Anatomy and Physiology

Subject: Career Development and Career and Technical Education
Grade: 10
Expectations: 106
Breakouts: 541

(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 Anatomy and Physiology 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 Anatomy and Physiology will study a variety of topics, including the structure and function of the human body and the interaction of body systems for maintaining homeostasis.

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) Employability skills. 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;

(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) exhibit the ability to cooperate, contribute, and collaborate as a member of a team; and

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

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

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

(C) investigate necessary skills for heath careers related to anatomy and physiology.

(i) investigate necessary skills for health careers related to anatomy

(ii) investigate necessary skills for health careers related to physiology

(2) Scientific and engineering practices. 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 lab notebooks or journals, calculators, spreadsheet software, data-collecting probes, computers, standard laboratory glassware, microscopes, various prepared slides, stereoscopes, metric rulers, meter sticks, electronic balances, micro pipettors, hand lenses, Celsius thermometers, hot plates, timing devices, Petri dishes, agar, lab incubators, dissection equipment, reflex hammers, pulse oximeters, stethoscope, otoscope, blood pressure monitors (sphygmomanometers), pen lights, ultrasound equipment, 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 the United States customary units as evidence

(iii) collect qualitative data as evidence

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

(i) organize quantitative data using lab reports

(ii) organize quantitative data using labeled drawings

(iii) organize quantitative data using graphic organizers

(iv) organize quantitative data using journals

(v) organize quantitative data using summaries

(vi) organize quantitative data using oral reports

(vii) organize quantitative data using technology-based reports

(viii) organize qualitative data using lab reports

(ix) organize qualitative data using labeled drawings

(x) organize qualitative data using graphic organizers

(xi) organize qualitative data using journals

(xii) organize qualitative data using summaries

(xiii) organize qualitative data using oral reports

(xiv) organize qualitative data 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 among scientific hypotheses, theories, and laws.

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

(3) Scientific and engineering practices. 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) Scientific and engineering practices. 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

(ii) develop explanations supported by models

(iii) develop explanations consistent with scientific ideas

(iv) develop explanations consistent with scientific principles

(v) develop explanations consistent with scientific theories

(vi) propose solutions supported by data

(vii) propose solutions supported by models

(viii) propose solutions consistent with scientific ideas

(ix) propose solutions consistent with scientific principles

(x) propose solutions 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) Scientific and engineering practices. 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) Human body organization. The student demonstrates an understanding of the anatomic and physiological basis of life and the ability to explain the interdependence of structure and function in biological systems. The student is expected to:

(A) distinguish between the six levels of structural organization in the human body, including chemical, cellular, tissue, organ, system, and organism, and explain their interdependence;

(i) distinguish between the six levels of structural organization in the human body, including chemical, cellular, tissue, organ, system, and organism

(ii) explain their [chemical, cellular, tissue, organ, system, and organism] interdependence;

(B) identify and use appropriate directional terminology when referring to the human body, including directional terms, planes, body cavities, and body quadrants;

(i) identify appropriate directional terminology when referring to the human body, including directional terms

(ii) identify appropriate directional terminology when referring to the human body, including planes

(iii) identify appropriate directional terminology when referring to the human body, body cavities

(iv) identify appropriate directional terminology when referring to the human body, including body quadrants

(v) use appropriate directional terminology when referring to the human body, including directional terms

(vi) use appropriate directional terminology when referring to the human body, including planes

(vii) use appropriate directional terminology when referring to the human body, including body cavities

(viii) use appropriate directional terminology when referring to the human body, including body quadrants

(C) identify and describe the major characteristics of living organisms, including response to stimuli, growth and development, homeostasis, cellular composition, metabolism, reproduction, and the ability to adapt to the environment;

(i) identify the major characteristics of living organisms, including response to stimuli

(ii) identify the major characteristics of living organisms, including growth and development

(iii) identify the major characteristics of living organisms, including homeostasis

(iv) identify the major characteristics of living organisms, including cellular composition

(v) identify the major characteristics of living organisms, including metabolism

(vi) identify the major characteristics of living organisms, including reproduction

(vii) identify the major characteristics of living organisms, including the ability to adapt to the environment

(viii) describe the major characteristics of living organisms, including response to stimuli

(ix) describe the major characteristics of living organisms, including growth and development

(x) describe the major characteristics of living organisms, including homeostasis

(xi) describe the major characteristics of living organisms, including cellular composition

(xii) describe the major characteristics of living organisms, including metabolism

(xiii) describe the major characteristics of living organisms, including reproduction

(xiv) describe the major characteristics of living organisms, including the ability to adapt to the environment

(D) research and describe negative and positive feedback loops as they apply to homeostasis; and

(i) research negative feedback loops as they apply to homeostasis

(ii) research positive feedback loops as they apply to homeostasis

(iii) describe negative feedback loops as they apply to homeostasis

(iv) describe positive feedback loops as they apply to homeostasis

(E) research and identify the effects of the failure to maintain homeostasis as it relates to common diseases in each of the body systems.

