Ohio Science

Human Anatomy and Physiology Content Elaborations: Grades 9-12

Adopted 2018

Human Anatomy and Physiology

Levels Of Organization

1. Hierarchy of organization AP.L0.1
    1. Students understand that several tissue types make up an organ. AP.L0.1.1
    2. Students understand that several organs working together make up an organ system. AP.L0.1.2
    3. Students understand that all the organ systems interact and form the human body. AP.L0.1.3
2. Types of tissues AP.L0.2
    1. Students understand that the human body is comprised of four types of tissues: epithelial, connective, muscle and nervous. AP.L0.2.1
    2. Students understand that this topic includes a broad overview of the structure, function and location of each tissue type. AP.L0.2.2
    3. Students understand that tissues can be studied as an independent unit or as they are encountered within each organ system. AP.L0.2.3
    4. Students understand that investigations are used to understand and explain types of tissues in a variety of inquiry and design scenarios that can incorporate evolutionary concepts, scientific reasoning, comparative analysis, communication skills and real-world applications. AP.L0.2.4
3. Homeostasis AP.L0.3
    1. Students understand that homeostasis is a theme that is explored throughout the course. AP.L0.3.1
    2. Students understand that homeostasis involves positive and negative feedback mechanisms that continuously monitor and adjust the body's internal conditions (e.g., temperature regulation, pH, hormone regulation, blood pressure, hemostasis). AP.L0.3.2
    3. Students understand that at times, there can be a disruption (or disruptions) in the feedback loops, creating an imbalance. AP.L0.3.3
    4. Students understand that this homeostatic imbalance can result in a variety of conditions. AP.L0.3.4
4. Anatomical terminology AP.L0.4
    1. Students understand that standard anatomical position is to be used as a reference point. AP.L0.4.1
    2. Students understand that each area of the human body is identified by region. AP.L0.4.2
    3. Students understand that the features and structures of the body, relative to each other, are described by directional terms. AP.L0.4.3
    4. Students understand that the body and its organs can be divided by planes. AP.L0.4.4
    5. Students understand that the organs are located in cavities. AP.L0.4.5

Support And Motion

1. Integumentary system AP.SM.1
    1. Students understand that the integumentary system consists of skin and accessory structures. AP.SM.1.1
    2. Students understand that the skin is composed of three layers: the epidermis, the dermis and the hypodermis (subcutaneous layer). AP.SM.1.2
    3. Students understand that the accessory structures can include sweat glands, sebaceous glands, arrector pili muscles, hair follicles and nails. AP.SM.1.3
    4. Students understand that skin functions include protection, temperature regulation, excretion and sensory perception. AP.SM.1.4
        a. Students understand that these occur through the processes of perspiration, skin production and shedding, vitamin D synthesis and repair. AP.SM.1.4.A
    5. Students understand that homeostatic imbalances are explored. AP.SM.1.5
        a. Students understand that these include, but are not limited to, burns, skin cancer, anhidrosis, acne, eczema or scleroderma. AP.SM.1.5.A
    6. Students understand that investigations are used to understand and explain the integumentary system in a variety of inquiry and design scenarios that can incorporate evolutionary concepts, scientific reasoning, comparative analysis, communication skills and real-world applications. AP.SM.1.6
2. Skeletal system AP.SM.2
    1. Students understand that the skeletal system is composed of bones, cartilage, joints and ligaments. AP.SM.2.1
    2. Students understand that bones make up most of the skeleton. AP.SM.2.2
    3. Students understand that there are four main cell types that compose bone tissue, each with a specific function: osteogenic cells, osteocytes, osteoblasts and osteoclasts. AP.SM.2.3
    4. Students understand that the microscopic anatomy of compact bone includes osteons. AP.SM.2.4
    5. Students understand that bones are classified by their shape. AP.SM.2.5
    6. Students understand that the structure of a typical long bone can be explored. AP.SM.2.6
    7. Students understand that specific bones of the skeleton can be studied by their subdivisions: the axial skeleton and the appendicular skeleton. AP.SM.2.7
    8. Students understand that cartilage is found in areas of the nose, ears, ribs and joints. AP.SM.2.8
    9. Students understand that joints can be classified by structure or by function. AP.SM.2.9
    10. Students understand that the general structure of synovial joints may be explored. AP.SM.2.10

