Curriculum Map Anatomy/Physiology 101 and 102

Standards	Content	Lab Experience	Assessment
Standard AP1: Levels of Organization in the Human Body ***HS-AP1-1**** *Plan and conduct an investigation to provide evidence that feedback mechanisms maintain homeostasis in humans.* ***HS-AP1-2.**** *Develop and use a model to illustrate the hierarchical organization of structural body systems that provide specific functions within the Human Body.* ***HS-AP1-3.**** *Compare and contrast the relationships among the various tissue types as well as the molecular and cellular composition of these tissues.* ***HS-AP1-4.**** *Compare and contrast the histological structure between the 4 basic tissue types.* ***HS-AP1-5.**** *Compare and contrast the major organ systems and describe their basic functional importance.*	1Introduction to Anatomical Terms PRE-LABEXERCISE1-1 Key Terms PRE-LAB EXERCISE 1-2 Body Cavities	EXERCISE 1-1 Anatomical Position EXERCISE 1-2 Directional Terms EXERCISE 1-3 Regional Terms EXERCISE 1-4 Body Cavities and Membranes EXERCISE 1-5 Planes of Section EXERCISE 1-6 Organs and Organ Systems	Check Your Recall Check Your Understanding
	3 Introduction to the Microscope	EXERCISE 3-1 Introduction to the Microscope	
	4 Cytology PRE-LAB EXERCISE 4-1 Key Terms PRE-LAB EXERCISE 4-2 The Plasma Membrane PRE-LAB EXERCISE 4-3 The Parts of the Cell PRE-LAB EXERCISE 4-4 The Cell Cycle	EXERCISE 4-1 Organelles and Cell Structures EXERCISE 4-2 Diffusion EXERCISE 4-3 Osmosis and Tonicity EXERCISE 4-4 Mitosis and the Cell Cycle	Check Your Recall Check Your Understanding
	5 Histology PRE-LAB EXERCISE 5-1 Key Terms	EXERCISE 5-1 Epithelial Tissue EXERCISE 5-2 Connective Tissue EXERCISE 5-3 Muscle Tissue EXERCISE 5-4 Nervous Tissue EXERCISE 5-5 Organology	Check Your Recall Check Your Understanding

Standard AP2*: Movement and Support, the Integumentary System** ***HS-AP2-1.* *Analyze the structural characteristics and functional importance of the integumentary system to maintain homeostasis of the body.* ***HS-AP2-2.**** *Evaluate and explain the consequence of injury (e.g., Burns) and/or disease (e.g., skin cancer, vitiligo) to the functionality of the integumentary system.*	6 Integumentary System P PRE-LAB EXERCISE 6-1 Key Terms PRE-LAB EXERCISE 6-2 Skin Anatomy PRE-LAB EXERCISE 6-3 Hair and Nail Anatomy	EXERCISE 6-1 Skin Anatomy and Accessory Structures EXERCISE 6-2 Histology of Integument E EXERCISE 6-3 Touch Receptor Distribution EXERCISE6-4 Fingerprinting	Check Your Recall Check Your Understanding
Standard AP3: Movement and Support, the Skeletal System ***HS-AP3-1.**Develop a model to illustrate the microscopic structure, development of, maintenance of, and function of compact and spongy bone.* ***HS-AP3-2.**** *Observe the characteristics of a bone from the axial or appendicular skeleton.* ***HS-AP3-3.**** *Then construct an argument to support how the structure determines the function.* ***HS-AP.4**Compare and contrast the different types of bone (e.g., long, short, flat, and irregular* ***HS-AP3-5.**** *Compare and contrast the major types of joints and construct an argument how these structural components influence functional mobility and stability.*	7 Introduction to the Skeletal System PRE-LAB EXERCISE 7-1 Key Terms PRE-LAB EXERCISE 7-2 Microscopic Anatomy of Compact Bone PRE-LAB EXERCISE 7-3 Structure of a Long Bone	EXERCISE 7-1 Histology of Osseous Tissue EXERCISE 7-2 Chemical Components of Bone Tissue EXERCISE 7-3 Bone Markings and Bone Shapes EXERCISE 7-4 Anatomy of Long Bones	Check Your Recall Check Your Understanding
	8 Skeletal System PRE-LAB EXERCISE 8-1 Key Terms PRE-LAB EXERCISE 8-2 Bones of the Skull PRE-LAB EXERCISE 8-3 Whole Skeleton	EXERCISE 8-1 The Skull EXERCISE 8-2 Remainder of the Axial Skeleton EXERCISE 8-3 The Appendicular Skeleton EXERCISE 8-4 More Practice	
Standard AP4: Movement and Support, the Muscular System ***HS-AP4-1.**** *Compare and contrast between the structural and functional characteristics of skeletal, cardiac, and smooth muscle.*	9 Articulations PRE-LAB EXERCISE 9-1 Key Terms PRE-LAB EXERCISE 9-2 Anatomy of Synovial Joints	EXERCISE 9-1 Classification of Joints EXERCISE 9-2 Synovial Joints EXERCISE 9-3 Knee Joint EXERCISE 9-4 Shoulder Joint	Check Your Recall Check Your Understanding