(i) research the effects of the failure to maintain homeostasis as it relates to common diseases in each of the body systems.

(ii) identify the effects of the failure to maintain homeostasis as it relates to common diseases in each of the body systems.

(7) Histology. The student demonstrates the ability to analyze the structure and function of eukaryotic cells in relation to the formation of tissue. The student is expected to:

(A) define tissue and identify the four primary tissue types, their subdivisions, and functions;

(i) define tissue

(ii) identify the four primary tissue types

(iii) identify [the] subdivisions [of the four primary tissue types]

(iv) identify [the] functions [of the four primary tissue types]

(B) compare epithelial tissue and connective tissue in terms of cell arrangement and interstitial materials;

(i) compare epithelial tissue and connective tissue in terms of cell arrangement

(ii) compare epithelial tissue and connective tissue in terms of interstitial materials

(C) describe the process of tissue repair involved in the normal healing of a superficial wound; and

(i) describe the process of tissue repair involved in the normal healing of a superficial wound

(D) describe the general metabolic pathways of carbohydrates, lipids, and proteins.

(i) describe the general metabolic pathways of carbohydrates

(ii) describe the general metabolic pathways of lipids

(iii) describe the general metabolic pathways of proteins

(8) Skeletal system. The student analyzes the relationships between the anatomical structures and physiological functions of the skeletal system. The student is expected to:

(A) identify and differentiate between the axial skeleton and appendicular skeleton;

(i) identify the axial skeleton

(ii) identify the appendicular skeleton

(iii) differentiate between the axial skeleton and appendicular skeleton

(B) identify the types of joints, including gliding, hinge, pivot, saddle, and ball and socket, and describe the movements of each;

(i) identify the types of joints, including gliding

(ii) identify the types of joints, including hinge

(iii) identify the types of joints, including pivot

(iv) identify the types of joints, including saddle

(v) identify the types of joints, including ball and socket

(vi) describe the movements of each [joint, including gliding]

(vii) describe the movements of each [joint, including hinge]

(viii) describe the movements of each [joint, including pivot]

(ix) describe the movements of each [joint, including saddle]

(x) describe the movements of each [joint, including ball and socket]

(C) identify and locate the anatomy of bone, including spongy and compact tissue, epiphysis, diaphysis, medullary cavity, periosteum, bone marrow, and endosteum;

(i) identify the anatomy of bone, including spongy [bone]

(ii) identify the anatomy of bone, including spongy compact [bone]

(iii) identify the anatomy of bone, including epiphysis

(iv) identify the anatomy of bone, including diaphysis

(v) identify the anatomy of bone, including medullary cavity

(vi) identify the anatomy of bone, including periosteum

(vii) identify the anatomy of bone, including bone marrow

(viii) identify the anatomy of bone, including endosteum

(ix) locate the anatomy of bone, including spongy [bone]

(x) locate the anatomy of bone, including compact [bone]

(xi) locate the anatomy of bone, including medullary cavity

(xii) locate the anatomy of bone, including epiphysis

(xiii) locate the anatomy of bone, including diaphysis

(xiv) locate the anatomy of bone, including periosteum

(xv) locate the anatomy of bone, including bone marrow

(xvi) locate the anatomy of bone, including endosteum

(D) explain the major physiological functions of the skeletal system;

(i) explain the major physiological functions of the skeletal system

(E) describe the role of osteoblasts, osteocytes, and osteoclasts in bone growth and repair;

(i) describe the role of osteoblasts in bone growth

(ii) describe the role of osteocytes in bone growth

(iii) describe the role of osteoclasts in bone growth

(iv) describe the role of osteoblasts in bone repair

(v) describe the role of osteocytes in bone repair

(vi) describe the role of osteoclasts in bone repair

(F) identify and describe the different types of fractures such as compound, complete, simple, spiral, greenstick, hairline, transverse, and comminuted; and

(i) identify the different types of fractures

(ii) describe the different types of fractures

(G) identify and describe common diseases and disorders of the skeletal system such as scoliosis, osteoporosis, and bone cancer.

(i) identify common diseases of the skeletal system

(ii) identify common disorders of the skeletal system

(iii) describe common diseases of the skeletal system

(iv) describe common disorders of the skeletal system

(9) Integumentary system. The student analyzes the relationships between the anatomical structures and physiological functions of the integumentary system. The student is expected to:

(A) identify and describe the structures of the integumentary system, including layers of the skin, accessory organs within each layer, and glandular components in each layer;

(i) identify the structures of the integumentary system, including layers of the skin

(ii) identify the structures of the integumentary system, including accessory organs within each layer

(iii) identify the structures of the integumentary system, including glandular components in each layer;

(iv) describe the structures of the integumentary system, including layers of the skin

(v) describe the structures of the integumentary system, including accessory organs within each layer

(vi) describe the structures of the integumentary system, including glandular components in each layer;

(B) describe the factors that can contribute to skin color;

(i) describe the factors that can contribute to skin color

(C) describe and explain the process of tissue repair and scar formation; and

(i) describe the process of tissue repair

(ii) describe the process of scar formation

(iii) explain the process of tissue repair

(iv) explain the process of scar formation

(D) identify and describe common diseases and disorders of the integumentary system such as skin cancer and psoriasis.