11. Students understand that ligaments connect bone to bone, stabilizing joints. AP.SM.2.11
12. Students understand that the skeletal system provides support for the human body, protects soft organs, allows for movement due to attachment of muscles, stores minerals and fat and forms blood cells. AP.SM.2.12
13. Students understand that processes of the skeletal system include hematopoiesis, ossification and bone growth and remodeling. AP.SM.2.13
14. Students understand that a comparison of male to female, juvenile to adult or human to other vertebrate skeletons may be explored. Homeostatic imbalances are explored. AP.SM.2.14
    a. Students understand that these include, but are not limited to, osteoporosis, malnutrition, fractures, anterior cruciate ligament (ACL) injuries and arthritis. AP.SM.2.14.A
15. Students understand that investigations are used to understand and explain the skeletal system in a variety of inquiry and design scenarios that can incorporate evolutionary concepts, scientific reasoning, comparative analysis, communication skills and real-world applications. AP.SM.2.15

3. Muscular system AP.SM.3
    1. Students understand that the muscular system consists of three types of muscle cells: skeletal, smooth and cardiac. AP.SM.3.1
    2. Students understand that the primary function of the muscular system is to contract, thereby, moving the body and internal fluids, maintaining posture, generating heat and stabilizing joints. AP.SM.3.2
    3. Students understand that muscles are controlled voluntarily and/or involuntarily. AP.SM.3.3
    4. Students understand that heart muscle cells are mononucleated, branched and striated. AP.SM.3.4
    5. Students understand that intercalated disks are characteristic of cardiac muscle and aid in communication between cardiac muscle cells. AP.SM.3.5
    6. Students understand that smooth muscle cells, found in the hollow organs and blood vessels, are mononucleated, spindle-shaped and nonstriated. AP.SM.3.6
    7. Students understand that skeletal muscle cells, found attached to bones and skin, are multinucleated, cylindrical and striated. AP.SM.3.7
    8. Students understand that the muscles of the body can be studied by group, which include the muscles of the head, face and neck, the trunk and the upper and lower limbs. AP.SM.3.8
    9. Students understand that processes of the muscular system include gross body movements produced by skeletal muscles as they interact with the skeletal system, and muscle contraction. AP.SM.3.9
    10. Students understand that the connection between the nervous system and the skeletal system should be explored through the study of action potentials and

the resulting contraction of sarcomeres, as described by the sliding filament theory. AP.SM.3.10

11. Students understand that energy processing and muscle responses to stimuli can be studied along with building muscle tissue through exercise. AP.SM.3.11
12. Students understand that the effects of steroids can also be investigated. AP.SM.3.12
13. Students understand that homeostatic imbalances are explored, which include, but are not limited to, muscular dystrophy and atrophy. AP.SM.3.13
14. Students understand that investigations are used to understand and explain the muscular system in a variety of inquiry and design scenarios that can incorporate evolutionary concepts, scientific reasoning, comparative analysis, communication skills and real-world applications. AP.SM.3.14

Integration And Coordination

1. Nervous system AP.IC.1
    1. Students understand that the nervous system consists of neurons and supporting cells that combine to form nerves, the spinal cord and the brain. AP.IC.1.1
    2. Students understand that the primary functions of the nervous system are sensation, integration and response. AP.IC.1.2
    3. Students understand that a comparison of the structures and functions of the central and peripheral nervous systems should be explored. AP.IC.1.3
    4. Students understand that the central nervous system is composed of the brain and spinal cord. AP.IC.1.4
    5. Students understand that the peripheral nervous system includes the remaining nervous tissue. AP.IC.1.5
    6. Students understand that a neuron consists of dendrites, a cell body and an axon. AP.IC.1.6
    7. Students understand that neurons conduct electrical impulses along their membranes and at synapses. AP.IC.1.7
    8. Students understand that brain cells can detect and sometimes respond to these impulses. AP.IC.1.8
    9. Students understand that neuroglial cells help to support neural function. AP.IC.1.9
    10. Students understand that the brain consists of three major parts: the cerebrum, cerebellum and brainstem. AP.IC.1.10
    11. Students understand that the cerebrum is divided into lobes and hemispheres. AP.IC.1.11
    12. Students understand that functions of the cerebrum that may be explored include voluntary muscle control, memory, sensory perception, emotions and speech. AP.IC.1.12
    13. Students understand that the cerebellum is primarily responsible for balance and coordination. AP.IC.1.13
    14. Students understand that the brainstem, a part of the autonomic nervous system, includes structural divisions that perform basic life functions such as breathing and heart rate. AP.IC.1.14
    15. Students understand that the spinal cord is a continuation of the brainstem. AP.IC.1.15
    16. Students understand that the spinal cord is a bundle of nerve tracts that transmits nerve signals between the brain and the body through electrical impulses. AP.IC.1.16
    17. Students understand that nerves are bundles of neurons that transmit impulses between the peripheral and central nervous systems. AP.IC.1.17
    18. Students understand that the study of nerves can include sciatic, cranial and spinal nerves. AP.IC.1.18

