

ANATOMY & PHYSIOLOGY CURRICULUM

The Anatomy and Physiology curriculum is structured on a systems approach. The numbers assigned to each criterion are arbitrary and are used only to facilitate ease of reference. Although the first criterion correlates with Colorado Model Content Standard 1, criterion 2 - 19 regard specific, individual systems at a comprehensive level that is beyond the scope of the Colorado Model Content Standards.

STANDARD 1: Students apply the processes of scientific investigation and design, conduct, communicate about, and evaluate such investigations.

Criterion	Indicators of Performance	Resources	Vocabulary
Design and perform scientific investigation utilizing the scientific inquiry process.	1.1 identifies question(s) to be asked and/or the problem(s) for which answers and solutions will be sought through investigation(s) undertaken 1.2 asks questions and state hypotheses, based on prior scientific knowledge, which help guide student development 1.3 formulates questions and hypotheses which correlate to scientific investigations relative to the human body, its anatomy, and physiology 1.4 uses hypotheses, formulate a prediction of expected results, and the causal factors that may influence those predictions 1.5 identifies independent and dependent variables and the concurrent control(s) to be used in any investigations undertaken 1.6 identifies and assesses the impact of variables on the results obtained from an investigation 1.7 creates and defends a written plan of action for a scientific investigation 1.8 uses appropriate tools and technologies to measure and collect data, including, but are not limited to 1.8a microscopes, devices that measure volume, length, mass, and weight in metric units, and computer-related technologies 1.9 utilizes observations and data collected from multiple trials and provide a rationale for doing so 1.10 selects and uses appropriate technologies to gather, process, and analyze data and to report information related to an investigation 1.11 depicts data in a table, graph, chart, or histogram 1.12 identifies major sources of error or uncertainty within		<i>Vocabulary will be based on the Science Glossary when released by CDE and instructional materials to support frameworks.</i>

	<p>an investigation (for example, particular measuring devices and experimental procedures)</p> <p>1.13 constructs and revises scientific explanations and models, using evidence, logic, and experiments that include identifying and controlling variables</p> <p>1.14 communicates and evaluates scientific thinking that leads to particular conclusions</p> <p>1.15 recognizes and analyzes alternative explanations and models</p> <p>1.16 explains the difference between a scientific theory and a scientific hypothesis</p> <p>1.17 designs and completes an advanced scientific investigation—either individually or as part of a student team—that extends over several days or weeks</p> <p>1.18 continues to practice and apply inquiry skills as students extend their understanding of science content through further study.</p>		
<p>Anatomical orientation</p>	<p>2.1 explore the organizational structures of the body from the molecular to the organism level</p> <p>2.2 distinguish between anatomy and physiology, and their various subdivisions</p> <p>2.3 investigate the structures of the major body systems, their functions, and relative locations</p> <p>2.4 investigate the body cavities and subdivisions of each cavity</p> <p>2.5 apply correct anatomical terminology when discussing the planes of the body</p> <p>2.6 apply correct anatomical terminology with respect to the orientation of body parts and regions</p> <p><i>a.</i> superior</p> <p><i>b.</i> inferior</p> <p><i>c.</i> anterior</p> <p><i>d.</i> posterior</p> <p><i>e.</i> medial</p> <p><i>f.</i> lateral</p> <p><i>g.</i> proximal</p> <p><i>h.</i> distal</p> <p><i>i.</i> deep</p> <p><i>j.</i> superficial</p>		