(i) identify common diseases of the integumentary system

(ii) identify common disorders of the integumentary system

(iii) describe common diseases of the integumentary system

(iv) describe common disorders of the integumentary system

(10) Muscular system. The student analyzes the relationships between the anatomical structures and physiological functions of the muscular system. The student is expected to:

(A) explain the major physiological functions of the muscular system, including voluntary movement, involuntary movement, heat production, and maintaining posture;

(i) explain the major physiological functions of the muscular system, including voluntary movement

(ii) explain the major physiological functions of the muscular system, including involuntary movement

(iii) explain the major physiological functions of the muscular system, including heat production

(iv) explain the major physiological functions of the muscular system, including maintaining posture

(B) explain the coordination of muscles, bones, and joints that allows movement of the body, including the methods of attachment of ligaments and tendons;

(i) explain the coordination of muscles that allows movement of the body, including the methods of attachment of ligaments

(ii) explain the coordination of muscles that allows movement of the body, including the methods of attachment of tendons

(iii) explain the coordination of bones that allows movement of the body, including the methods of attachment of ligaments

(iv) explain the coordination of bones that allows movement of the body, including the methods of attachment of tendons

(v) explain the coordination of joints that allows movement of the body, including the methods of attachment of ligaments

(vi) explain the coordination of joints that allows movement of the body, including the methods of attachment of tendons

(C) examine common characteristics of muscle tissue, including excitability, contractibility, extensibility, and elasticity;

(i) examine common characteristics of muscle tissue, including excitability

(ii) examine common characteristics of muscle tissue, including contractibility

(iii) examine common characteristics of muscle tissue, including extensibility

(iv) examine common characteristics of muscle tissue, including elasticity

(D) identify and describe the appearance, innervation, and function of the three muscle types, including cardiac, skeletal, and smooth;

(i) identify the appearance of the three muscle types, including cardiac

(ii) identify the appearance of the three muscle types, including skeletal

(iii) identify the appearance of the three muscle types, including smooth

(iv) identify the innervation of the three muscle types, including cardiac

(v) identify the innervation of the three muscle types, including skeletal

(vi) identify the innervation of the three muscle types, including smooth

(vii) identify the function of the three muscle types, including cardiac

(viii) identify the function of the three muscle types, including skeletal

(ix) identify the function of the three muscle types, including smooth

(x) describe the appearance of the three muscle types, including cardiac

(xi) describe the appearance of the three muscle types, including skeletal

(xii) describe the appearance of the three muscle types, including smooth

(xiii) describe the innervation of the three muscle types, including cardiac

(xiv) describe the innervation of the three muscle types, including skeletal

(xv) describe the innervation of the three muscle types, including smooth

(xvi) describe the function of the three muscle types, including cardiac

(xvii) describe the function of the three muscle types, including skeletal

(xviii) describe the function of the three muscle types, including smooth

(E) examine the microscopic anatomy of a muscle fiber, including sarcomere, actin, and myosin;

(i) examine the microscopic anatomy of a muscle fiber, including sarcomere

(ii) examine the microscopic anatomy of a muscle fiber, including actin

(iii) examine the microscopic anatomy of a muscle fiber, including myosin

(F) describe the mechanisms of muscle contraction at the neuromuscular junction;

(i) describe the mechanisms of muscle contraction at the neuromuscular junction

(G) name, locate, and describe the action of major voluntary muscles in regions of the body, including the head and neck, trunk, upper extremity, and lower extremity;

(i) name the action of major voluntary muscles in regions of the body, including the head and neck

(ii) name the action of major voluntary muscles in regions of the body, including the trunk

(iii) name the action of major voluntary muscles in regions of the body, including the upper extremity

(iv) name the action of major voluntary muscles in regions of the body, including the lower extremity

(v) locate the action of major voluntary muscles in regions of the body, including the head and neck

(vi) locate the action of major voluntary muscles in regions of the body, including the trunk

(vii) locate the action of major voluntary muscles in regions of the body, including the upper extremity

(viii) locate the action of major voluntary muscles in regions of the body, including the lower extremity

(ix) describe the action of major voluntary muscles in regions of the body, including the head and neck

(x) describe the action of major voluntary muscles in regions of the body, including the trunk

(xi) describe the action of major voluntary muscles in regions of the body, including the upper extremity

(xii) describe the action of major voluntary muscles in regions of the body, including the lower extremity