HS-AP4-2.* *Develop a model to illustrate the components of a muscle fiber and how they interact in contraction and relaxation.* ***HS-AP4-3.**** *Conduct an investigation to analyze the molecular processes involved in sliding filament models to explain and identify changes in disease-related illnesses.* ***HS-AP4-4.**** *Describe how a neuromuscular junction functions.* ***HS-AP4-5.**** *Design an experiment to determine how motor recruitment influences the force and velocity of contraction. Use a diagram, model, or dissection to identify major muscle groups.* ***HS-AP4-6.**** *Compare and contrast between isotonic and isometric contractions and construct an explanation for the causes of hypertrophy and atrophy of muscles.*	PRE-LAB EXERCISE 9-3 The Knee Joint PRE-LAB	EXERCISE 9-5 Motions of Synovial and Cartilaginous Joints	
	11 Muscle Tissue PRE-LAB EXERCISE 11-1 Key Terms PRE-LAB EXERCISE 11-2 Basic Skeletal Muscle Anatomy PRE-LAB EXERCISE 11-3 Muscle Fiber Microanatomy PRE-LAB EXERCISE 11-4 Types of Muscle Tissue	EXERCISE 11-1 Microscopic Anatomy of Skeletal Muscle Tissue EXERCISE 11-2 Muscle Physiology EXERCISE 11-3 Smooth and Cardiac Muscle Tissues	Check Your Recall Check Your Understanding
Standard AP5: Integration and Coordination, the Nervous System ***HS-AP5-1.**** *Develop a model that illustrates the structural components and functional subdivisions of the nervous system.* ***HS-AP5-2.**** *Observe and identify the structure and function of the various neurons and neuroglia. Explain how the varying structures determine the specified function.* ***HS-AP5-3.**** *Compare and contrast the actions, origins, and pathways of nerve fibers in the parasympathetic and sympathetic divisions of the autonomic nervous system.* ***HS-AP5-4.**** *Identify and model how action potentials are generated, via neurotransmitters, the ions and channel protein involved, and the basic structural and functional aspects which allow for synaptic connection.* ***HS-AP5-5.**** *Identify the various classification of neurotransmitters and their associated functions. Describe how certain disease states*	12 Introduction to the Nervous System PRE-LAB EXERCISE 12-1 Key Terms PRE-LAB EXERCISE 12-2 Nervous Tissue Microanatomy	EXERCISE 12-1 Neurons and Neuroglia EXERCISE 12-2 Nervous Tissue Physiology	Check Your Recall Check Your Understanding
	13 Central Nervous System PRE-LAB EXERCISE 13-1 Key Terms PRE-LAB EXERCISE 13-2 Brain Anatomy PRE-LAB EXERCISE 13-3 Spinal Cord Anatomy	EXERCISE 13-1 Anatomy of the Brain EXERCISE 13-2 The Spinal Cord	Check Your Recall Check Your Understanding
	14 Peripheral and Autonomic Nervous System PRE-LAB EXERCISE 14-1 Key Terms PRE-LAB EXERCISE 14-2 Peripheral Nerve Anatomy	EXERCISE 14-1 Peripheral Nerve Anatomy EXERCISE 14-2 The Cranial Nerves EXERCISE 14-3 Spinal Nerves and Reflexes	Check Your Recall Check Your Understanding

