This tool serves to help us analyze the gaps in our curriculum as we move to the new standards. The Biology I ideal percentage of items aids in the vertical alignment to inform pacing that allows our students to gain the skills and knowledge needed to be successful as they move from grade-to-grade.

Current-PASS (2011) Standards- Tested through 2015-16	**New Oklahoma Academic Standards- To be tested 2016-17**	**Biology I EOI Ideal % of Test Items (2014-15 BP)**
Science/Inquiry Processes	**Science and Engineering Practices**	
P1.0 Observe and Measure ○ Qualitative/Quantitative Observations/Changes ○ Appropriate Tools and ○ Use Appropriate System International SI (metric) Units **P2.0 Classify** ○ 2.1 Use Observable Properties to Classify ○ 2.2 Identify Properties of a Classification System **P3.0 Experimental Design** ○ 3.1 Evaluate the Design of Investigations ○ 3.2 Identify Controlled Variables and Experimental Controls in an Experiment and ○ 3.4 Identify a Testable Hypothesis in a Biology Investigation ○ 3.3 Use Mathematics to Show Relationships ○ 3.5 Identify Potential Hazards and Practice Safety Procedures in all Science Activities **P4.0 Interpret and Communicate** ○ 4.1 Select Predictions Based on Observed Patterns of Evidence ○ 4.3 Interpret Line, Bar, Trend, and Circle Graphs ○ 4.4 Accept or Reject a Hypothesis ○ 4.5 Make Logical Conclusions Based on Experimental Data ○ 4.8 Identify an Appropriate Graph or Chart **P5.0 Model** ○ 5.1 Interpret a Model which Explains a Given Set of Observations ○ 5.2 Select Predictions Based on Models, Using Mathematics ***(To be taught throughout the year)***	1. Asking questions (for science) and defining problems (for engineering) 2. Developing and using models 3. Planning and carrying out investigations *4.* Analyzing and interpreting data Analyzing data in 9–12 builds on K–8 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. (*Apply concepts of statistics and probability (including determining function fi to data, slope, intercept, and correlation coefficient for linear fits) to scientific and engineering questions and problems, using digital tools when feasible.)* 5. Using mathematics and computational thinking 6. Constructing explanations (for science) and designing solutions (for engineering) 7. Engaging in argument from evidence 8. Obtaining, evaluating, and communicating information (***To be embedded with the crosscutting concepts in all instructional units so that students gain the skills needed to deepen their understanding of the Disciplinary Core Ideas as demonstrated through the Performance Expectations.***)	✓ **P1.0-(10%)** ✓ **P2.0-(12-13%)** ✓ **P3.0-(27-32%)** ✓ **P4.0-(33-40%)** ✓ **P5.0-(13%)**

Current-PASS (2011) Standards- Tested through 2015-16	Oklahoma Academic Standards for Science (OASS) To be tested 2016-17	Biology I EOI Ideal % of Test Items (2014-15 BP)
C1.0 The Cell – Cells are the fundamental unit of life, composed of a variety of structures that perform functions necessary to maintain life. ○ C1.1-Cells are composed of a variety of structures such as the nucleus, cell/plasma membrane, cell wall, cytoplasm, ribosomes, mitochondria, and chloroplasts. a. The cell/plasma membrane functions (i.e., active transport, passive transport, diffusion, osmosis, and surface area to volume ratio) to maintain homeostasis. b. Differentiate among hypotonic, hypertonic, and isotonic conditions. c. Compare and contrast prokaryotic and eukaryotic cells. ○ C1.2. In multicellular organisms, cells have levels of organization (i.e., cells, tissues, organs, organ systems, organisms). ○ C1.3. Specialized cells enable organisms to monitor what is going on in the world around them (e.g., detect light, sound, specific chemicals, gravity, plant tropism, sense organs, and homeostasis	**HS-LS-1:From Molecules to Organisms: Structure and Function** **HS-LS1-1 § TRANSCRIPTION AND TRANSLATION** ✓ Construct an explanation based on evidence for how the structure of DNA determines the structure of proteins, which carry out the essential functions of life through systems of specialized cells. ***Assessment Boundary-*** *does not include identification of specific cell or tissue types, whole body systems, specific protein structures and functions, or the biochemistry of protein synthesis.* **HS-LS1-2§ LEVELS OF ORGANIZATION-** ✓ Develop and use a model to illustrate the hierarchical organization of interacting systems that provide specific functions within multicellular organisms**. *Assessment Boundary:*** *does not include interactions and functions at the molecular or chemical level.* **HS-LS1-3- ORGANISMS RESPONSE (INTERNAL AND EXTERNAL)-** ✓ Plan and conduct an investigation to provide evidence of the importance of maintaining homeostasis in living organisms. ***Assessment Boundary:*** *does not include the cellular processes involved in the feedback mechanism.* **HS-LS1-4 MITOSIS & DIFFERENTIATION** ✓ Use a model to illustrate the role of cellular division (mitosis) and differentiation in producing and maintaining complex organisms. ***Assessment Boundary:*** *does not include specific gene control mechanisms or rote memorization of the steps of mitosis.*	**C1.0- 21-27%** **(12-15 Questions)**