(H) identify and describe common diseases and disorders of the muscular system such as muscle strains and muscular dystrophy; and

(i) identify common diseases of the muscular system

(ii) identify common disorders of the muscular system

(iii) describe common diseases of the muscular system

(iv) describe common disorders of the muscular system

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

(i) analyze the effects of pressure on the human body

(ii) analyze the effects of movement on the human body

(iii) analyze the effects of torque on the human body

(iv) analyze the effects of tension on the human body

(v) analyze the effects of elasticity on the human body

(vi) describe the effects of pressure on the human body

(vii) describe the effects of movement on the human body

(viii) describe the effects of torque on the human body

(ix) describe the effects of tension on the human body

(x) describe the effects of elasticity on the human body

(11) Nervous system. The student analyzes the relationship between the anatomical structures and physiological functions of the nervous system. The student is expected to:

(A) summarize and distinguish between the major physiological functions of the nervous system, including sensation, integration, and motor response;

(i) summarize the major physiological functions of the nervous system, including sensation

(ii) summarize the major physiological functions of the nervous system, including integration

(iii) summarize the major physiological functions of the nervous system, including motor response

(iv) distinguish between the major physiological functions of the nervous system, including sensation, integration, and motor response

(B) identify the senses and explain their relationship to nervous system;

(i) identify the senses

(ii) explain [the] relationship [of the senses] to nervous system

(C) investigate and explain the interdependence between the cranial and spinal nerves with the special senses of vision, hearing, smell, and taste;

(i) investigate the interdependence between the cranial and spinal nerves with the special sense of vision

(ii) investigate the interdependence between the cranial and spinal nerves with the special sense of hearing

(iii) investigate the interdependence between the cranial and spinal nerves with the special sense of smell

(iv) investigate the interdependence between the cranial and spinal nerves with the special sense of taste

(v) explain the interdependence between the cranial and spinal nerves with the special sense of vision

(vi) explain the interdependence between the cranial and spinal nerves with the special sense of hearing

(vii) explain the interdependence between the cranial and spinal nerves with the special sense of smell

(viii) explain the interdependence between the cranial and spinal nerves with the special senses of taste

(D) describe the anatomy of the structures associated with the senses, including vision, hearing, smell, taste, and touch;

(i) describe the anatomy of the structures associated with the senses, including vision

(ii) describe the anatomy of the structures associated with the senses, including hearing

(iii) describe the anatomy of the structures associated with the senses, including smell

(iv) describe the anatomy of the structures associated with the senses, including taste

(v) describe the anatomy of the structures associated with the senses, including touch

(E) identify the anatomical and physiological divisions of the peripheral nervous system and central nervous system;

(i) identify the anatomical divisions of the peripheral nervous system

(ii) identify the anatomical divisions of the central nervous system

(iii) identify the physiological divisions of the peripheral nervous system

(iv) identify the physiological divisions of the central nervous system

(F) explain the glial cells within the central nervous system and peripheral nervous system and their associated functions;

(i) explain the glial cells within the central nervous system

(ii) explain the glial cells within the peripheral nervous system

(iii) explain [the] associated functions [of glial cells within the central nervous system]

(iv) explain [the] associated functions [of glial cells within the peripheral nervous system]

(G) analyze the functional and structural differences between gray and white matter relative to neurons;

(i) analyze the functional differences between gray and white matter relative to neurons

(ii) analyze the structural differences between gray and white matter relative to neurons

(H) distinguish between the types of neurons and explain the initiation of a nerve impulse during resting and action potential;

(i) distinguish between the types of neurons

(ii) explain the initiation of a nerve impulse during resting potential

(iii) explain the initiation of a nerve impulse during action potential

(I) categorize the major neurotransmitters by chemical and physical mechanisms; and

(i) categorize the major neurotransmitters by chemical mechanisms

(ii) categorize the major neurotransmitters by physical mechanisms

(J) identify and describe common diseases and disorders of the nervous system such as epilepsy, neuralgia, Parkinson's disease, and Alzheimer's disease.

(i) identify common diseases of the nervous system

(ii) identify common disorders of the nervous system

(iii) describe common diseases of the nervous system

(iv) describe common disorders of the nervous system

(12) Endocrine system. The student analyzes the relationships between the anatomical structures and physiological functions of the endocrine system. The student is expected to:

(A) identify and locate the nine glands associated with the endocrine system, including the ovaries, testes, pineal gland, pituitary gland, thyroid gland, parathyroid glands, thymus, pancreas, and adrenal glands;

(i) identify the nine glands associated with the endocrine system, including the ovaries

(ii) identify the nine glands associated with the endocrine system, including the testes

(iii) identify the nine glands associated with the endocrine system, including the pineal gland

(iv) identify the nine glands associated with the endocrine system, including the pituitary gland

(v) identify the nine glands associated with the endocrine system, including the thyroid gland

(vi) identify the nine glands associated with the endocrine system, including the parathyroid glands