19. Students understand that supporting structures of the central nervous system include the meninges and cerebrospinal fluid which protect the central nervous system. AP.IC.1.19
20. Students understand that processes of the nervous system are action potential propagation, simple nerve pathways (reflex arc) and neurotransmitter function. AP.IC.1.20
21. Students understand that homeostatic imbalances are explored. These include, but are not limited to, the effects of drugs, mental illnesses, spinal injuries, concussions, meningitis and multiple sclerosis (MS). AP.IC.1.21
22. Students understand that investigations are used to understand and explain the nervous system in a variety of inquiry and design scenarios that can incorporate evolutionary concepts, scientific reasoning, comparative analysis, communication skills and real-world applications. AP.IC.1.22

2. Special senses AP.IC.2
    1. Students understand that the special senses consist of sight, hearing, balance, smell and taste. AP.IC.2.1
    2. Students understand that each sense involves a network of feedback processes and consists of distinct structures. AP.IC.2.2
    3. Students understand that the eye provides visual environmental feedback and includes primary and accessory structures. AP.IC.2.3
    4. Students understand that light enters through the pupil and is then focused by the lens onto the retina at the visual axis. AP.IC.2.4
    5. Students understand that the optic nerve transmits the electrical impulses to the brain where they are translated. AP.IC.2.5
    6. Students understand that the accessory structures provide lubrication, protection and support to the eye. AP.IC.2.6
    7. Students understand that processes include stimulation of the photoreceptors (rods and cones) by light. AP.IC.2.7
    8. Students understand that homeostatic imbalances are explored. These include, but are not limited to, certain types of blindness, conjunctivitis, glaucoma, astigmatism, hyperopia, myopia and cataracts. AP.IC.2.8
    9. Students understand that investigations are used to understand and explain the sense of sight in a variety of inquiry and design scenarios that can incorporate evolutionary concepts, scientific reasoning, comparative analysis (e.g., squid, falcon, hawks) communication skills and real-world applications. AP.IC.2.9
    10. Students understand that the ears respond to a range of sounds and provide a sense of equilibrium. AP.IC.2.10
    11. Students understand that the structures include those of the outer, middle and inner ear. AP.IC.2.11
    12. Students understand that processes of hearing and balance should be explored including the perception of sound and spatial awareness. AP.IC.2.12

13. Students understand that homeostatic imbalances are explored. AP.IC.2.13
14. Students understand that these include, but are not limited to, certain types of hearing loss, otitis media, lack of balance (e.g., vertigo), tinnitus, auditory processing, motion sickness and Meniere's syndrome. AP.IC.2.14
15. Students understand that investigations are used to understand and explain the senses of hearing and balance in a variety of inquiry and design scenarios that can incorporate evolutionary concepts, scientific reasoning, comparative analysis, communication skills and real-world applications. AP.IC.2.15
16. Students understand that the senses of taste and smell occur primarily in the oral and nasal cavities. AP.IC.2.16
17. Students understand that the structure of taste buds and olfactory cells are the foundation of taste and smell. AP.IC.2.17
18. Students understand that the location, structure and afferent pathways of taste and smell receptors should be addressed. AP.IC.2.18
19. Students understand that processes include activation of chemoreceptors and transmission of electrical impulses to the brain, where they are integrated. AP.IC.2.19
20. Students understand that homeostatic imbalances are explored. AP.IC.2.20
21. Students understand that these include, but are not limited to, age-related sensitivities, taste preferences, anosmia and olfactory auras. AP.IC.2.21
22. Students understand that investigations are used to understand and explain the senses of taste and smell in a variety of inquiry and design scenarios that can incorporate evolutionary concepts, scientific reasoning, comparative analysis, communication skills and real-world applications. AP.IC.2.22