	<p>2.7 identify body sections</p> <p>2.7a. sagittal section divides the body into right and left portions.</p> <p>2.7b. transverse section divides the body into superior and inferior portions.</p> <p>2.7c. coronal section divides the body into anterior and posterior sections.</p> <p>2.7d. cross section, oblique section, longitudinal section</p> <p>2.8 classify organ systems of the body as:</p> <p>2.8a. protection</p> <p>2.8b. support</p> <p>2.8c. movement</p> <p>2.8d. regulation</p> <p>2.8e. regulation</p> <p>2.8f. integration</p> <p>2.8g. transport</p> <p>2.8h. absorption</p> <p>2.8i. excretion</p> <p>2.9 identify body landmarks and apply appropriate terminology for those landmarks</p> <p>2.10 relate positive and negative feedback mechanisms to the maintenance of homeostasis within the body, and predict their effects on body cells, tissues, organs, or systems</p> <p>2.11 identify careers related to anatomy and physiology in medicine, allied health, and research.</p>		
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<p>chemical organization</p>	<p>3.1 Matter</p> <p><i>3.1a.</i> understand the states of matter</p> <p><i>3.1b</i> understand that matter occupies space and mass</p> <p><i>3.1c</i> be able to relate the Law of Conservation of Matter and Energy to chemical reactions</p> <p>3.2 Energy</p> <p><i>3.2a.</i> understand that energy does not occupy space and has no mass</p> <p><i>3.2b.</i> be able to compare and contrast potential energy - stored energy</p> <p><i>3.2c.</i> be able to describe and apply the concept that kinetic energy is the energy of work and/or motion</p> <p><i>3.2d.</i> identify, compare, and contrast the forms of energy (chemical, electrical, mechanical, radiant, heat)</p> <p><i>3.2e.</i> be able to identify and explain the conversion of energies (e.g. chemical into mechanical)</p> <p>3.3 Composition of matter</p> <p><i>3.3a.</i> understand what elements are, and that they are the fundamental unit in chemistry</p> <p><i>3.3b.</i> atoms</p> <ol style="list-style-type: none"> 1. understand and recognize atomic symbols, numbers, and masses and their importance 2. explain that atoms are the smallest whole unit in any element 3. identify and explain the roles, charges, and masses of subatomic particles in any atom 4. recognize the importance of electrons in any chemical reaction 5. identify and state the significance of isotopes <ul style="list-style-type: none"> * atoms of an element with different numbers of neutrons * radioisotopes are unstable isotopes which release particles, energy, or both upon decay <p>3.4 Chemical Bonding</p> <p><i>3.4a.</i> ionic bonds</p> <p><i>3.4b.</i> non-polar covalent bonds</p> <p><i>3.4c.</i> polar covalent bonds</p>		
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	<p>3.4d. hydrogen bonds 3.4e. valence electrons 3.4f. octet rule 3.4g. anions 3.4h. cations</p> <p>3.5 Chemical Reactions</p> <p>3.5a. use chemical notation and symbols to correctly write and balance chemical equations</p> <p>3.5b. understand and apply oxidation-reduction (Redox) reactions in physiological reactions</p> <p>3.5c. understand and apply the role(s) of water in chemical reactions:</p> <ol style="list-style-type: none"> 1. high heat capacity of water 2. high heat of vaporization 3. polarity 4. role of water as a solvent 5. role of water in dissociation reactions <p>3.6 Understand molecules and molecular structure</p> <p>3.6a. understand the differences between molecules, mixtures, solutions, colloids, and suspensions</p> <p>3.6b. understand moles, molarity, and molality</p> <p>3.7 Organic Molecules</p> <p>3.7a. identify and describe the molecular structure of lipids, carbohydrates, proteins, and nucleic acids</p> <p>3.7b. compare and contrast the role of dehydration synthesis and hydrolysis in synthesis and decomposition of molecules, and the formation and degradation of polymers</p> <p>3.7c. understand and identify the roles played by different organic molecules</p> <p>3.7d. identify macromolecules and their roles in cells and tissues (e.g. glycoproteins, glycolipids)</p> <p>3.8 Carbon-based Nature of Organic Molecules</p> <p>3.8a. recognize that carbon is electroneutral</p> <p>3.8b. understand carbohydrates (sugars and starches)</p> <p>3.8c. be aware of the structure and identities of monosaccharides glucose, fructose, galactose</p> <p>3.8d. recognize disaccharides: sucrose, lactose, maltose</p> <p>3.8e. be able to identify polysaccharides: starch, glycogen, cellulose</p>		
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- 3.8f. know the structure of lipids: neutral fats/triglycerides - oils (unsaturated) vs. fats
- 3.8g. understand the importance and structure of phospholipids (e.g. phospholipid bilayer of membranes)
- 3.8h. recognize structure/role of steroids: cholesterol, estrogen, testosterone, cortisol, aldosterone
- 3.8i. recognize structure and role of eicosanoids
- 3.8j. recognize structure of prostaglandins
- 3.8k. recognize structure of: amino acids tyrosine, tryptophan, serine, leucine, peptides, polymers, and polypeptides, myosin, trypsin, adrenocorticotropin; fibrous vs. globular proteins; collagen, and hemoglobin enzymes as organic catalysts, formation of enzyme-substrate complex
 1. understand and apply nucleic acids as building blocks:
 2. nucleotides: adenine, thymine, guanine, cytosine (DNA); or uracil (RNA),
 3. deoxyribose + nucleotide = nucleoside (mtDNA)
 4. ribosomal RNA: mRNA, tRNA, rRNA
 5. ATP: adenosine triphosphate ~-bond: adenine-ribose-PO₄~PO₃~PO₃
 6. phosphorylation-dephosphorylation
 7. CAMP: cyclic adenosine monophosphate
- 3.9 acids and bases
 - 3.9a. understand and apply role of acids [ionic compounds that release H⁺ (protons)] in the physiology of health and disease
 - 3.9b. understand and apply the role of bases [ionic compounds that release H⁺ (protons)] in the physiology of health and disease
 - 3.9c. pH: measures relative concentration of H⁺ in solutions {pH = -log₁₀[H⁺]}
 - 3.9d. pH scale: 0 - 14 [0 = most acidic; 7 = neutral; 14 = most basic]
 - 3.9e. recognize the role of buffers in maintaining homeostasis

<p>cells and tissues with related membranes</p>	<ul style="list-style-type: none"> 4.1. understand the correlation between cell, tissue, organ, and organ system function and homeostasis 4.2 develop scenarios of positive and negative feedback mechanisms and predict their effect upon homeostasis. 4.3 identify the major cell and tissue groups 4.4 list the hierarchy of structural organization from the molecular level through the organism level 4.5 label the sub-cellular (including organelle) components in the cell and identify the role(s) of each component 4.6 list the survival needs of living organisms 4.7 distinguish between cellular anatomy and physiology 4.8 be able to correlate the differentiation in cellular anatomy and physiology to specific and interrelated cell functions and forms among cells 4.9 classify organ systems of the body as either (1) protection, support, and movement, (2) regulation and integration, (3) transport, or (4) absorption and excretion. 4.10 illustrate the directional terms that refer to the body using correct anatomical terminology. 4.11 construct a concept map to illustrate the cavities in the body and the organs contained within each area. 4.12 relate positive and negative feedback mechanisms to the maintenance of homeostasis within the body. 4.13 identify careers related to anatomy and physiology in medicine, allied health, and research.investigate the structures of the major body systems and relate form to function 4.14 understand that molecules make up the fabric of living cells, which, in turn, make up tissues 4.15 understand the role of adhesion molecules, the classification of tissues, and the various cell types found in various tissue types 4.16 Compare and contrast the different ways in which substances cross the plasma membrane including diffusion and osmosis, facilitated diffusion, active transport, endocytosis, and exocytosis both as a function of passive cellular transport and as a function of the kinetic energy present in molecules 4.17 Describe the role of different types of proteins in cell 		
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	<p>function and structure as well as give specific examples of proteins and their functions and describe how proteins are synthesized</p> <p>4.18 Describe the general structure of an epithelium including the basement membrane</p> <p>4.19 Describe the types and locations of epithelia. Describe endocrine and exocrine glands and their development from glandular epithelium.</p> <p>4.20 Compare and contrast epithelial and synovial membranes.</p> <p>4.21 Compare and contrast the structure and function of cells that make up the various types of muscle tissue, nerve tissue, and connective tissue.</p> <p>4.22 Discuss the important physiological functions of the skin.</p> <p>4.23 Describe the structure of the skin, including the hypodermis, dermis, and the layers of the epidermis.</p> <p>4.24 Discuss the accessory structures of the skin: hairs, nails, and glands.</p>		
<p>movement and support in humans</p>	<p>5.1 understand the physiology and structure of bones and skeletal muscle as they interact to provide movement and support of the human body</p> <p>5.2 understand the chemical and microscopic structure of bone; its development, repair, turnover, and growth; and its ability to heal when damaged</p> <p>5.3 know that although the skeleton is made up of rigid bones, many joints allow for movement and the specific movement allowed in joints reinforces the concept of form following function</p> <p>5.4 explain the anatomical position and the terms that describe relative positions, body planes, and body regions. Describe the body cavities, their membranes, and the organs within each cavity; the major organ systems; and their role in the functioning of the body.</p> <p>5.5 distinguish bones according to shape and describe the major functions of bone. Describe the structure of a typical long bone and indicate how each part functions in the physiology and growth of the bone.</p> <p>5.6 compare and contrast the microscopic organization of compact (cortical) bone and spongy (trabecular) bone.</p>		