can be caused by interruption of neurotransmitters.	PRE-LAB EXERCISE 14-3 Cranial Nerve Functions PRE-LAB EXERCISE 14-4 Spinal Nerve Plexuses and the Anterior Rami of the Spinal Nerves PRE-LAB EXERCISE 14-5 Anterior Rami of the Spinal Nerves: PRE-LAB EXERCISE 14-6 Branches of the Autonomic Nervous System	EXERCISE 14-4 The Autonomic Nervous System	
Standard AP6: Integration and Coordination, Somatic and Special Senses ***HS-AP6-1.**** *Compare and contrast the somatic, visceral, and special senses, the prominent sensory receptor types of each, and their functional operation.* ***HS-AP6-2.**** *Make and/or use a model of the anatomy of the eye; then construct an explanation for hyperopia, myopia and astigmatism using the model.* ***HS-AP6-3.**** *Make and/or use a model of the anatomy of the ear. Construct an explanation for sensorineural and conductive hearing loss using the basic structure and function of the ear.*	15 General and Special Senses PRE-LAB EXERCISE 15-1 Key Terms PRE-LAB EXERCISE 15-2 Anatomy of the Eye LAB EXERCISE 15-3 Extrinsic Eye Muscles PRE-LAB EXERCISE 15-4 Anatomy of the Ear	EXERCISE 15-1 Anatomy of the Eye and Vision EXERCISE 15-2 Anatomy of the Ear, Hearing, and Equilibrium EXERCISE 15-3 Olfactory and Taste Senses EXERCISE 15-4 The General Senses: Cutaneous Sensation	Check Your Recall Check Your Understanding
Standard AP7: Integration and Coordination, the Endocrine System ***HS-AP7-1.**** *Investigate the structure and function of the endocrine system and develop models showing how changes in prominent hormone levels impact homeostasis throughout the body systems.* ***HS-AP7-2.**** *Assess the structural and functional differences between an endocrine gland and an exocrine gland.* ***HS-AP7-3.**** *Compare and contrast the hormones of the hypothalamus-pituitary complex. Analyze*	16 Endocrine System PRE-LAB EXERCISE 16-1 Key Terms PRE-LAB EXERCISE 16-2 Endocrine System Anatomy PRE-LAB EXERCISE 16-3 Hormones: Target Tissues and Effects	EXERCISE 16-1 Endocrine System Anatomy EXERCISE 16-2 Endocrine Organ Histology EXERCISE 16-3 Time to Trace! Negative Feedback Loops EXERCISE 16-4 Endocrine "Mystery Cases"	Check Your Recall Check Your Understanding

the function of each hormone and connect them to feedback signals for the gonads, thyroid, and adrenal cortex. ***HS-AP7-4.**** *Construct an explanation to show the impact of stress on the hypothalamus pituitary complex, sympathetic nervous system, and the adrenal medulla.* ***HS-AP7-5.**** *Construct an explanation for maintaining blood sugar levels via endocrine and exocrine functions of the pancreas.*			
	Final Exam		Final Exam

Second Semester Follows this document

Second Semester APHY 102

Standard AP8: Transport, Blood and the Cardiovascular System ***HS-AP8-1.**** *Perform an investigation to identify the composition and function of whole blood components, and the role they play in maintaining homeostasis.* ***HS-AP8-2.**** *Conduct an investigation to learn about the ABO blood type.* ***HS-AP8-3.**** *Discuss how the surface-antigens and plasma antibodies allow and/or disallow for certain blood transfusions.* ***HS-AP8-4.**** *Investigate the primary structures of the cardiovascular system and explore their functional importance to maintaining homeostasis.* ***HS-AP8-5.**** *Create a model of vasoconstriction and vasodilation to demonstrate the structural and functional difference between arteries and veins.* ***HS-AP8-6.**** *Use a diagram and/or a model of the heart to illustrate the external and internal structures, the vessels entering and exiting, unidirectional blood flow and how the heart supports pulmonary and cardiac circulation. Construct a model of hypertension to model the regulation of the cardiac cycle.* ***HS-AP8-7.**** *Design an experiment to illustrate how the cardiovascular system maintains homeostasis.*	17 Cardiovascular System-Part I: The Heart PRE-LAB EXERCISE 17-1 Key Terms PRE-LAB EXERCISE 17-2 Anatomy of the Thoracic Cavity PRE-LAB EXERCISE 17-3 Anatomy of the Heart PRE-LAB EXERCISE 17-4 Pathway of Blood Flow through the Heart	EXERCISE 17-1 Anatomy of the Heart EXERCISE 17-2 Cardiac Muscle Histology	Check Your Recall Check Your Understanding
	18 Cardiovascular System-Part II: Blood Vessel Anatomy PRE- LAB EXERCISE 18-1 Arterial Anatomy PRE-LAB EXERCISE 18-2 Venous Anatomy	EXERCISE 18-1 Major Arteries of the Body EXERCISE 18-2 Major Veins of the Body EXERCISE 18-3 Time to Trace! EXERCISE 18-4 Histology of the Blood Vessel Wall EXERCISE 18-5 Clinical Applications	Check Your Recall Check Your Understanding
	20 Blood PRE-LAB EXERCISE 20-1 Key Terms PRE-LAB EXERCISE 20-2 Formed Elements	EXERCISE 20-1 Formed Elements (Cells) of Blood EXERCISE 20-2 ABO and Rh Blood Groups EXERCISE 20-3 Murder Mystery Game EXERCISE 20-4 Blood Donation EXERCISE 20-5 Typing and Examining Your Own Blood	Check Your Recall Check Your Understanding
Standard AP9: Transport, the Lymphatic System and Immune Mechanisms	21 Lymphatics and Immunity PRE-LAB EXERCISE 21-1 Key Terms	EXERCISE 21-1 Lymphatic System Anatomy	Check Your Recall

