Texas Health Education

Anatomy and Physiology

Implementation: I.A

1 **The provisions of this section shall be implemented by school districts beginning with the 20242025 school year.** I.A.1

2 **School districts shall implement the employability skills student expectations listed in §127.15(d)(2) of this chapter (relating to Career and Technical Education Employability Skills) as an integral part of this course.** I.A.2

b **General requirements. This course is recommended for students in Grades 10-12. Prerequisite: one credit in biology and one credit in chemistry, Integrated Physics and Chemistry, or physics. Recommended prerequisite: a course from the Health Science Career Cluster. This course satisfies a high school science graduation requirement. Students shall be awarded one credit for successful completion of this course.** I.B

Introduction I.C

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.** I.C.1

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.** I.C.2

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.** I.C.3

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.** I.C.4

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cientific inquiry is the planned and deliberate investigation of the natural world
sing 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. I.C.6

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. I.C.6.A

B Engineering practices. Students should be able to identify problems and design solutions using appropriate tools and models. I.C.6.B

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)** I.C.7

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.** I.C.8

9 **Students are encouraged to participate in extended learning experiences such as career and technical student organizations and other organizations that foster leadership and career development in the profession such as student chapters of related professional associations.** I.C.9

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.** I.C.10

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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** I.C.5.A

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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. I.C.5.B

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.** I.C.5.B

Knowledge and skills. I.D

1 **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:** I.D.1

A ask questions and define problems based on observations or information from text, phenomena, models, or investigations; I.D.1.A

B apply scientific practices to plan and conduct descriptive, comparative, and experimental investigations and use engineering practices to design solutions to problems; I.D.1.B

C use appropriate safety equipment and practices during laboratory, classroom, and field investigations as outlined in Texas Education Agency-approved safety standards; I.D.1.C

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.D.1.D

E collect quantitative data using the International System of Units (SI) and United States customary units and qualitative data as evidence; I.D.1.E

F organize quantitative and qualitative data using lab reports, labeled drawings, graphic organizers, journals, summaries, oral reports, and technology-based reports; I.D.1.F

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G develop and use models to represent phenomena, systems, processes, or solutions to engineering problems; and I.D.1.G

H distinguish among scientific hypotheses, theories, and laws. I.D.1.H

2 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: I.D.2

A identify advantages and limitations of models such as their size, scale, properties, and materials; I.D.2.A

B analyze data by identifying significant statistical features, patterns, sources of error, and limitations; I.D.2.B

C use mathematical calculations to assess quantitative relationships in data; and I.D.2.C

D evaluate experimental and engineering designs. I.D.2.D

3 Scientific and engineering practices. The student develops evidence-based explanations and communicates findings, conclusions, and proposed solutions. The student is expected to: I.D.3

A develop explanations and propose solutions supported by data and models and consistent with scientific ideas, principles, and theories; I.D.3.A

B communicate explanations and solutions individually and collaboratively in a variety of settings and formats; and I.D.3.B

C engage respectfully in scientific argumentation using applied scientific explanations and empirical evidence. I.D.3.C

4 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: I.D.4

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.D.4.A

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.D.4.B

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.D.4.C

5 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: I.D.5

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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.D.5.A

B identify and use appropriate directional terminology when referring to the human body, including directional terms, planes, body cavities, and body quadrants; I.D.5.B

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.D.5.C

D research and describe negative and positive feedback loops as they apply to homeostasis; and I.D.5.D

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.D.5.E

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6 **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:** I.D.6

A define tissue and identify the four primary tissue types, their subdivisions, and functions; I.D.6.A

B compare epithelial tissue and connective tissue in terms of cell arrangement and interstitial materials; I.D.6.B

C describe the process of tissue repair involved in the normal healing of a superficial wound; and I.D.6.C

D describe the general metabolic pathways of carbohydrates, lipids, and proteins. I.D.6.D

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7 **Skeletal system. The student analyzes the relationships between the anatomical structures and physiological functions of the skeletal system. The student is expected to:** I.D.7

A identify and differentiate between the axial skeleton and appendicular skeleton; I.D.7.A

B identify the types of joints, including gliding, hinge, pivot, saddle, and ball and socket, and describe the movements of each; I.D.7.B