	<p>5.7 Describe the types of cell found in bone and their role in bone growth and control of bone mass.</p> <p>5.8 distinguish the axial from the appendicular skeleton and name the major bones of each.</p> <p>5.9 Locate and identify the bones and the major features of the bones that make up the skull, vertebral column, thoracic cage, pectoral girdle, upper limb, pelvic girdle, and lower limb.</p> <p>5.10 describe the major types of joints in terms of their mobility and the tissues that hold them together.</p> <p>5.11 Describe the structures that make up a synovial joint; describe synovial fluid and its properties.</p> <p>5.12 MUSCLE STRUCTURE AND PHYSIOLOGY</p> <p><i>5.12a.</i> Compare and contrast the microscopic structure, organization, function, and molecular basis of contraction in skeletal, smooth, and cardiac muscle.</p> <p>5.12b. Name the components of a skeletal muscle fiber and describe their functions.</p> <p><i>5.12c.</i> Describe how the thin and thick filaments are organized in the sarcomere.</p> <p><i>5.12d.</i> Explain the molecular processes and biochemical mechanisms that provide energy for muscle contraction and relaxation.</p> <p><i>5.12e.</i> Describe a motor unit and its importance in controlling the force and velocity of muscle contraction.</p> <p><i>5.12f.</i> Describe the neuromuscular junction and the neurotransmitter released at the neuromuscular junction.</p> <p><i>5.12g.</i> Identify the major muscles on a diagram of the body's musculature and describe the movements associated with each of them.</p> <p><i>5.12h.</i> Distinguish between isotonic and isometric contractions of skeletal muscle; cite examples of each and discuss how muscle contraction is amplified by the use of lever systems.</p> <p><i>5.12i.</i> Explain what is meant by muscular hypertrophy and atrophy and the causes of these conditions.</p>		
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<p>nervous tissue and neurophysiology</p>	<p>6.1 recognizes that the nervous system, together with the endocrine system, controls and integrates the workings of the human body</p> <p>6.2 recognizes that nerve cells are the functional cellular units of the nervous system, and that their activity allows for rapid transmission of information along their axons as well as an ability to network by "talking" to other nerve cells</p> <p>6.3 discusses the three basic types of activity in the nervous system: (1) sensory; (2) integration, interpretation, information storage, decision-making; (3) motor function</p> <p>6.4 distinguishes the structures of the various functional types of neurons; diagram the structure of a motor neuron and explain the function of each component</p> <p>6.5 describes the different types of neuroglial cells</p> <p>6.6 describes the function of oligodendrocytes and Schwann cells</p> <p>6.7 describes the structure and function of the myelin sheath and the role that Schwann cells play in regeneration of a severed nerve axon.</p> <p>6.8 discusses mathematically the origin of the resting potential, referring to the intra- and extracellular concentrations of sodium and potassium ions, the permeability of the plasma membrane to these ions, and the intracellular concentration of negatively-charged proteins.</p> <p>6.9 explains the changes in membrane potential during the action potential and their relationship to the number of open channels for sodium and potassium ions</p> <p>6.10 explains the structure and the role of excitatory and inhibitory neurotransmitters in a synapse</p> <p>6.11 explains why it is important to remove a neurotransmitter after it has been released and describes two mechanisms for doing this</p>		
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<p>structure and function of the nervous system</p>	<p>7.1 understands that the nervous system is divided into the peripheral nervous system (PNS) and the central nervous system (CNS).</p> <p>7.2 understands the structure and functions of the spinal cord and the subdivisions of the brain.</p> <p>7.3 recognizes that the nervous system is divided into the peripheral nervous system and the central nervous system</p> <p>7.4 identifies and describe the three meningeal layers that cover the brain and spinal cord</p> <p>7.5 describes the ventricles in the brain and how they are interconnected</p> <p>7.6 describes the secretion, flow pathways, and absorption of cerebrospinal fluid, its locations, and explain its functions</p> <p>7.7 discusses the functions of the spinal cord. Describe the five segments (regions) of the spinal cord and explain its cross-sectional anatomy in terms of organization</p> <p>7.8 describes a dermatome and its clinical importance</p> <p>7.9 describes the various types of spinal reflex and discuss their importance with regards to posture and avoidance of painful stimuli</p> <p>7.10 discusses the components and broad function of the brain stem and the diencephalon. Describe and give the functions of the various structures that make up the cerebrum including the cerebral cortex and its anatomical divisions, the cerebral components of the basal ganglia, and the corpus callosum</p> <p>7.11 describes the functions and locations of the motor, sensory, and association areas of the cerebral cortex</p> <p>7.12 explains hemispheric dominance</p> <p>7.13 describes the structure and functions of the cerebellum and its nuclei regarding postural control, smooth coordination of movements, and motor learning</p> <p>7.14 describes the major characteristics of the autonomic nervous system and contrast its efferent pathways with those of the somatic nervous system</p> <p>7.15 compares and contrasts the actions, origins, and pathways of nerve fibers in the parasympathetic and</p>		
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	<p>sympathetic divisions of the autonomic nervous system including their associated ganglia and neurotransmitters</p> <p>7.16 describes the structure and function of sensory receptors and their role in human survival.</p> <p>7.17 distinguishes between somatic senses and special senses and classify sensory receptors according to the types of stimuli that activate them.</p> <p>7.18 explains how information on stimulus intensity and stimulus quality is signaled to the brain.</p> <p>7.19 explains what is meant by sensory receptor adaptation and give examples related to everyday experience.</p> <p>7.20 SPECIAL SENSES</p> <p>7.20a describes the structure, function, and location of olfactory and taste receptor cells.</p> <p>7.20b names the parts of the eye: explain the function of the parts involved in light detection with the parts defining the optical properties of the eye.</p> <p>7.20c describes the three regions of the ear.</p> <p>7.20d distinguishes the structure and function of the vestibular apparatus from the auditory apparatus.</p> <p>7.20e describes how sound is transmitted from the external auditory meatus to the cochlea.</p>		
<p>endocrine system</p>	<p>8.1 understands the structure and function of the endocrine system in relation to digestion and metabolism, homeostasis, survival, growth, development, and reproduction</p> <p>8.2 discusses the difference between an endocrine gland and an exocrine gland.</p> <p>8.3 explains the nature of a hormone and the importance of the endocrine system in relation to digestion and metabolism, homeostasis, survival, growth, development, and reproduction.</p> <p>8.4 contrasts the endocrine glands that are exclusively endocrine in function with endocrine tissue found in organs that also have other functions.</p> <p>8.5 identifies the various chemical classes to which hormones belong and explain that some hormones act</p>		