HS-AP9-1.* *Identify the primary structural and functional components of the lymphatic system.* ***HS-AP9-2.**** *Analyze the relationship of the components of the lymphatic system with bone marrow and the thymus gland.* ***HS-AP9-3.**** *Differentiate between innate and acquired immunity.* ***HS-AP9-4.**** *Construct an explanation for defense against foreign pathogens using cellular and non-cellular components of the immune response.*	PRE-LAB EXERCISE 21-2 Anatomy of the Lymphatic System	EXERCISE 21-2 Lymphatic Organ Histology EXERCISE 21-3 The Immune Response Exercise 21-4 ELISA Test for Antigens	Check Your Understanding
Standard AP11: Absorption and Excretion, the Respiratory System ***HS-AP11-1.**** *Identify and locate major organs of the respiratory system and discuss their functions. Differentiate between the components of the upper and lower respiratory systems.* ***HS-AP11-2.**** *Observe the anatomical structures and explain the physiological processes involved in inspiration & expiration.* ***HS-AP11-3.**** *Analyze data to investigate how percentages and partial pressure gradients of oxygen and carbon dioxide impact net gas exchange.* ***HS-AP11-4.**** *Construct an explanation for maintaining blood pH via specialized carbon dioxide receptors and the respiratory response.*	22 Respiratory System PRE-LAB EXERCISE 22-1 Key Terms PRE-LAB EXERCISE 22-2 Respiratory System Anatomy	EXERCISE 22-1 Respiratory System Anatomy EXERCISE 22-2 Histology of the Respiratory Tract EXERCISE 22-3 Lung Inflation	Check Your Recall Check Your Understanding
	23 Respiratory System Physiology PRE-LAB EXERCISE 23-1 Key Terms PRE-LAB EXERCISE 23-2 Defining Pulmonary Volumes and Capacities PRE-LAB EXERCISE 23-3 Labeling Pulmonary Volumes and Capacities	EXERCISE23-1 Pressure-Volume Relationships in the Lungs EXERCISE 23-2 Measuring Pulmonary Volumes and Capacities EXERCISE 23-3 pH and Ventilation	Check Your Recall Check Your Understanding