3. Endocrine system AP.IC.3
    1. Students understand that the endocrine system is comprised of glands that secrete hormones resulting in a response in target cells or organs. AP.IC.3.1
    2. Students understand that glands with their associated hormones may include pituitary, hypothalamus, thyroid, thymus, parathyroid, pineal, pancreas, adrenal, ovaries and testes. AP.IC.3.2
    3. Students understand that the endocrine system results in regulating metabolism, maintaining homeostasis, regulating growth and development, and controlling reproduction through hormonal release. AP.IC.3.3
    4. Students understand that the processes involved in the endocrine system should include a comparison of negative and positive feedback systems. AP.IC.3.4
    5. Students understand that negative feedback examples can include regulation of blood glucose levels, calcium levels, blood pressure and temperature. AP.IC.3.5
    6. Students understand that positive feedback examples can include oxytocin in childbirth and hemostasis. AP.IC.3.6
    7. Students understand that homeostatic imbalances are explored. These include, but are not limited to, hyper- and hypo- functions of glands, diabetes (type I and type II), gigantism and dwarfism. AP.IC.3.7

8. Students understand that investigations are used to understand and explain the endocrine system in a variety of inquiry and design scenarios that can incorporate evolutionary concepts, scientific reasoning, comparative analysis, communication skills and real-world applications. AP.IC.3.8

Transport

1. Blood AP.T.1
    1. Students understand that blood is composed of plasma and the formed elements: red blood cells (erythrocytes), white blood cells (leukocytes), and platelets (thrombocytes). AP.T.1.1
    2. Students understand that the primary functions of blood are transportation, protection and regulation. AP.T.1.2
    3. Students understand that plasma, the most abundant component of blood, is the liquid portion that transports dissolved nutrients, waste, hormones, antibodies and proteins throughout the body. AP.T.1.3
    4. Students understand that red blood cells carry oxygen used during cellular processes throughout the body. AP.T.1.4
    5. Students understand that white blood cells identify and protect the body against infectious disease and foreign cells. AP.T.1.5
    6. Students understand that platelets bind together when a blood vessel is damaged resulting in blood clot formation. AP.T.1.6
    7. Students understand that the major ABO blood types, A, B, AB and O, are determined by the presence or absence of antigens on the surface of red blood cells. AP.T.1.7
    8. Students understand that an additional antigen is present or absent on the surface of red blood cells determining Rh factor. AP.T.1.8
    9. Students understand that blood type antibodies are found in plasma. AP.T.1.9
    10. Students understand that processes related to blood include the production of blood cells and platelets, and hemostasis. AP.T.1.10
    11. Students understand that homeostatic imbalances are explored. These include, but are not limited to, sickle cell anemia, hemophilia, deep vein thrombosis, leukemia and lymphoma. AP.T.1.11
    12. Students understand that investigations are used to understand and explain blood in a variety of inquiry and design scenarios that can incorporate evolutionary concepts, scientific reasoning, comparative analysis, communication skills and real-world applications. AP.T.1.12
2. Cardiovascular system AP.T.2
    1. Students understand that the cardiovascular system consists of the heart and blood vessels. AP.T.2.1
    2. Students understand that the heart is mostly comprised of cardiac muscle which is supplied with oxygenated blood by coronary arteries. AP.T.2.2
    3. Students understand that the structure of the heart includes four chambers, four valves and major vessels leading to and from the heart. AP.T.2.3
    4. Students understand that the flow of blood through the heart, pulmonary and systemic circuits should be explored. AP.T.2.4