	<p>via second messengers while others affect gene expression.</p> <p>8.6 discusses neural, hormonal, and other chemical compounds that control hormone secretion.</p> <p>8.7 uses examples, describe negative feedback in the control of hormone secretion.</p> <p>8.8 describes the structure and hormones of the hypothalamus-pituitary complex, and the function of these hormones in controlling the thyroid, gonads, and adrenal cortex.</p> <p>8.9 describes structure of these glands and the functions of the hormones secreted by them. For the glands that are not under the control of the hypothalamus-pituitary complex (e.g. the parathyroid, the pancreas, the pineal gland, and the adrenal medulla), describe their structure, the hormones secreted and their function, and their stimuli for secretion.</p> <p>8.10 discusses how the hypothalamus-pituitary complex, the sympathetic nervous system, the adrenal medulla, and the adrenal cortex are all involved in the response to stress.</p>		
<p>the blood</p>	<p>9.1 understands the functions of blood including its role in:</p> <ul style="list-style-type: none"> 9.1a. transporting oxygen throughout the body 9.1b. transporting nutrients to cells 9.1c. removing wastes produced through cellular metabolism 9.1d. maintaining homeostasis in thermal regulation 9.1e. blood pressure regulation 9.1f. protection from invading microorganisms, acute inflammation, and immune responses 9.1g. production of bile salts. <p>9.2 distinguishes whole blood from plasma and serum.</p> <p>9.3 recognizes that red blood cells are anucleate and have a limited life span</p> <p>9.4 classifies and explains the functions of the formed elements found in blood and describe where they are produced.</p> <p>9.5 identifies the location of red blood cell and white blood cell production</p> <p>9.6 describes how erythropoietin regulates red blood cell</p>		

	<p>production in response to anoxia.</p> <p>9.7 explains the ABO blood types and Rh factor, and discusses their importance during a blood transfusion</p> <p>9.7a role of genetics in determination of blood type</p> <p>9.7b role of specific antigens in determination of blood type</p> <p>9.8 describes hemostasis and the basic processes in blood clotting</p>		
<p>cardiovascular system</p>	<p>10.1 recognizes the anatomy of the heart</p> <p>10.1a. orientation of the heart inside the body as well as its comparative size</p> <p>10.1b. location, structure, and function of the atria</p> <p>10.1c. location, structure, and function of the ventricles</p> <p>10.1d. location, structure, and function of the valves of the heart</p> <ol style="list-style-type: none"> 1. Explain how the heart valves ensure one-way blood flow during systole and diastole 2. Discuss the heart sounds. <p>10.1e location, structure and function of the septum, papillary muscles, chordae tendinae</p> <p>10.1f location, structure and function of the aorta, pulmonary artery, pulmonary vein, superior & inferior vena cava</p> <p>10.1g location and function of the coronary arteries and veins</p> <p>10.1h role of pericardium and pericardial fluid</p> <p>10.2 recognizes heart is two pumps, dictating the pathway of blood</p> <p>10.2a right (side of heart) pump</p> <ol style="list-style-type: none"> 1. right atrium – tricuspid valve – right ventricle - pulmonary semilunar valve - pulmonary artery – lungs 2. blood deoxygenated <p>10.2 b. left (side of heart) pump</p> <ol style="list-style-type: none"> 1. pulmonary vein – left atrium – mitral valve – left ventricle – aortic semilunar valve – aorta – body 2. blood oxygenated 		