C2.0: The Molecular Basis of Heredity – DNA determines the characteristics of organisms. The student will engage in investigations that integrate the process standards and lead to the discovery of the following objectives:

- C2.1. Cells function according to the information contained in the master code of DNA (i.e., cell cycle, DNA replication and transcription). Transfer RNA and protein synthesis will be taught in life science courses with rigor greater than Biology I.
- C2.2. A sorting and recombination of genes during sexual reproduction results in a great variety of possible gene combinations from the offspring of any two parents (i.e., Punnett squares and pedigrees). Students will understand concepts in a single trait cross (e.g., alleles, dominant trait, recessive trait, phenotype, genotype, homozygous, heterozygous, incomplete dominance, and sex-linked traits).

C3.0: Biological Diversity – Diversity of species is developed through gradual processes over many generations.

- C3.1. Different species might look dissimilar, but the unity among organisms becomes apparent from an analysis of internal structures, the similarity of their chemical processes, and the evidence of common ancestry (e.g., homologous and analogous structures, embryology, fossil record, genetic data).
- C3.2. Characteristics of populations change through the mechanism of natural selection. These biological adaptations, including changes in structures, behaviors, and/or physiology, may enhance or limit survival and reproductive success within a particular environment.
- C3.3. Broad patterns of behavior exhibited by animals have changed over time to ensure reproductive success. Responses to external stimuli can result from interactions with the organism's own species and others, as well as environmental changes; these responses can be either innate or learned.

HS-LS3- Heredity, Inheritance and Variation of Traits

HS-LS-3-1-DNA and Coding

✓ Ask questions to clarify relationships about the role of DNA and chromosomes in coding the instructions for characteristic traits passed from parents to offspring. (***Assessment Boundary****: Assessments may include codominance, incomplete dominance, and sex-linked traits, but should not include dihybrid crosses.)*

HS-LS3-2- Genetic Variations

✓ Make and defend a claim based on evidence that inheritable genetic variations may result from: (1) new genetic combinations through meiosis, (2) viable errors occurring during replication, and/or (3) mutations caused by environmental factors. (***Assessment Boundary:*** *Assessment does not include the phases of meiosis or the biochemical mechanisms of specific steps in the process.)*

HS-LS3-3-Math of Punnett Squares

✓ Apply concepts of statistics and probability to explain the variation and distribution of expressed traits in a population. (***Assessment Boundary:*** *The assessment should provide evidence of students' abilities to use mathematical reasoning to explain the variation observed in a population as a combination of genetic and environmental factors. Hardy-Weinberg calculations are beyond the intent.)*

HS-LS-4: BIOLOGICAL UNITY AND DIVERSITY

HS-LS4-1-COMMON ANCESTRY and DIVERSITY

✓ Analyze and evaluate how evidence such as similarities in DNA sequences, anatomical structures, and order of appearance of structures during embryo- logical development contribute to the scientific explanation of biological diversity. (***Assessment Boundary:*** *The assessment should provide evidence of students' abilities to evaluate and analyze evidence (e.g. cladograms, analogous/homologous structures, and fossil records).*

