirical evidence so as to encourage critical thinking by the student

(ii) analyze scientific explanations and solutions by using logical reasoning so as to encourage critical thinking by the student

(iii) analyze scientific explanations and solutions by using experimental testing so as to encourage critical thinking by the student

(iv) analyze scientific explanations and solutions by using observational testing so as to encourage critical thinking by the student

(v) evaluate scientific explanations and solutions by using empirical evidence so as to encourage critical thinking by the student

(vi) evaluate scientific explanations and solutions by using logical reasoning so as to encourage critical thinking by the student

(vii) evaluate scientific explanations and solutions by using experimental testing so as to encourage critical thinking by the student

(viii) evaluate scientific explanations and solutions by using observational testing so as to encourage critical thinking by the student

(ix) critique scientific explanations and solutions by using empirical evidence so as to encourage critical thinking by the student

(x) critique scientific explanations and solutions by using logical reasoning so as to encourage critical thinking by the student

(xi) critique scientific explanations and solutions by using experimental testing so as to encourage critical thinking by the student

(xii) critique scientific explanations and solutions by using observational testing so as to encourage critical thinking by the student

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

(i) relate the impact of past research on scientific thought including research methodology

(ii) relate the impact of past research on scientific thought including cost-benefit analysis

(iii) relate the impact of past research on scientific thought including contributions of diverse scientists as related to the content

(iv) relate the impact of past research on scientific thought including contributions of diverse engineers as related to the content

(v) relate the impact of past research on society including research methodology

(vi) relate the impact of past research on society including cost-benefit analysis

(vii) relate the impact of past research on society including contributions of diverse scientists as related to the content

(viii) relate the impact of past research on society including contributions of diverse engineers as related to the content

(ix) relate the impact of current research on scientific thought including research methodology

(x) relate the impact of current research on scientific thought including cost-benefit analysis

(xi) relate the impact of current research on scientific thought including contributions of diverse scientists as related to the content

(xii) relate the impact of current research on scientific thought including contributions of diverse engineers as related to the content

(xiii) relate the impact of current research on society including research methodology

(xiv) relate the impact of current research on society including cost-benefit analysis

(xv) relate the impact of current research on society including contributions of diverse scientists as related to the content

(xvi) relate the impact of current research on society including contributions of diverse engineers as related to the content

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

(i) research STEM careers

(ii) explore resources in order to investigate STEM careers

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

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

(i) describe abnormal biological processes at the cellular level

(ii) describe abnormal chemical processes at the cellular level

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

(i) examine changes resulting from mutations by examining cells

(ii) examine changes resulting from mutations by examining tissues

(iii) examine changes resulting from mutations by examining organs

(iv) examine changes resulting from mutations by examining systems

(v) examine changes resulting from neoplasms by examining cells

(vi) examine changes resulting from neoplasms by examining tissues

(vii) examine changes resulting from neoplasms by examining organs

(viii) examine changes resulting from neoplasms by examining systems

(ix) analyze changes resulting from mutations by examining cells

(x) analyze changes resulting from mutations by examining tissues

(xi) analyze changes resulting from mutations by examining organs

(xii) analyze changes resulting from mutations by examining systems

(xiii) analyze changes resulting from neoplasms by examining cells

(xiv) analyze changes resulting from neoplasms by examining tissues

(xv) analyze changes resulting from neoplasms by examining organs

(xvi) analyze changes resulting from neoplasms by examining systems

(C) investigate factors that contribute to disease, including age, gender, environment, lifestyle, and heredity; and

(i) investigate factors that contribute to disease, including age

(ii) investigate factors that contribute to disease, including gender

(iii) investigate factors that contribute to disease, including environment

(iv) investigate factors that contribute to disease, including lifestyle

(v) investigate factors that contribute to disease, including heredity

(D) analyze and describe how the body's compensating mechanisms attempt to maintain homeostasis when changes occur.