	<p>10.3 recognizes the anatomy, structure and function of blood vessels</p> <p><i>10.3a</i> carry blood away from the heart</p> <p>10.3b three layers of tissue – all with distinct structures and elasticity</p> <p><i>10.3c</i> elasticity of arteries provides pulse at different locations in the body</p> <p><i>10.3d</i> blood pressure in arteries exceeds that of veins</p> <p><i>10.3e</i> valves exist in capillaries, only</p> <p>10.4 recognizes and discusses the structure and function of the veins</p> <p><i>10.4a</i> carry blood toward heart</p> <p><i>10.4b</i> two layers of tissue, minimal elasticity</p> <p><i>10.4c</i> blood pressure in veins generally lower than that of arteries</p> <p><i>10.4d</i> contain valves that prevent backflow of blood</p> <p><i>10.4e</i> structure and function of arteries</p> <p><i>10.4f</i> be able to describe the layers found in the walls of blood vessels and discuss the relative prominence of these layers in the different types of blood vessels.</p> <p><i>10.4g</i> analyze roles of vasoconstriction and vasodilatation and their role in controlling blood flow through tissues.</p> <p>10.5 identifies diseases of the cardiovascular system as a major cause of death in this country</p> <p>10.6 understands the normal physiology of the heart and blood vessels</p> <p>10.7 BARORECEPTORS</p> <p><i>10.7a</i> discusses baroreceptor location and the importance of the baroreceptor reflex in the regulation of blood pressure.</p> <p><i>10.7b</i> Explains</p> <ol style="list-style-type: none"> 1. what is meant by hypertension 2. and identifies the instruments used to measure blood pressure, and how blood pressure is measured 3. how to correlate diastolic and systolic pressures with atrial and ventricular contraction and relaxation 		
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	<p>4. the negative affects of blood pressure on the circulatory system</p> <p>5. and describes some of the dangers associated with hypertension and a range of possible remedies.</p> <p>10.8 ELECTRICAL ACTIVITY OF THE HEART AND THE ELECTROCARDIOGRAM</p> <p><i>10.8a</i> discusses the functioning of pacemaker cells and how the wave of depolarization is transmitted from the atria to the ventricles</p> <ol style="list-style-type: none"> 1. sino-atrial node – atrioventricular node – bundle of His – Purkinje fibers 2. auto-rhythmic cell depolarization – contractile cell depolarization and muscle contraction 3. be able to identify, through pulse rates, what an individuals average pulse rate is at rest/exercising <p>10.9 describes how the action potential of a cardiac muscle cell differs from that of a neuron</p> <p>10.10 describes the importance of calcium ion influx during the plateau phase of the action potential</p> <p>10.11 explains the origins of the P, Q, R, S, T waves of the electrocardiogram and their medical significance in diagnosing a heart problem</p> <p>10.12 is able to differentiate between a normal and abnormal ECG</p> <p>10.13 ADJUSTMENT OF THE CARDIOVASCULAR SYSTEM TO EXERCISE AND HEMORRHAGE</p> <p><i>10.13a</i> explain the similarities and differences between the adjustment of the cardiovascular system to exercise</p> <p><i>10.13b</i> compare and contrast the similarities and differences between the adjustment of the cardiovascular system to exercise and hemorrhage.</p> <p><i>10.13c</i> contrast changes in the distribution of blood flow and cardiac output and explain the importance of the sympathetic and parasympathetic branches of the autonomic nervous system in these responses.</p>		
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<p>lymphatic system</p>	<p>11.1 understands the role of the lymphatic system in the body's defense against pathogens that may enter the body/bloodstream.</p> <p>11.2 understands many of the cells of the immune system are formed, reside in, are processed in, or travel within and through the structures of the lymphatic system</p> <p>11.3 understands these structures, classify them, and know their location</p> <p>11.4 discusses the major anatomical structures and functions of the lymphatic system including the lymphatic vessels; the structure and major groupings of lymph nodes; and the structures and functions of the spleen, thymus, and bone marrow</p> <p>11.5 describes the formation of lymph and its movement through the lymphatic system</p> <p>11.6 describes immune mechanisms</p> <p>11.7 knows that pathogens attempt to invade our bodies to take advantage of our nutrients and our protein synthetic machinery. Students should understand the various lines of defense including the two immune systems that save us from certain death by infection. Students should know the cellular and non-cellular components of the innate, natural, non-specific immune system and the specific, acquired immune system.</p> <p>11.8 discusses the different types of pathogens and outline the strategies the body uses to protect itself from them. Distinguish non-specific, innate, or natural immunity from specific or acquired immunity. Recognize their overlap and describe their cellular and non-cellular components</p> <p>11.9 describes the mechanisms of the acute inflammatory response, its causes, and the role of chemical signaling molecules</p> <p>11.10 describes the development and maturation of B- and T-lymphocytes. Discuss why the development of self-tolerance is important</p> <p>11.11 defines and discusses antigens, antibodies, and complement.</p>		
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respiratory system	<p>12.1 recognizes that breathing supplies oxygen that is critical for oxidative phosphorylation</p> <p>12.2 understands the role of oxygen in body metabolism</p> <p style="padding-left: 20px;"><i>12.2a</i> as the final electron acceptor in the electron transport chain</p> <p style="padding-left: 20px;"><i>12.2b</i> as a requirement for oxidative phosphorylation</p> <p style="padding-left: 20px;"><i>12.2c</i> as a determining factor in the metabolic pathway based on its concentration in cellular mitochondria</p> <p>12.3 understands breathing mechanics and how breathing is controlled</p> <p style="padding-left: 20px;"><i>12.3a</i> understand the role of the diaphragm</p> <p style="padding-left: 20px;"><i>12.3b</i> describe the effect of changing gas and pH concentrations in the blood on respiration</p> <p style="padding-left: 20px;"><i>12.3c</i> role of cerebellum and hypothalamus on respiration</p> <p style="padding-left: 20px;"><i>12.3d</i> predict changes that occur in lung ventilation when compared to changes in blood oxygen levels, carbon dioxide levels, and pH</p> <p>12.4 describes the neuronal networks controlling respiration. Contrast and compare the chemoreceptors involved in control of respiration and the stimuli to which they respond</p> <p>12.5 explain how chemoreceptors affect ventilation when</p> <p style="padding-left: 20px;"><i>12.5a</i> low arterial oxygen levels occur</p> <p style="padding-left: 20px;"><i>12.5b</i> low partial pressures exist</p> <p style="padding-left: 20px;"><i>12.5c</i> high arterial carbon dioxide levels exist</p> <p style="padding-left: 20px;"><i>12.5d</i> low arterial pH increases blood acidity</p> <p>12.6 describes the anatomy of the respiratory system and the route taken by the inspiratory flow of air from the nose into the alveoli</p> <p>12.7 contrasts the mechanisms of inspiration and expiration (quiet and forced) and explain the role of various muscles and of lung elasticity in this process</p> <p>12.8 compares the percentages of the oxygen and carbon dioxide in the external air to the percentages in the alveolar and the pulmonary capillaries, and explains the meaning of partial pressure</p> <p>12.9 explain the use of the spirometer and describe the data it generates in a spirogram</p>		
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<p>digestive system</p>	<p>13.1 understands the importance and reasons for the digestive process</p> <p>13.2 explains why food is essential for life</p> <p>13.3 understands and be able to describe how food is digested</p> <p>13.4 describes ingestion – the intake of food</p> <p>13.5 defines digestion – the mechanical and chemical breakdown of food into a form usable by the body</p> <p>13.6 differentiates mechanical digestion – the physical breakdown of food into smaller pieces</p> <p>13.7 describes chemical digestion – the chemical breakdown of macromolecules into monomers (via enzymes)</p> <p>13.8 discusses absorption – the uptake of nutrients into the epithelial cells of the digestive tract</p> <p>13.9 describes the oral cavity</p> <p style="padding-left: 20px;">13.9a discuss the structure and function of: teeth; oropharynx; hard palate; soft palate; uvula; epiglottis</p> <p style="padding-left: 20px;">13.9b identify, locate, and discuss the role of the salivary glands:</p> <p>13.10 identifies, discusses, and relates function(s) and composition of saliva and the salivary glands</p> <p>13.11 describes function of saliva</p> <p style="padding-left: 20px;">13.11a moistens food</p> <ol style="list-style-type: none"> 1. binds pieces of food together 2. begins the digestion of carbohydrates and fats 3. makes taste possible 4. regulates pH in the mouth 5. cleanses the mouth and inhibits bacterial growth <p style="padding-left: 20px;">13.11b composition</p> <ol style="list-style-type: none"> 1. mostly water 2. salivary amylase *enzyme that begins starch digestion in the mouth 3. lingual lipase *enzyme that digests fat 4. mucus *binds food and lubricates it 		
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	<p>5. immunoglobulin A (IgA) *antibody that inhibits bacterial growth</p> <p>6. electrolytes *including sodium, potassium, chloride, phosphate, and bicarbonate ions</p> <p><i>13.11c</i> salivary glands</p> <ol style="list-style-type: none"> 1. parotid glands 2. submandibular glands 3. sublingual glands <p>13.12 describes stimulation of salivary glands based on smell, sight, taste, chemical structure of foods</p> <p>13.13 describes role of saliva in the digestive process *enzymatic production, lubrication, maintaining pH</p> <p>13.14 identifies the sequence and role of specific organs through which food travels as it passes through the alimentary canal</p> <p>13.15 explains the mastication process * breaks the food down into smaller pieces; increases the surface area</p> <p>13.16 the pharynx * passageway for air, food, and drink</p> <p><i>13.16a</i> discuss the process involved in Swallowing</p> <ol style="list-style-type: none"> 1. formation of bolus 2. elevation of soft palate 3. role of tongue in pushing food/liquid to oropharynx 4. role of epiglottis 5. role of uvula <p><i>13.16b</i> the esophagus * tube that connects the pharynx to the stomach</p> <ol style="list-style-type: none"> 1. anatomical features associated with the esophagus 2. esophageal hiatus – the opening in the diaphragm that for the esophagus 3. cardiac sphincter – group of circular muscles at the end of the esophagus 4. primarily prevents regurgitation of food; protects the esophagus from stomach acids 		
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- 13.17 defines and discusses the anatomy of, function of, secretions of, and absorption in, the Stomach
- 13.17a. Gross anatomy of the stomach*
1. regions of the stomach
 - * cardiac – area adjacent to the opening from the esophagus
 - * fundus – superior-most section
 - * body – the main part of the stomach
 - * pyloric – muscular section that pushes the stomach contents into the small intestine
 - * pyloric sphincter – a group of circular muscles that control the movement of stomach contents into the small intestine
 2. microscopic anatomy of the stomach
 - * mucosa
 - * simple columnar epithelium
 - * gastric pits
 - * cells at the base of the gastric pits divide and produce new epithelial cells
 - * glandular cells
 - * mucous cells
 - * secrete mucus
 - * parietal cells
 - * secrete hydrochloric acid and intrinsic factor
 - * Chief cells – secrete pepsinogen
 3. gastric secretions
 - * hydrochloric acid
 - * makes the stomach acidic
 - a) activates pepsin
 - b) denatures proteins
 - c) destroys microorganisms
 - * Pepsin
 - * enzyme that splits proteins
 - * Intrinsic factor
 - * aids in the absorption of vitamin B12