Standard AP10: Absorption and Excretion, the Digestive System ***HS-AP10-1.**** *Identify and locate major and accessory organs of the digestive system and investigate their physiological functions.* ***HS-AP10-2.**** *Construct an explanation for enzymes involved in the processing of, digestion of and absorbance of macromolecules.* ***HS-AP10-3.**** *Compare and contrast mechanical and chemical digestion.* ***HS-AP10-4.****Differentiate between metabolic and respiratory acidosis and alkalosis.*	24 Digestive System PRE-LAB EXERCISE 24-1 Key Terms PRE-LAB EXERCISE 24-2 Anatomy of the Digestive System PRE-LAB EXERCISE 24-3 Digestive Enzymes	EXERCISE 24-1 Digestive System Anatomy EXERCISE 24-2 Digestive System Histology EXERCISE 24-3 Digestion EXERCISE 24-4 Time to Trace!	Check Your Recall Check Your Understanding
AP12: Absorption and Excretion, the Urinary System ***HS-AP12-1.**** *Identify and locate major organs of the urinary system and discuss their functions.* ***HS-AP12-2.****Observe and identify the structures of the kidney; then construct an explanation for maintaining blood volume via kidney function.* ***HS-AP12-3.**** *Develop a model of the nephron to explore its structural components, associated hormones, and the functional processes of filtration, excretion, secretion, and reabsorption.*	25 Urinary System Anatomy PRE-LAB EXERCISE 25-1 Key Terms PRE-LAB EXERCISE 25-2 Structures of the Urinary System PRE-LAB EXERCISE 25-3 Microanatomy of the Kidney	EXERCISE 25-1 Urinary System Anatomy EXERCISE 25-2 Urinary Organ Histology	Check Your Recall Check Your Understanding
	26 Urinary System Physiology PRE-LAB EXERCISE 26-1 Key Terms PRE-LAB EXERCISE 26-2 Nephron Structure and Function PRE-LAB EXERCISE 26-3 Glomerular Filtration and Tubular Reabsorption	EXERCISE 26-1 The Model Kidney EXERCISE 26-2 Urinalysis EXERCISE 26-3 Time to Trace!	Check Your Recall Check Your Understanding

Standard AP13: Life Cycle, the Reproductive System ***HS-AP13-1.**** *Identify and locate major and accessory organs of the female and male reproductive systems and discuss their functions.* ***HS-AP13-2.**** *Create a diagram or model to analyze the role of hormones in the male and female reproductive system.* ***HS-AP13-3.**** *Describe how spermatozoa move through the female reproductive tract and describe the process of fertilization.* ***HS-AP13-4.**** *Construct an explanation of the rise of the three primary germ layers via zygote creation, blastocyst development and gastrulation process.* ***HS-PS13-5.**** *Describe the stages of embryonic development after gastrulation, up to the birth of a baby.*	27 Reproductive System -LAB EXERCISE 27-1 Key Terms PRE-LAB EXERCISE 27-2 Male Reproductive Anatomy PRE-LAB EXERCISE 27-3 Female Reproductive Anatomy PRE-LAB EXERCISE 27-4 Stages of Mitosis	EXERCISE 27-1 Male Reproductive Anatomy EXERCISE27-2 Female Reproductive Anatomy EXERCISE 27-3 Meiosis EXERCISE 27-4 Histology of the Reproductive System	Check Your Recall Check Your Understanding
	28 Human Hereditary		
	29 the big picture of anatomy and physiology		
	Final Exam		Final Exam

The following standards are to be added to his document

IDOE: SCIENCE AND ENGINEERING PRACTICE

SEP.1: Asking Questions and Defining Problems.

Asking questions and defining problems in 9–12 builds on K–8 experiences and progresses to formulating, refining, and evaluating empirically testable questions and design problems using models and simulations.

- *Ask questions*
  - *that arise from careful observation of phenomena, or unexpected results, to clarify and/or seek additional information.*
  - *that arise from examining models or a theory, to clarify and/or seek additional information and relationships.*
  - *to determine relationships, including quantitative relationships, between independent and dependent variables.*

○ *to clarify and refine a model, an explanation, or an engineering problem*

● *Evaluate a question to determine if it is testable and relevant.*

● *Ask questions that can be investigated within the scope of the school laboratory, research facilities, or field (e.g., outdoor environment) with available resources and, when appropriate, frame a hypothesis based on a model or theory.*

● *Ask and/or evaluate questions that challenge the premise(s) of an argument, the interpretation of a data set, or the suitability of a design.*

● *Define a design problem that involves the development of a process or system with interacting components and criteria and constraints that may include social, technical, and/or environmental considerations.*

SEP.2: Developing and Using Models

Modeling in 9–12 builds on K–8 experiences and progresses to using, synthesizing, and developing models to predict and show relationships among variables between systems and their components in the natural and designed worlds.