Additional Aligning OASS Standards continued on the next page

C2.0- 21-27%
(12-15 Questions)

C3.0- 21-27%
(12-15 Questions)

PASS 2011- Tested through 2015-16 **C2.0: The Molecular Basis of Heredity** **C3.0: Biological Diversity**	**HS-LS4-2-DNA EVIDENCE-** ✓ Construct an explanation based on evidence that biological diversity is influenced by (1) the potential for a species to increase in number, (2) the heritable genetic variation of individuals in a species due to mutation and sexual reproduction, (3) competition for limited resources, and (4) the proliferation of those organisms that are better able to survive and reproduce in the environment. (***Assessment Boundary:*** *does not include genetic drift, gene flow through migration, and co-evolution).* **HS-LS4-3-FACTORS OF NATURAL SELECTION** ✓ Apply concepts of statistics and probability to support explanations that organisms with an advantageous heritable trait tend to increase in proportion to organisms lacking this trait. (**Assessment Boundary:** *The assessment should provide evidence of students' abilities to analyze shifts in numerical distribution of traits as evidence to support explanations. Analysis is limited to basic statistical and graphical analysis, not gene frequency calculations.)* **HS-LS4-4-TYPES OF NATURAL SELECTION** ✓ Construct an explanation based on evidence for how natural selection leads to adaptation of populations. (***Assessment Boundary:*** *The assessment should measure students' abilities to differentiate types of evidence used in explanations.)* **HS-LS 4-5- ENVIRONMENTAL FACTORS THAT EFFECT NATURAL SELECTION** ✓ Synthesize, communicate, and evaluate the information that describes how changes in environmental conditions can affect the distribution of traits in a population causing: 1) increases in the number of individuals of some species, 2) the emergence of new species over time, and 3) the extinction of other species. (**Assessment Boundary:** The assessment should provide evidence of students' abilities to explain the cause and effect for how changes to the environment affect distribution or disappearance of traits in species.)	

C4.0: The Interdependence of Organisms – Interdependence of organisms in an environment includes the interrelationships and interactions between and among organisms. ○ C4.1. Organisms both cooperate and compete in ecosystems (e.g., symbiotic relationships). ○ C4.2. Living organisms have the capacity to produce populations of infinite size, but environments and resources limit population size (e.g., carrying capacity, limiting factors, ecological succession). **C5.0: Matter, Energy, and Organization in Living Systems – Living systems require a continuous input of energy to maintain their chemical and physical organizations.** ○ C5.1. The complexity and organization of organisms accommodates the need for obtaining, transforming, transporting, releasing, and eliminating the matter and energy used to sustain the organism (i.e., photosynthesis and cellular respiration). ○ C5.2. As matter and energy flow through different levels of organization of living systems and between living systems and the physical environment, chemical elements are recombined in different ways by different structures. Matter and energy are conserved in each change (i.e., water cycle, carbon cycle, nitrogen cycle, food webs, and energy pyramids). ○ C5.3- Matter on earth cycles among the living (biotic) and nonliving (abiotic) components of the biosphere.	**FROM MOLECULES to ORGANISMS** **HS-LS-1-5- PHOTOSYNTHESIS** ✓ Use a model to illustrate how photosynthesis transforms light energy into stored chemical energy. **(*Assessment Boundary:*** *The assessment should provide evidence of students' abilities to describe the inputs and outputs of photosynthesis, not the specific biochemical steps. (e.g. photosystems, electron transport, and Calvin cycle).* **HS-LS-1-6 (Builds on HS-LS1-5) HYDROCARBON BACKBONES** ✓ Construct and revise an explanation based on evidence for how carbon, hydrogen, and oxygen from sugar molecules may combine with other elements to form amino acids and/or other large carbon-based molecules. **(*Assessment Boundary:*** *Assessment does not include the details of the specific chemical reactions or identification of macromolecules.)* **HS-LS1-7 (Builds on HS-LS1-6) CELLULAR RESPIRATION** ✓ Use a model to illustrate that cellular respiration is a chemical process whereby the bonds of food molecules and oxygen molecules are broken and the bonds in new compounds are formed resulting in a net transfer of energy. **(*Assessment Boundary:*** *Assessment should not include identification of the steps or specific processes involved in cellular respiration (e.g. glycolysis and Kreb's Cycle).* **ECOSYSTEMS: INTERACTIONS, ENERGY, AND DYNAMICS** **HS-LS2-1LIMITING FACTORS OF CARRYING CAPACITY** ✓ Use mathematical and/or computational representations to support explanations of factors that affect carrying capacity of ecosystems at different scales**. (*Assessment Boundary:*** *Assessment does not include deriving mathematical equations to make comparisons.)* ***Additional Aligning OASS Standards continued on next page***	**C4.0- 14-18%** **(8-10 Questions)** **C5.0- 21%** **(12 Questions)**