	<p>4. protection of the stomach</p> <ul style="list-style-type: none"> * mucous coat <ul style="list-style-type: none"> * produces a highly alkaline mucus * Epithelial cell replacement <ul style="list-style-type: none"> * every 3 to 6 days <p>13.17b Regulation of gastric function</p> <ul style="list-style-type: none"> * Cephalic phase <ul style="list-style-type: none"> * the stomach responds to the sight, smell, taste, or thought of food * Gastric phase <ul style="list-style-type: none"> * the presence of food in digestive tract, the stomach distension, and changes in pH stimulate gastric secretions * Intestinal phase <ul style="list-style-type: none"> * gastric secretions are in response to the intestinal gastrin which is released when the stomach contents first enter the small intestine <p>13.18 Liver</p> <p>13.18a. functions of the liver</p> <ol style="list-style-type: none"> 1. regulates glucose concentrations in the blood 2. controls the synthesis and catabolism of fats and proteins 3. stores glycogen, iron, and vitamins A, D, and B12 4. filters damaged red blood cells and bacteria from the blood 5. detoxifies the blood <p>13.18b microscopic anatomy of the liver</p> <p>13.19 Gallbladder</p> <ul style="list-style-type: none"> * stores and concentrates bile between meals <p>13.19a Bile composition</p> <ol style="list-style-type: none"> 1. bile salts <ul style="list-style-type: none"> * aid in digestion 2. bile pigments <ul style="list-style-type: none"> * give it its green color; results from the breakdown of red blood cells 		
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	<p>3. cholesterol * used to produce bile salts</p> <p>4. some electrolytes are present in bile</p> <p><i>13.19b</i> function of bile salts</p> <ol style="list-style-type: none"> 1. emulsify fats 2. aid in the absorption of fatty acids, cholesterol, and fat-soluble vitamin D <p>13.20 Pancreas</p> <p><i>13.20a</i> secrete enzymes that breakdown carbohydrates, fats, proteins, and nucleic acids</p> <p><i>13.20b</i> pancreatic juice also is high in bicarbonate ions neutralize the contents coming from the stomach.</p> <p><i>13.20c</i> regulation of pancreatic secretion</p> <p><i>13.20d</i> Hormones</p> <ol style="list-style-type: none"> 1. secretin * released in response to the acid in chyme 2. cholecystokinin * released in response to the presence of fats/proteins present in chyme <p>13.21 small intestine *most of the nutrient absorption takes place in the small intestine</p> <p>13.22 identifies and explain the role regarding the gross anatomy of the small intestine</p> <ol style="list-style-type: none"> 1. duodenum 2. jejunum 3. ileum <p><i>13.22b</i> other structural modifications</p> <ol style="list-style-type: none"> 1. villi * finger-like projections that increase the surface area for nutrient absorption 2. microvilli * microscopic finger *like projections on the surface of epithelial cells 		
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	<p>3. plicae circulares *deep permanent folds of the mucosa *increase surface area *slows down the movement of chyme</p> <p>13.22c intestinal secretions</p> <ol style="list-style-type: none"> 1. mucus * protects against acidity 2. intestinal juice * watery fluid that is used for nutrient absorption <p>13.23 large intestine</p> <p>13.23a functions of the large intestine</p> <ol style="list-style-type: none"> 1. Little or no digestive functions 2. Absorbs water and electrolytes 3. Forms and stores feces 4. Secretes mucus – need for lubrication <p>13.23 b gross anatomy of the large intestine</p> <ol style="list-style-type: none"> 1. parts of the large intestines 2. ascending colon 3. transverse colon 4. descending colon 5. Cecum 6. rectum – storage area for feces 7. anal canal 8. anus – opening of the anal canal to the exterior of the body 9. internal and external sphincter muscles control movement of feces out of the body 10. no villi present <p>13.24 Bacterial flora</p> <p>13.24a Break down cellulose</p> <p>13.24b Produce vitamins K, B12, thiamine, and riboflavin</p> <p>13.24c Produce methane gas – the cause of flatulence</p> <p>13.24d Absorption and motility</p> <ol style="list-style-type: none"> 1. peristalsis is sluggish to allow sufficient water and electrolyte absorption 		
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	<p style="text-align: center;">2. mass movements</p> <p>13.25 identifies, locates and explains the role of accessory organs in the digestive process (e.g. pancreas, liver)</p> <p>13.26 describes the types of molecules digested chemically in each of the organs in the alimentary canal interrelationships of organs that comprise the gastrointestinal tract</p> <p>13.27 describes the cells and layers found within the walls of the organs of the digestive tract</p> <p>13.28 understands and explains the role of enzymatic secretions in the digestion of specific molecules</p> <p>13.29 identifies the regulators, and method of regulation in primary and accessory organs</p> <p>13.30 describes the purpose and anatomy of splanchnic circulation and its relationship to the liver *the salivary glands, liver, and pancreas.</p> <p>13.31 describes the functions of all the structural components and enzymes of the gastrointestinal tract and accessory organs in relation to the processing, digesting, and absorbing of the three major food classes.</p> <p>13.32 states the chemical forms in which the three major food classes are absorbed</p> <p>13.33 explains the roles of the lacteals and the hepatic portal vein in transporting the products of digestion</p> <p>13.34 describes the regulation of the enzyme and bicarbonate content of the pancreatic juice</p> <p>13.35 describes the microscopic anatomy of the liver and its relationship to the functions of the liver</p>		
<p>14. urinary system</p>	<p>14.1 understands the microscopic and macroscopic anatomy of the renal system</p> <p>14.2 understands the function of the kidneys in relation to homeostatic control of bodily fluids, blood pressure, and erythrocyte production</p> <p>14.3 understands micturition, the properties of urine, and the physiological processes involved in the production of urine.</p> <p>14.4 understands the importance of a high blood flow through the kidneys and the kidney's role in control of sugar, salts, and water</p>		