● *Develop and use a model based on evidence to illustrate the relationships between systems or between components of a system.*

● *Evaluate merits and limitations of two different models of the same proposed tool, process, mechanism or system in order to select or revise a model that best fits the evidence or design criteria.*

● *Design a test of a model to ascertain its reliability.*

● *Develop, revise, and/or use a model based on evidence to illustrate and/or predict the relationships between systems or between components of a system.*

● *Develop and/or use multiple types of models to provide mechanistic accounts and/or predict phenomena, and move flexibly between model types based on merits and limitations.*

● *Develop a complex model that allows for manipulation and testing of a proposed process or system.*

● *Develop and/or use a model (including mathematical and computational) to generate data to support explanations, predict phenomena, analyze systems, and/or solve problems.*

SEP.3: Planning and Carrying Out Investigations

Planning and carrying out investigations in 9-12 builds on K-8 experiences and progresses to include investigations that provide evidence for and test conceptual, mathematical, physical, and empirical models.

● *Plan and conduct an investigation individually and collaboratively to produce data to serve as the basis for evidence, and in the design: decide on types, how much, and accuracy of data needed to produce reliable measurements and consider limitations on the precision of the data (e.g., number of trials, cost, risk, time), and refine the design accordingly.*

● *Plan an investigation or test a design individually and collaboratively to produce data to serve as the basis for evidence as part of building and revising models, supporting explanations for phenomena, or testing solutions to problems.*

● *Consider possible confounding variables or effects and evaluate the investigation's design to ensure variables are controlled.*

● *Plan and conduct an investigation or test a design solution in a safe and ethical manner including considerations of environmental, social, and personal impacts.* ● *Select appropriate tools to collect, record, analyze, and evaluate data.*

● *Make directional hypotheses that specify what happens to a dependent variable when an independent variable is manipulated.*

● *Manipulate variables and collect data about a complex model of a proposed process or system to identify failure points or improve performance relative to criteria for success or other variables.*

SEP.4. Analyzing and interpreting data

Analyzing data in 9–12 builds on K–8 experiences and progresses to introducing more detailed statistical analysis, the comparison of data sets for consistency, and the use of models to generate and analyze data. ● *Analyze data using tools, technologies, and/or models (e.g., computational, mathematical) in order to make valid and reliable scientific claims or determine an optimal design solution.* ● *Apply concepts of statistics and probability (including determining function fits to data, slope, intercept, and correlation coefficient for linear fits) to scientific and engineering questions and problems, using digital tools when feasible.* ● *Consider limitations of data analysis (e.g., measurement error, sample selection) when analyzing and interpreting data.* ● *Compare and contrast various types of data sets (e.g., self-generated, archival) to examine consistency of measurements and observations.* ● *Evaluate the impact of new data on a working explanation and/or model of a proposed process or system.* ● *Analyze data to identify design features or characteristics of the components of a proposed process or system to optimize it relative to criteria for success.*

SEP.5. Using mathematics and computational thinking

Mathematical and computational thinking in 9- 12 builds on K-8 experiences and progresses to using algebraic thinking and analysis, a range of linear and nonlinear functions including trigonometric functions, exponentials and logarithms, and computational tools for statistical analysis to analyze, represent, and model data. Simple computational simulations are created and used based on mathematical models of basic assumptions. ● Create and/or revise a computational model or simulation of a phenomenon, designed device, process, or system. ● Use mathematical, computational, and/or algorithmic representations of phenomena or design solutions to describe and/or support claims and/or explanations. ● Apply techniques of algebra and functions to represent and solve scientific and engineering problems. ● Use simple limit cases to test mathematical expressions, computer programs, algorithms, or simulations of a process or system to see if a model "makes sense" by comparing the outcomes with what is known about the real world. ● Apply ratios, rates, percentages, and unit conversions in the context of complicated measurement problems involving quantities with derived or compound units (such as mg/mL, kg/m3 , acre-feet, etc.).

SEP.6. Constructing explanations (for science) and designing solutions (for engineering)

Constructing explanations and designing solutions in 9–12 builds on K–8 experiences and progresses to explanations and designs that are supported by multiple and independent student-generated sources of evidence consistent with scientific ideas, principles, and theories.

● Make a quantitative and/or qualitative claim regarding the relationship between dependent and independent variables.

● Construct and revise an explanation based on valid and reliable evidence obtained from a variety of sources (including students' own investigations, models, theories, simulations, peer review) and the assumption that theories and laws that describe the natural world operate today as they did in the past and will continue to do so in the future.

● Apply scientific ideas, principles, and/or evidence to provide an explanation of phenomena and solve design problems, taking into account possible unanticipated effects.