(vii) identify the nine glands associated with the endocrine system, including the thymus

(viii) identify the nine glands associated with the endocrine system, including the pancreas

(ix) identify the nine glands associated with the endocrine system, including the adrenal glands

(x) locate the nine glands associated with the endocrine system, including the ovaries

(xi) locate the nine glands associated with the endocrine system, including the testes

(xii) locate the nine glands associated with the endocrine system, including the pineal gland

(xiii) locate the nine glands associated with the endocrine system, including the pituitary gland

(xiv) locate the nine glands associated with the endocrine system, including the thyroid gland

(xv) locate the nine glands associated with the endocrine system, including the parathyroid glands

(xvi) locate the nine glands associated with the endocrine system, including the thymus

(xvii) locate the nine glands associated with the endocrine system, including the pancreas

(xviii) locate the nine glands associated with the endocrine system, including the adrenal glands

(B) compare and contrast endocrine and exocrine glands and identify the glands associated with each;

(i) compare and contrast endocrine and exocrine glands

(ii) identify the glands associated with [endocrine glands]

(iii) identify the glands associated with [exocrine glands]

(C) describe the hormones associated with each endocrine gland;

(i) describe the hormones associated with each endocrine gland

(D) research the impact of the endocrine systems on homeostatic mechanisms and other body systems such as the integration between the hypothalamus and the pituitary gland;

(i) research the impact of the endocrine systems on homeostatic mechanisms

(ii) research the impact of the endocrine systems on other body systems

(E) explain how the endocrine glands are regulated, including neural, hormonal, and humoral control; and

(i) explain how the endocrine glands are regulated, including neural control

(ii) explain how the endocrine glands are regulated, including hormonal control

(iii) explain how the endocrine glands are regulated, including humoral control

(F) identify and describe common diseases and disorders of the endocrine system such as hypothyroidism, pancreatic cancer, and diabetes.

(i) identify common diseases of the endocrine system

(ii) identify common disorders of the endocrine system

(iii) describe common diseases of the endocrine system

(iv) describe common disorders of the endocrine system

(13) Urinary system. The student analyzes the relationships between the anatomical structures and physiological functions of the urinary system. The student is expected to:

(A) identify and describe the anatomical structures and functions of the urinary system, including the kidney, ureters, bladder, and urethra;

(i) identify the anatomical structures of the urinary system, including the kidney

(ii) identify the anatomical structures of the urinary system, including the ureters

(iii) identify the anatomical structures of the urinary system, including the bladder

(iv) identify the anatomical structures of the urinary system, including the urethra

(v) identify the anatomical functions of the urinary system, including the kidney

(vi) identify the anatomical functions of the urinary system, including the ureters

(vii) identify the anatomical functions of the urinary system, including the bladder

(viii) identify the anatomical functions of the urinary system, including the urethra

(ix) describe the anatomical structures of the urinary system, including the kidney

(x) describe the anatomical structures of the urinary system, including the ureters

(xi) describe the anatomical structures of the urinary system, including the bladder

(xii) describe the anatomical structures of the urinary system, including the urethra

(xiii) describe the anatomical functions of the urinary system, including the kidney

(xiv) describe the anatomical functions of the urinary system, including the ureters

(xv) describe the anatomical functions of the urinary system, including the bladder

(xvi) describe the anatomical functions of the urinary system, including the urethra

(B) compare and contrast the anatomical structures and describe the functions of the male and female urinary system;

(i) compare and contrast the anatomical structures of the male and female urinary system

(ii) describe the functions of the male urinary system

(iii) describe the functions of the female urinary system

(C) summarize and illustrate the structures, functions, and types of nephrons;

(i) summarize the structures of nephrons

(ii) summarize the functions of nephrons

(iii) summarize the types of nephrons

(iv) illustrate the structures of nephrons

(v) illustrate the functions of nephrons

(vi) illustrate the types of nephrons

(D) examine the methods of fluid balance and homeostasis in the urinary system, including fluid intake and output;

(i) examine the methods of fluid balance in the urinary system, including fluid intake

(ii) examine the methods of fluid balance in the urinary system, including fluid output

(iii) examine the methods of fluid homeostasis in the urinary system, including fluid intake

(iv) examine the methods of fluid homeostasis in the urinary system, including fluid output

(E) analyze the composition of urine and the process of urine formation, including filtration, reabsorption, and secretion;

(i) analyze the composition of urine

(ii) analyze the process of urine formation, including filtration

(iii) analyze the process of urine formation, including, reabsorption

(iv) analyze the process of urine formation, including secretion

(F) describe the relationship between the nervous system, renal system, and muscular system before and during micturition; and

(i) describe the relationship between the nervous system, renal system, and muscular system before micturition

(ii) describe the relationship between the nervous system, renal system, and muscular system during micturition

(G) identify and describe common diseases and disorders of the urinary system such as chronic kidney disease, kidney stones, urinary tract infections, and renal cancer.