	<p>14.5 discusses the functions of the kidneys</p> <p>14.6 describes the anatomy of the renal system, including the gross anatomy, blood supply, and location of the kidneys, and the layers in the walls of the ureters and urinary bladder</p> <p>14.7 explains the neural basis of micturition including the function of the sphincters associated with the male and female urethra</p> <p>14.8 describes the internal structure of the kidney; describe the parts of a nephron and how they are involved in the three steps in the production of urine; compare the composition of plasma and ultrafiltrate and discuss the percentages of filtered water, sodium, and glucose normally reabsorbed by the kidney tubules</p> <p>14.9 explains the importance of the juxtaglomerular cells in the secretion of renin, which plays a central role in controlling blood pressure by controlling blood levels of angiotensin and aldosterone</p>		
<p>15. fluid, electrolyte and acid-base balance</p>	<p>15.1 explains how control of salt content and fluid volume in interstitial fluid is accomplished</p> <p>15.2 explains why control of salt concentrations and fluid volumes are necessary</p> <p>15.3 explains why it is necessary to control the pH of the fluids in our bodies</p> <p style="padding-left: 20px;"><i>15.3a</i> sources of acid</p> <p style="padding-left: 20px;"><i>15.3b</i> three intrinsic manners in which the body defends itself against lethal changes in pH</p> <p style="padding-left: 20px;"><i>15.3c</i> causation for, and effects of, acidosis</p> <p style="padding-left: 20px;"><i>15.3d</i> causation for, and effects of, alkalosis</p> <p>15.4 contrasts the volume and electrolyte content of the intracellular and extracellular fluid compartments</p> <p>15.5 explains the importance of sodium, potassium, and calcium in the body's physiology</p> <p>15.6 discusses how the volume of body fluid is determined by the balance between ingested and metabolic water on the one hand and water lost in the urine, respiration, feces, and sweating on the other hand.</p> <p>15.7 describes the factors that generate the sensation of thirst</p> <p>15.8 describes how the kidneys respond to excess water intake and to dehydration</p>		