● Apply scientific reasoning, theory, and/or models to link evidence to the claims to assess the extent to which the reasoning and data support the explanation or conclusion.

● Design, evaluate, and/or refine a solution to a complex real-world problem, based on scientific knowledge, student-generated sources of evidence, prioritized criteria, and trade off considerations.

SEP.7. Engaging in argument from evidence

Engaging in argument from evidence in 9–12 builds on K–8 experiences and progresses to using appropriate and sufficient evidence and scientific reasoning to defend and critique claims and explanations about the natural and designed world(s). Arguments may also come from current scientific or historical episodes in science. ● Compare and evaluate competing arguments or design solutions in light of currently accepted explanations, new evidence, limitations (e.g., trade-offs), constraints, and ethical issues. ● Evaluate the claims, evidence, and/or reasoning behind currently accepted explanations or solutions to determine the merits of arguments. ● Respectfully provide and/or receive critiques on scientific arguments by probing reasoning and evidence, challenging ideas and conclusions, responding thoughtfully to diverse perspectives, and determining additional information required to resolve contradictions. ● Construct, use, and/or present an oral and written argument or counter-arguments based on data and evidence. ● Make and defend a claim based on evidence about the natural world or the effectiveness of a design solution that reflects scientific knowledge and student-generated evidence. ● Evaluate competing design solutions to a real-world problem based on scientific ideas and principles, empirical evidence, and/or logical arguments regarding relevant factors (e.g. economic, societal, environmental, ethical considerations).

SEP.8. Obtaining, evaluating, and communicating information

Obtaining, evaluating, and communicating information in 9–12 builds on K–8 experiences and progresses to evaluating the validity and reliability of the claims, methods, and designs. ● Critically read scientific literature adapted for classroom use to determine the central ideas or conclusions and/or to obtain scientific and/or technical information to summarize complex evidence, concepts, processes, or information presented in a text by paraphrasing them in simpler but still accurate terms. ● Compare, integrate and evaluate sources of information presented in different media or formats (e.g., visually, quantitatively) as well as in words in order to address a scientific question or solve a problem. ● Gather, read, and evaluate scientific and/or technical information from multiple authoritative sources, assessing the evidence and usefulness of each source. ● Evaluate the validity and reliability of and/or synthesize multiple claims, methods, and/or designs that appear in scientific and technical texts or media reports, verifying the data when possible. ● Communicate scientific and/or technical information or ideas (e.g. about phenomena and/or the process of development and the design and performance of a proposed process or system) in multiple formats (i.e., orally, graphically, textually, mathematically).

IDOE: CROSSCUTTING CONCEPTS

Crosscutting Concepts

Marinda Wooten	11

The seven crosscutting concepts bridge disciplinary boundaries and unit core ideas throughout the fields of science and engineering. Their purpose is to help students deepen their understanding of the disciplinary core ideas, and develop a coherent, and scientifically based view of the world. The seven crosscutting concepts are as follows:

***CC-1.** Patterns. Observed patterns of forms and events guide organization and classification, and prompt questions about relationships and the factors that influence them.*

***CC-2**. Cause and Effect: Mechanism and Explanation. Events have causes, sometimes simple, sometimes multifaceted. A major activity of science is investigating and explaining causal relationships and the mechanisms by which they are mediated. Indiana Academic Standards: Science Anatomy and Physiology *Denotes Indiana Specific Standard Such mechanisms can then be tested across given contexts and used to predict and explain events in new contexts.*

***CC-3.** Scale, Proportion, and Quantity. In considering phenomena, it is critical to recognize what is relevant at different measures of size, time, and energy and to recognize how changes in scale, proportion, or quantity affect a system's structure or performance.*

***CC-4**. Systems and System Models. Defining the system under study—specifying its boundaries and making explicit a model of that system—provides tools for understanding and testing ideas that are applicable throughout science and engineering.*

***CC-5**. Energy and Matter: Flows, Cycles, and Conservation. Tracking fluxes of energy and matter into, out of, and within systems helps one understand the systems' possibilities and limitations.*

***CC-6**. Structure and Function. The way in which an object or living thing is shaped and its substructure determines many of its properties and functions.*

***CC-7.** Stability and Change. For natural and built systems alike, conditions of stability and determinants of rates of change or evolution of a system are critical elements of study.*