(i) identify common diseases of the urinary system

(ii) identify common disorders of the urinary system

(iii) describe common diseases of the urinary system

(iv) describe common disorders of the urinary system

(14) Cardiovascular system. The student analyzes the relationships between the anatomical structures and physiological functions of the cardiovascular system. The student is expected to:

(A) identify the major functions of the cardiovascular system, including transport, maintaining homeostasis, and immune response;

(i) identify the major functions of the cardiovascular system, including transport

(ii) identify the major functions of the cardiovascular system, including maintaining homeostasis

(iii) identify the major functions of the cardiovascular system, including immune response

(B) compare and contrast the anatomical structure of arteries, arterioles, capillaries, venules, and veins;

(i) compare and contrast the anatomical structure of arteries, arterioles, capillaries, venules, and veins;

(C) investigate and illustrate how systemic circulation transports blood, gasses, and nutrients from the heart to the internal anatomy of the heart, including tissue layers, chambers, and valves, and external anatomy of the heart, including coronary vessels;

(i) investigate how systemic circulation transports blood from the heart to the internal anatomy of the heart, including tissue layers

(ii) investigate how systemic circulation transports blood from the heart to the internal anatomy of the heart, including chambers

(iii) investigate how systemic circulation transports blood from the heart to the internal anatomy of the heart, including valves

(iv) investigate how systemic circulation transports gasses from the heart to the internal anatomy of the heart, including tissue layers

(v) investigate how systemic circulation transports gasses from the heart to the internal anatomy of the heart, including chambers

(vi) investigate how systemic circulation transports gasses from the heart to the internal anatomy of the heart, including valves

(vii) investigate how systemic circulation transports nutrients from the heart to the internal anatomy of the heart, including tissue layers

(viii) investigate how systemic circulation transports nutrients from the heart to the internal anatomy of the heart, including chambers

(ix) investigate how systemic circulation transports nutrients from the heart to the internal anatomy of the heart, including valves

(x) investigate external anatomy of the heart, including coronary vessels

(xi) illustrate how systemic circulation transports blood from the heart to the internal anatomy of the heart, including tissue layers

(xii) illustrate how systemic circulation transports blood from the heart to the internal anatomy of the heart, including chambers

(xiii) illustrate how systemic circulation transports blood from the heart to the internal anatomy of the heart, including valves

(xiv) illustrate how systemic circulation transports gasses from the heart to the internal anatomy of the heart, including tissue layers

(xv) illustrate how systemic circulation transports gasses from the heart to the internal anatomy of the heart, including chambers

(xvi) illustrate how systemic circulation transports gasses from the heart to the internal anatomy of the heart, including valves

(xvii) illustrate how systemic circulation transports nutrients from the heart to the internal anatomy of the heart, including tissue layers

(xviii) illustrate how systemic circulation transports nutrients from the heart to the internal anatomy of the heart, including chambers

(xix) illustrate how systemic circulation transports nutrients from the heart to the internal anatomy of the heart, including valves

(xx) illustrate external anatomy of the heart, including coronary vessels

(D) describe the relationship between blood flow and blood pressure, including systolic and diastolic pressure, pulse pressure, and mean arterial pressure;

(i) describe the relationship between blood flow and blood pressure, including systolic pressure

(ii) describe the relationship between blood flow and blood pressure, including diastolic pressure

(iii) describe the relationship between blood flow and blood pressure, including pulse pressure

(iv) describe the relationship between blood flow and blood pressure, including mean arterial pressure

(E) compare and contrast coronary, pulmonary, and systemic circulation, and describe the major vessels of each;

(i) compare and contrast coronary, pulmonary, and systemic circulation

(ii) describe the major vessels of [coronary circulation]

(iii) describe the major vessels of [pulmonary circulation]

(iv) describe the major vessels of [systemic circulation]

(F) illustrate how the PQRST waves of an electrocardiogram (EKG) demonstrate the conduction of electricity through the structures of the heart;

(i) illustrate how the PQRST waves of an electrocardiogram (EKG) demonstrate the conduction of electricity through the structures of the heart

(G) describe the relationship between the cardiovascular system, nervous system, and muscular system in regulating cardiac output; and

(i) describe the relationship between the cardiovascular system, nervous system, and muscular system in regulating cardiac output

(H) identify and describe common diseases and disorders of the cardiovascular system such as heart disease, myocardial infarction, ischemia, and hypertrophic cardiomyopathy.