	<p>15.9 explains the role of antidiuretic hormone (ADH) and of other hormones that control sodium and water absorption in the kidney</p> <p>15.10 describes how food and metabolic processes add acid to the body fluids; recognize how chemical buffers, the lungs and the kidneys, interact in protecting the body against lethal changes of pH</p> <p>15.11 explain the difference between metabolic and respiratory acidosis and alkalosis.</p>		
<p>16. reproduction and development</p>	<p>16.1 explains the structure, function and hormonal control of</p> <ul style="list-style-type: none"> <i>16.1a</i> the male and female reproductive systems <i>16.1b</i> fertilization, early embryonic development <i>16.1c</i> pregnancy <i>16.1d</i> parturition. <p>16.2 differentiates anatomy and physiology of the male and female reproductive systems.</p> <p>16.3 compare and contrasts oogenesis and spermatogenesis</p> <ul style="list-style-type: none"> 16.3a distinguishes diploid germ cells from haploid/monoploid sex cells 16.3b describes related hormones 16.3c describes cell origins 16.3d delineates their functions 16.3e explains functions of ...(in male and/or female) <ul style="list-style-type: none"> 1. gonadotropins 2. follicle stimulating hormone 3. leutinizing hormone <p>16.4 explains what is happening during the follicular, ovulatory, and luteal phases of the menstrual cycle</p> <p>16.5 describes how estradiol and progesterone released by the ovaries are responsible for the phases of the uterine cycle</p> <p>16.6 describes how spermatozoa move through the female reproductive tract</p> <p>16.7 describes the process of fertilization</p> <p>16.8 explains the differences among</p> <ul style="list-style-type: none"> <i>16.8a</i> dikaryon zygote <i>16.8b</i> zygote 		

	<p><i>16.8c</i> morula <i>16.8d</i> blastocyst</p> <ol style="list-style-type: none">1. recognizes that the blastocyst secretes human gonadotropin2. recognizes that gonadotropic prolongs the life of the corpus luteum3. understands that increased lifespan of the corpus luteum maintains levels of progesterone <p>16.9 describes the process of implantation, development of the placenta, the substances that move across it, and the role of the placenta in maintaining the high levels of progesterone essential for a successful pregnancy.</p>		
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Attachment 1a

Date

Dear Parent/Guardian,

Seventh grade science will soon be starting a unit on sexual reproduction. The information taught in the course is addressed in the Colorado Model Content Standards for Science as well as the RE-1 Valley School District Science Frameworks.

The information is found on pages ____ of your son's/daughter's current science text book. The primary topics to be covered include:

- Male and female anatomy
- Menstrual cycle
- Fertilization to birth
- Developed
- *****Content may be changed as necessary to reflect textbook selection

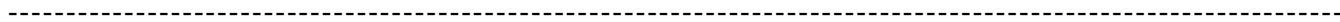
Should you object to the reproduction unit, I will give your son/daughter an alternative assignment. Please complete the form at the bottom of this page and return to me by _____. I must have a signed form before our son/daughter will be allowed to participate in the class.

Sincerely,

_____, Instructor
_____, School

_____, Principal
_____, School

(tear along dotted line)



Parent/Guardian Signature

___Yes, my son/daughter may participate in the unit described above.

___No, my son/daughter may not participate in the unit described above.

Attachment 1b

Date

Dear Parent/Guardian,

Tenth grade science will soon be starting a unit on sexual reproduction. The information taught in the course is addressed in the Colorado Model Content Standards for Science as well as the RE-1 Valley School District Science Frameworks.

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Sincerely,

_____, Instructor
_____, School

_____, Principal
_____, School

(tear along dotted line)



Parent/Guardian Signature

____ Yes, my son/daughter may participate in the unit described above.

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