C identify and locate the anatomy of bone, including spongy and compact tissue, epiphysis, diaphysis, medullary cavity, periosteum, bone marrow, and endosteum; I.D.7.C

D explain the major physiological functions of the skeletal system; I.D.7.D

E describe the role of osteoblasts, osteocytes, and osteoclasts in bone growth and repair; I.D.7.E

F identify and describe the different types of fractures such as compound, complete, simple, spiral, greenstick, hairline, transverse, and comminuted; and I.D.7.F

G identify and describe common diseases and disorders of the skeletal system such as scoliosis, osteoporosis, and bone cancer. I.D.7.G

8 **Integumentary system. The student analyzes the relationships between the anatomical structures and physiological functions of the integumentary system. The student is expected to:** I.D.8

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.D.8.A

B describe the factors that can contribute to skin color; I.D.8.B

C describe and explain the process of tissue repair and scar formation; and I.D.8.C

D identify and describe common diseases and disorders of the integumentary system such as skin cancer and psoriasis. I.D.8.D

9 **Muscular system. The student analyzes the relationships between the anatomical structures and physiological functions of the muscular system. The student is expected to:** I.D.9

A explain the major physiological functions of the muscular system, including voluntary movement, involuntary movement, heat production, and maintaining posture; I.D.9.A

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.D.9.B

C examine common characteristics of muscle tissue, including excitability, contractibility, extensibility, and elasticity; I.D.9.C

D identify and describe the appearance, innervation, and function of the three muscle types, including cardiac, skeletal, and smooth; I.D.9.D

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E examine the microscopic anatomy of a muscle fiber, including sarcomere, actin, and myosin; I.D.9.E

F describe the mechanisms of muscle contraction at the neuromuscular junction; I.D.9.F

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.D.9.G

H identify and describe common diseases and disorders of the muscular system such as muscle strains and muscular dystrophy; and I.D.9.H

I analyze and describe the effects of pressure, movement, torque, tension, and elasticity on the human body. I.D.9.I

10 Nervous system. The student analyzes the relationship between the anatomical structures and physiological functions of the nervous system. The student is expected to: I.D.10

A summarize and distinguish between the major physiological functions of the nervous system, including sensation, integration, and motor response; I.D.10.A

B identify the senses and explain their relationship to nervous system; I.D.10.B

C investigate and explain the interdependence between the cranial and spinal nerves with the special senses of vision, hearing, smell, and taste; I.D.10.C

D describe the anatomy of the structures associated with the senses, including vision, hearing, smell, taste, and touch; I.D.10.D

E identify the anatomical and physiological divisions of the peripheral nervous system and central nervous system; I.D.10.E

F explain the glial cells within the central nervous system and peripheral nervous system and their associated functions; I.D.10.F

G analyze the functional and structural differences between gray and white matter relative to neurons; I.D.10.G

H distinguish between the types of neurons and explain the initiation of a nerve impulse during resting and action potential; I.D.10.H

I categorize the major neurotransmitters by chemical and physical mechanisms; and I.D.10.I

J identify and describe common diseases and disorders of the nervous system such as epilepsy, neuralgia, Parkinson's disease, and Alzheimer's disease. I.D.10.J

11 Endocrine system. The student analyzes the relationships between the anatomical structures and physiological functions of the endocrine system. The student is expected to: I.D.11

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.D.11.A

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B compare and contrast endocrine and exocrine glands and identify the glands associated with each; I.D.11.B

C describe the hormones associated with each endocrine gland; I.D.11.C

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.D.11.D

E explain how the endocrine glands are regulated, including neural, hormonal, and humoral control; and I.D.11.E

F identify and describe common diseases and disorders of the endocrine system such as hypothyroidism, pancreatic cancer, and diabetes. I.D.11.F

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12 Urinary system. The student analyzes the relationships between the anatomical structures and physiological functions of the urinary system. The student is expected to: I.D.12

A identify and describe the anatomical structures and functions of the urinary system, including the kidney, ureters, bladder, and urethra; I.D.12.A

B compare and contrast the anatomical structures and describe the functions of the male and female urinary system; I.D.12.B

C summarize and illustrate the structures, functions, and types of nephrons; I.D.12.C

D examine the methods of fluid balance and homeostasis in the urinary system, including fluid intake and output; I.D.12.D