5. Students understand that blood flows from arteries, to arterioles, to capillaries, to venules, then to veins. AP.T.2.5
6. Students understand that in the capillaries, oxygen, nutrients, and chemical messengers diffuse out (leave) and carbon dioxide and other waste products diffuse in (enter). AP.T.2.6
7. Students understand that veins have valves that keep the blood flowing toward the heart. AP.T.2.7
8. Students understand that the primary function of the cardiovascular system is the transport of oxygen, carbon dioxide, hormones, nutrients, waste products and chemical messengers. AP.T.2.8
9. Students understand that processes involved in the cardiovascular system include the cardiac cycle and cardiac and conductive pathway which is measured by electrocardiograms and blood pressure. AP.T.2.9
10. Students understand that homeostatic imbalances are explored. AP.T.2.10
11. Students understand that these include, but are not limited to, a variety of cardiovascular diseases and structural imperfections of the heart, valves and vessels. Examples include, but are not limited to, myocardial infarction, aneurysm, atherosclerosis, hypertrophic cardiomyopathy, hypo/hypertension and arrhythmias. AP.T.2.11
12. Students understand that investigations are used to understand and explain the cardiovascular system in a variety of inquiry and design scenarios that can incorporate evolutionary concepts, scientific reasoning, comparative analysis, communication skills and real-world applications. AP.T.2.12

3. Lymphatic and immune system AP.T.3
    1. Students understand that the lymphatic system includes lymph, lymphatic vessels, lymph nodes and the immune system. AP.T.3.1
    2. Students understand that the lymphatic system has multiple, interrelated functions. AP.T.3.2
    3. Students understand that they include the removal of fluid from tissues, absorption of large fatty acids in small intestines and transport of white blood cells to the lymph nodes. AP.T.3.3
    4. Students understand that the immune system consists of white blood cells that destroy foreign antigens. AP.T.3.4
    5. Students understand that tissue fluid that has entered into lymphatic capillaries becomes lymph. AP.T.3.5
    6. Students understand that multiple lymphatic capillaries form lymphatic vessels. As lymph circulates through the body, it passes through multiple lymph nodes. AP.T.3.6
    7. Students understand that these lymph nodes contain lymphocytes which destroy foreign antigens. AP.T.3.7
    8. Students understand that processes of the lymphatic system include defense through nonspecific and specific resistance. Examples of nonspecific resistance

include mechanical barriers such as the skin, enzymes, species resistance and mucous membranes. AP.T.3.8

9. Students understand that in specific resistance, antibodies are produced that defend the body against foreign antigens. AP.T.3.9
10. Students understand that memory cells are produced following an infection that allow for possible immunity against a specific antigen upon re-exposure. AP.T.3.10
11. Students understand that a comparison of primary versus secondary immune responses can be explored. AP.T.3.11
12. Students understand that homeostatic imbalances are explored. AP.T.3.12
13. Students understand that these include, but are not limited to, autoimmune disorders, parasitic diseases, allergies, bacterial versus viral infections and ringworm. AP.T.3.13
14. Students understand that vaccinations provide the body with either long-term protection or short-term protection against many pathogens. AP.T.3.14
15. Students understand that investigations are used to understand and explain the lymphatic system in a variety of inquiry and design scenarios that can incorporate evolutionary concepts, scientific reasoning, comparative analysis, communication skills and real-world applications. AP.T.3.15

Absorption And Excretion

1. Digestive system AP.AE.1
    1. Students understand that the digestive system consists of the gastrointestinal tract (alimentary canal) as well as various accessory organs including the teeth, tongue, salivary glands, liver, gallbladder and pancreas. AP.AE.1.1
    2. Students understand that the digestive system processes and supplies the molecules needed to sustain the living tissues within the body through the absorption of nutrients. AP.AE.1.2
    3. Students understand that six major functions of the digestive system include secretion, ingestion, mechanical processing, enzymatic digestion, absorption and excretion. AP.AE.1.3
    4. Students understand that the lining of the digestive system protects surrounding tissues from the mechanical and enzymatic stresses of the digestive process. AP.AE.1.4
    5. Students understand that processes of the digestive system include the mechanical and chemical breakdown of food into small molecules which are then absorbed by the digestive tract. AP.AE.1.5
    6. Students understand that specific actions within the digestive system include mastication, peristalsis, segmentation and the release of hormones and enzymes necessary for digestion. AP.AE.1.6
    7. Students understand that the metabolic functions of the accessory organs play strategic roles in the breakdown of food products, the maintenance of glucose levels within the blood and the regulation of homeostasis in the body. AP.AE.1.7
    8. Students understand that indigestible material is excreted as waste. AP.AE.1.8
    9. Students understand that homeostatic imbalances are explored. These include, but are not limited to, conditions such as gallstones, heartburn, ulcers, dehydration, diarrhea, cirrhosis and cancers of the digestive system. AP.AE.1.9
    10. Students understand that investigations are used to understand and explain the digestive system in a variety of inquiry and design scenarios that can incorporate evolutionary concepts, scientific reasoning, comparative analysis, communication skills and real-world applications. AP.AE.1.10
2. Respiratory system AP.AE.2
    1. Students understand that the respiratory system is comprised of the airways, lungs and diaphragm. AP.AE.2.1
    2. Students understand that the airways include the nasal and oral cavities, pharynx, larynx, trachea, bronchi, bronchioles and alveoli. AP.AE.2.2
    3. Students understand that the respiratory system transports and exchanges gases including oxygen and carbon dioxide. AP.AE.2.3
    4. Students understand that processes involved in the respiratory system include respiration mechanics and gas exchange. AP.AE.2.4