(i) identify common diseases of the cardiovascular system

(ii) identify common disorders of the cardiovascular system

(iii) describe common diseases of the cardiovascular system

(iv) describe common disorders of the cardiovascular system

(15) Lymphatic system. The student analyzes the relationships between the anatomical structures and physiological functions of the lymphatic system and understands the immune response. The student is expected to:

(A) evaluate the interaction of the lymphatic system with other body systems such as the circulatory system;

(i) evaluate the interaction of the lymphatic system with other body systems

(B) describe the structure and function of the lymphatic organs and explain how lymph moves through the body;

(i) describe the structure of the lymphatic organs

(ii) describe function of the lymphatic organs

(iii) explain how lymph moves through the body

(C) identify and describe the role and function of the immune cells, including T cells and B cells, within the lymphatic system structures;

(i) identify the role of the immune cells, including T cells, within the lymphatic system structures

(ii) identify the role of the immune cells, including B cells, within the lymphatic system structures

(iii) identify the function of the immune cells, including T cells, within the lymphatic system structures

(iv) identify the function of the immune cells, including B cells, within the lymphatic system structures

(v) describe the role of the immune cells, including T cells, within the lymphatic system structures

(vi) describe the role of the immune cells, including B cells, within the lymphatic system structures

(vii) describe the function of the immune cells, including T cells, within the lymphatic system structures

(viii) describe the function of the immune cells, including B cells, within the lymphatic system structures

(D) identify and determine antigens associated with ABO blood typing, including Rhesus (Rh) factor;

(i) identify antigens associated with ABO blood typing, including Rhesus (Rh) factor

(ii) determine antigens associated with ABO blood typing, including Rhesus (Rh) factor

(E) summarize the ways the body protects and defends against disease, including inflammation, barrier defenses, and active and passive immunity;

(i) summarize the ways the body protects against disease, including inflammation

(ii) summarize the ways the body protects against disease, including barrier defenses

(iii) summarize the ways the body protects against disease, including active and passive immunity

(iv) summarize the ways the body defends against disease, including inflammation

(v) summarize the ways the body defends against disease, including barrier defenses

(vi) summarize the ways the body defends against disease, including active and passive immunity

(F) describe the role of antigens and antibodies in the immune response; and

(i) describe the role of antigens in the immune response

(ii) describe the role of antibodies in the immune response

(G) identify and describe common diseases and disorders associated with the lymphatic and immune systems such as inherited or acquired immunodeficiencies, autoimmune diseases, and lymphomas.

(i) identify common diseases associated with the lymphatic system

(ii) identify common disorders associated with the lymphatic system

(iii) describe common diseases associated with the lymphatic system

(iv) describe common disorders associated with the lymphatic system

(v) identify common diseases associated with the immune system

(vi) identify common disorders associated with the immune system

(vii) describe common diseases associated with the immune system

(viii) describe common disorders associated with the immune system

(16) Digestive system. The student analyzes the relationships between the anatomical structures and physiological functions of the digestive system. The student is expected to:

(A) examine the anatomical structures and function of the alimentary canal and accessory organs;

(i) examine the anatomical structures of the alimentary canal

(ii) examine the anatomical function of the alimentary canal

(iii) examine the anatomical structures of the accessory organs

(iv) examine the anatomical function of the accessory organs

(B) compare and contrast mechanical and chemical digestive processes;

(i) compare and contrast mechanical and chemical digestive processes

(C) evaluate the modes by which energy is processed and stored within the body, including ingestion, propulsion, absorption, and elimination; and

(i) evaluate the modes by which energy is processed within the body, including ingestion

(ii) evaluate the modes by which energy is processed within the body, including propulsion

(iii) evaluate the modes by which energy is processed within the body, including absorption

(iv) evaluate the modes by which energy is processed within the body, including elimination

(v) evaluate the modes by which energy is stored within the body, including absorption

(D) identify and describe common diseases and disorders of the digestive system such as gallstones, Crohn's disease, irritable bowel syndrome, and gastroesophageal reflux disorder.

(i) identify common diseases of the digestive system

(ii) identify common disorders of the digestive system

(iii) describe common diseases of the digestive system

(iv) describe common disorders of the digestive system

(17) Respiratory system. The student analyzes the relationships between the anatomical structures and physiological functions of the respiratory system. The student is expected to:

(A) identify and sequence the anatomical structures and functions of the respiratory system;

(i) identify the anatomical structures of the respiratory system

(ii) identify the anatomical functions of the respiratory system

(iii) sequence the anatomical structures of the respiratory system

(iv) sequence the anatomical functions of the respiratory system

(B) compare and contrast the functions of upper and lower respiratory tract;

(i) compare and contrast the functions of upper and lower respiratory tract

(C) describe the physiology of respiration, including internal and external respiration and gas exchange;

(i) describe the physiology of respiration, including internal respiration

(ii) describe the physiology of respiration, including external respiration

(iii) describe the physiology of respiration, including gas exchange

(D) describe the relationship between the respiratory and cardiovascular systems during pulmonary circulation;

(i) describe the relationship between the respiratory and cardiovascular systems during pulmonary circulation

(E) investigate factors that affect respiration, including exercise and environmental changes such as altitude; and

(i) investigate factors that affect respiration, including exercise

(ii) investigate factors that affect respiration, including environmental changes

(F) identify and describe common diseases of the respiratory system such as asthma, emphysema, pneumonia, viruses, and allergies.