(i) analyze how the body's compensating mechanisms attempt to maintain homeostasis when changes occur

(ii) describe how the body's compensating mechanisms attempt to maintain homeostasis when changes occur

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

(A) differentiate and identify pathogenic organisms using microbiological techniques such as gram staining, biochemical identification, and microscopic observation;

(i) differentiate pathogenic organisms using microbiological techniques

(ii) identify pathogenic organisms using microbiological techniques

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

(i) research the stages of pathogenesis, including incubation period

(ii) research the stages of pathogenesis, including prodromal period

(iii) research the stages of pathogenesis, including exacerbation or remission

(iv) summarize the stages of pathogenesis, including incubation period

(v) summarize the stages of pathogenesis, including prodromal period

(vi) summarize the stages of pathogenesis, including exacerbation or remission

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

(i) analyze the body's natural defense systems against infection, including barriers

(ii) analyze the body's natural defense systems against infection, including the inflammatory response

(iii) analyze the body's natural defense systems against infection, including the immune response

(D) analyze other mechanisms of disease prevention and treatment such as vaccinations, antibiotics, chemotherapy, and immunotherapy; and

(i) analyze other mechanisms of disease prevention

(ii) analyze other mechanisms of disease treatment

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

(i) evaluate the effects of chemical agents on the disease process

(ii) evaluate the effects of environmental pollution on the disease process

(iii) evaluate the effects of trauma on the disease process

(8) The student examines diseases throughout the body's systems. The student is expected to:

(A) investigate the etiology, signs and symptoms, diagnosis, prognosis, and treatment of diseases;

(i) investigate the etiology of diseases

(ii) investigate the signs of diseases

(iii) investigate the symptoms of diseases

(iv) investigate the diagnosis of diseases

(v) investigate the prognosis of diseases

(vi) investigate the treatment of diseases

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

(i) explore advanced technologies for the diagnosis of disease

(ii) explore advanced technologies for the treatment of disease

(iii) describe advanced technologies for the diagnosis of disease

(iv) describe advanced technologies for the treatment of disease

(C) research and describe reemergence of diseases such as malaria, tuberculosis, polio, and measles;

(i) research reemergence of diseases

(ii) describe reemergence of diseases

(D) research the causes, prevention, and impact of nosocomial infections and differentiate between the causes, prevention, and impact of nosocomial infections versus community-acquired infections;

(i) research the causes of nosocomial infections

(ii) research the prevention of nosocomial infections

(iii) research the impact of nosocomial infections

(iv) differentiate between the causes of nosocomial infections versus community-acquired infections

(v) differentiate between the prevention of nosocomial infections versus community-acquired infections

(vi) differentiate between the impact of nosocomial infections versus community-acquired infections

(E) research and describe antibiotic-resistant diseases such as methicillin-resistant Staphylococcus aureus;

(i) research antibiotic-resistant diseases

(ii) describe antibiotic-resistant diseases

(F) differentiate between various types of diseases and disorders, including hereditary, infectious, and auto-immune; and

(i) differentiate between various types of diseases including hereditary, infectious, and auto-immune

(ii) differentiate between various types of disorders, including hereditary, infectious, and auto-immune

(G) investigate ways diseases such as diabetes, Parkinson's, lupus, and congestive heart failure affect multiple body systems.

(i) investigate ways diseases affect multiple body systems

(9) 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;

(i) evaluate public health issues related to asepsis

(ii) evaluate public health issues related to isolation

(iii) evaluate public health issues related to immunization

(iv) evaluate public health issues related to quarantine

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

(i) analyze the effects of stress on the body

(ii) analyze the effects of aging on the body

(C) analyze patient medical data and interpret medical laboratory test results to inform diagnosis and treatment;

(i) analyze patient medical data to inform diagnosis

(ii) analyze patient medical data to inform treatment

(iii) interpret medical laboratory test results to inform diagnosis

(iv) interpret medical laboratory test results to inform treatment

(D) analyze and interpret epidemiological data to determine common trends and predict outcomes in disease progression;

(i) analyze epidemiological data to determine common trends in disease progression

(ii) interpret epidemiological data to determine common trends in disease progression

(iii) predict outcomes in disease progression

(E) research and summarize diseases that threaten world health and propose intervention strategies; and

(i) research diseases that threaten world health

(ii) summarize diseases that threaten world health

(iii) propose intervention strategies

(F) develop a prevention plan that considers how behaviors contribute to lifestyle diseases.

(i) develop a prevention plan that considers how behaviors contribute to lifestyle diseases