5. Students understand that respiration mechanics is the process by which humans breathe and includes the movement of the diaphragm and pressure-volume relationships. AP.AE.2.5
6. Students understand that gas exchange refers to the diffusion of gas across the alveolar epithelium in the respiratory system and capillary endothelium of the cardiovascular system. AP.AE.2.6
7. Students understand that lung volumes and capacities can be measured using spirometry. AP.AE.2.7
8. Students understand that homeostatic imbalances are explored. These include, but are not limited to, asthma, chronic obstructive pulmonary disease (COPD), tuberculosis, cystic fibrosis and the effects of smoking and pollution. AP.AE.2.8
9. Students understand that investigations are used to understand and explain the respiratory system in a variety of inquiry and design scenarios that can incorporate evolutionary concepts, scientific reasoning, comparative analysis, communication skills and real-world applications. AP.AE.2.9

3. Urinary system AP.AE.3
    1. Students understand that the urinary system is a regulatory system that helps maintain homeostasis. AP.AE.3.1
    2. Students understand that the structures of the urinary system include the kidneys, ureters, bladder and urethra. AP.AE.3.2
    3. Students understand that each kidney consists of the renal cortex, medulla and renal pyramids. AP.AE.3.3
    4. Students understand that the functional unit of the kidney is the nephron. AP.AE.3.4
    5. Students understand that the renal pelvis is a funnel-shaped chamber that is connected to the ureter. AP.AE.3.5
    6. Students understand that the primary functions of the urinary system are excretion, elimination and regulation of blood volume and pressure. AP.AE.3.6
    7. Students understand that processes of the urinary system include filtration, reabsorption and secretion, which occurs in the nephrons. AP.AE.3.7
    8. Students understand that urine is normally a clear, yellow, sterile solution but the composition can vary slightly between individuals. AP.AE.3.8
    9. Students understand that urinalysis is a diagnostic tool for detecting substances and conditions in the body. AP.AE.3.9
    10. Students understand that antidiuretic hormone (ADH) and aldosterone hormones influence the volume and concentration of urine. AP.AE.3.10
    11. Students understand that caffeine and alcohol act as diuretics and can lead to short or long-term kidney issues. AP.AE.3.11
    12. Students understand that homeostatic imbalances are explored. These include, but are not limited to, urinary tract infections, kidney stones, nephritis and acute and chronic kidney disease. AP.AE.3.12

13. Students understand that investigations are used to understand and explain the urinary system in a variety of inquiry and design scenarios that can incorporate evolutionary concepts, scientific reasoning, comparative analysis, communication skills and real-world applications. AP.AE.3.13

Reproduction

1. Reproductive system AP.R.1
    1. The reproductive system is comprised of internal and external organs and hormones. AP.R.1.1
    2. The ovaries and testes produce gametes that fuse to form a zygote, a single cell that develops into an embryo and eventually an adult. AP.R.1.2
    3. The female body has the function of providing protection and nourishment for the developing fetus until birth. If all is successful, a new generation of offspring will occur. AP.R.1.3
    4. The processes of the reproductive system include oogenesis, spermatogenesis and fertilization. AP.R.1.4
    5. Additional processes can include lactation and menstruation. AP.R.1.5
    6. Homeostatic imbalances are explored. These include, but are not limited to, infertility, chromosomal disorders, endometriosis, cancer, Human Papillomavirus (HPV), and sexually transmitted diseases (STD's). AP.R.1.6
    7. Investigations are used to understand and explain the reproductive system in a variety of inquiry and design scenarios that can incorporate evolutionary concepts, scientific reasoning, comparative analysis, communication skills and real-world applications. AP.R.1.7