(i) identify common diseases of the respiratory system

(ii) describe common diseases of the respiratory system

(18) Reproductive system. The student analyzes the relationships between the anatomical structures and physiological functions of the reproductive system. The student is expected to:

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

(i) explain embryological development of cells

(ii) explain embryological development of tissues

(iii) explain embryological development of organs

(iv) explain embryological development of systems

(B) describe and examine the location, structure, and functions of the internal and external female and male reproductive organs and accessory glands;

(i) describe the location of the internal female reproductive organs

(ii) describe the structure of the internal female reproductive organs

(iii) describe the functions of the internal female reproductive organs

(iv) describe the location of the external female reproductive organs

(v) describe the structure of the external female reproductive organs

(vi) describe the functions of the external female reproductive organs

(vii) describe the location of the female accessory glands

(viii) describe the structure of the female accessory glands

(ix) describe the functions of the female accessory glands

(x) describe the location of the internal male reproductive organs

(xi) describe the structure of the internal male reproductive organs

(xii) describe the functions of the internal male reproductive organs

(xiii) describe the location of the external male reproductive organs

(xiv) describe the structure of the external male reproductive organs

(xv) describe the functions of the external male reproductive organs

(xvi) describe the location of the male accessory glands

(xvii) describe the structure of the male accessory glands

(xviii) describe the functions of the male accessory glands

(xix) examine the location of the internal female reproductive organs

(xx) examine the structure of the internal female reproductive organs

(xxi) examine the functions of the internal female reproductive organs

(xxii) examine the location of the external female reproductive organs

(xxiii) examine the structure of the external female reproductive organs

(xxiv) examine the functions of the external female reproductive organs

(xxv) examine the location of the female accessory glands

(xxvi) examine the structure of the female accessory glands

(xxvii) examine the functions of the female accessory glands

(xxviii) examine the location of the internal male reproductive organs

(xxix) examine the structure of the internal male reproductive organs

(xxx) examine the functions of the internal male reproductive organs

(xxxi) examine the location of the external male reproductive organs

(xxxii) examine the structure of the external male reproductive organs

(xxxiii) examine the functions of the external male reproductive organs

(xxxiv) examine the location of the male accessory glands

(xxxv) examine the structure of the male accessory glands

(xxxvi) examine the functions of the male accessory glands

(C) describe and compare the process of oogenesis and spermatogenesis;

(i) describe the process of oogenesis

(ii) describe the process of spermatogenesis

(iii) compare the process of oogenesis and spermatogenesis

(D) research and discuss the physiological effects of hormones on the stages of the menstrual cycle;

(i) research the physiological effects of hormones on the stages of the menstrual cycle

(ii) discuss the physiological effects of hormones on the stages of the menstrual cycle

(E) identify and distinguish the hormones involved in maturation and development throughout the life cycle, including puberty, gestation, and menopause; and

(i) identify the hormones involved in maturation, including puberty

(ii) identify the hormones involved in maturation, including gestation

(iii) identify the hormones involved in maturation, including menopause

(iv) identify the hormones involved in development throughout the life cycle, including puberty

(v) identify the hormones involved in development throughout the life cycle, including gestation

(vi) identify the hormones involved in development throughout the life cycle, including menopause

(vii) distinguish the hormones involved in maturation, including puberty

(viii) distinguish the hormones involved in maturation, including gestation

(ix) distinguish the hormones involved in maturation, including menopause

(x) distinguish the hormones involved in development throughout the life cycle, including puberty

(xi) distinguish the hormones involved in development throughout the life cycle, including gestation

(xii) distinguish the hormones involved in development throughout the life cycle, including menopause

(F) identify and describe common diseases and disorders of the reproductive system such as sexually transmitted diseases and cancers of the female and male reproductive systems.

(i) identify common diseases of the reproductive system

(ii) identify common disorders of the reproductive system

(iii) describe common diseases of the reproductive system

(iv) describe common disorders of the reproductive system

(19) Emerging technologies. The student identifies emerging technological advances in science and healthcare treatment and delivery. The student is expected to:

(A) research and discuss advances in science and medicine at the organ and tissue level such as bionics and wearable monitoring technologies; and

(i) research advances in science at the organ level

(ii) research advances in medicine at the organ level

(iii) research advances in science at the tissue level

(iv) research advances in medicine at the tissue level

(v) discuss advances in science at the organ level

(vi) discuss advances in medicine at the organ level

(vii) discuss advances in science at the tissue level

(viii) discuss advances in medicine at the tissue level

(B) research and describe advances in science and medicine at the cellular level such as stem cells and gene therapy.

(i) research advances in science at the cellular level

(ii) research advances in medicine at the cellular level

(iii) describe advances in science at the cellular level

(iv) describe advances in medicine at the cellular level