E analyze the composition of urine and the process of urine formation, including filtration, reabsorption, and secretion; I.D.12.E

F describe the relationship between the nervous system, renal system, and muscular system before and during micturition; and I.D.12.F

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.D.12.G

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13 Cardiovascular system. The student analyzes the relationships between the anatomical structures and physiological functions of the cardiovascular system. The student is expected to: I.D.13

A identify the major functions of the cardiovascular system, including transport, maintaining homeostasis, and immune response; I.D.13.A

B compare and contrast the anatomical structure of arteries, arterioles, capillaries, venules, and veins; I.D.13.B

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.D.13.C

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D describe the relationship between blood flow and blood pressure, including systolic and diastolic pressure, pulse pressure, and mean arterial pressure; I.D.13.D

E compare and contrast coronary, pulmonary, and systemic circulation, and describe the major vessels of each I.D.13.E

F illustrate how the PQRST waves of an electrocardiogram (EKG) demonstrate the conduction of electricity through the structures of the heart; I.D.13.F

G describe the relationship between the cardiovascular system, nervous system, and muscular system in regulating cardiac output; and I.D.13.G

H identify and describe common diseases and disorders of the cardiovascular system such as heart disease, myocardial infarction, ischemia, and hypertrophic cardiomyopathy. I.D.13.H

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14 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: I.D.14

A evaluate the interaction of the lymphatic system with other body systems such as the circulatory system; I.D.14.A

B describe the structure and function of the lymphatic organs and explain how lymph moves through the body; I.D.14.B

C identify and describe the role and function of the immune cells, including T cells and B cells, within the lymphatic system structures; I.D.14.C

D identify and determine antigens associated with ABO blood typing, including Rhesus (Rh) factor; I.D.14.D

E summarize the ways the body protects and defends against disease, including inflammation, barrier defenses, and active and passive immunity; I.D.14.E

F describe the role of antigens and antibodies in the immune response; and I.D.14.F

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.D.14.G

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15 Digestive system. The student analyzes the relationships between the anatomical structures and physiological functions of the digestive system. The student is expected to: I.D.15

A examine the anatomical structures and function of the alimentary canal and accessory organs; I.D.15.A

B compare and contrast mechanical and chemical digestive processes; I.D.15.B

C evaluate the modes by which energy is processed and stored within the body, including ingestion, propulsion, absorption, and elimination; and I.D.15.C

D evaluate the modes by which energy is processed and stored within the body, including ingestion, propulsion, absorption, and elimination; and I.D.15.D

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16 **Respiratory system. The student analyzes the relationships between the anatomical structures and physiological functions of the respiratory system. The student is expected to:** I.D.16

- A identify and sequence the anatomical structures and functions of the respiratory system; I.D.16.A
- B compare and contrast the functions of upper and lower respiratory tract; I.D.16.B
- C describe the physiology of respiration, including internal and external respiration and gas exchange; I.D.16.C
- D describe the relationship between the respiratory and cardiovascular systems during pulmonary circulation; I.D.16.D
- E investigate factors that affect respiration, including exercise and environmental changes such as altitude; and I.D.16.E
- F identify and describe common diseases of the respiratory system such as asthma, emphysema, pneumonia, viruses, and allergies. I.D.16.F

17 **Reproductive system. The student analyzes the relationships between the anatomical structures and physiological functions of the reproductive system. The student is expected to:** I.D.17

- A explain embryological development of cells, tissues, organs, and systems; I.D.17.A
- B describe and examine the location, structure, and functions of the internal and external female and male reproductive organs and accessory glands; I.D.17.B
- C describe and compare the process of oogenesis and spermatogenesis; I.D.17.C
- D research and discuss the physiological effects of hormones on the stages of the menstrual cycle; I.D.17.D
- E identify and distinguish the hormones involved in maturation and development throughout the life cycle, including puberty, gestation, and menopause; and I.D.17.E
- 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.D.17.F

18 **Emerging technologies. The student identifies emerging technological advances in science and healthcare treatment and delivery. The student is expected to:** I.D.18

- A research and discuss advances in science and medicine at the organ and tissue level such as bionics and wearable monitoring technologies; and I.D.18.A
- B research and describe advances in science and medicine at the cellular level such as stem cells and gene therapy. I.D.18.B