PASS 2011- Tested through 2015-16 **C4.0: The Interdependence of Organisms –** **5.0: Matter, Energy, and Organization in Living Systems**	**HS-LS2-2-MATH CALCULATIONS OF LIMITING FACTORS** ✓ Use mathematical representations to support and revise explanations based on evidence about factors affecting biodiversity and populations in ecosystems of different scales. (***Assessment Boundary:*** *Assessment is limited to provided data.)* **HS-LS2-3-SOURCES OF ENERGY PHOTOSYNTHESIS AND CELLULAR RESPIRATION (ANAEROBIC & AEROBIC)** ✓ Construct and revise an explanation based on evidence for the cycling of matter and flow of energy in aerobic and anaerobic conditions.*(**Assessment Boundary:** Assessment does not include the specific chemical processes of either aerobic or anaerobic respiration.)* **HS-LS2-4-CYCLES OF MATTER** ✓ Use a mathematical representation to support claims for the cycling of matter and flow of energy among organisms in an ecosystem. **(*Assessment Boundary:*** *The assessment should provide evidence of students' abilities to develop and use energy pyramids, food chains, food webs, and other models from data sets.)* **HS-LS2-5-EFFECT OF PHOTOSYNTHESIS AND CELLULAR RESPIRATION ON CARBON CYCLE** ✓ Develop a model to illustrate the role of photosynthesis and cellular respiration in the cycling of carbon among the biosphere, atmosphere, hydrosphere, and geosphere. *(**Assessment Boundary:** Assessment does not include the specific chemical steps of photosynthesis and respiration.)* **HS-LS2-6-ENVIRONMENTAL FACTORS (PRIMARY AND SECONDARY SUCCESSION)** ✓ Evaluate the claims, evidence, and reasoning that the complex interactions in ecosystems maintain relatively consistent numbers and types of organisms in stable conditions, but changing conditions may result in a new ecosystem. ***Assessment Boundary:*** *The assessment should provide evidence of students' abilities to derive trends from graphical representations of population trends. Assessments should focus on describing drivers of ecosystem stability and change, not on the organismal mechanisms of responses and interactions.* **HS-LS2-8POPULATION BEHAVIORS** ✓ Evaluate evidence for the role of group behavior on individual and species' chances to survive and reproduce**. (*Assessment Boundary:*** *provide evidence of students' abilities to: (1) distinguish between group versus individual behavior, (2) identify evidence supporting the outcomes of group behavior, and (3) develop logical and reasonable arguments based on evidence.)*	

Crosscutting Concepts aligned to the new OASS Standards*- These represent common threads that should be embedded throughout the course.*

Patterns

- Different patterns may be observed at each of the scales at which a system is studied and can provide evidence for causality in explanations of phenomena. (HS-LS4-1, HS-LS4-3)

Cause and Effect

- Empirical evidence is required to differentiate between cause and correlation and make claims about specific causes and effects. (HS-LS2-8, HS-LS3-1, HS-LS3-2, HS-LS4-2, HS-LS4-4, HS-LS4-5)

Energy and Matter

- Changes of energy and matter in a system can be described in terms of energy and matter flow into, out of, and within that system. (HS-LS-1-5, HS-LS1-6)
- Energy drives the cycling of matter within and between systems. (HS-LS-2-3)
- Energy cannot be created or destroyed- it only moves between one place and another place, between objects and/or fields, or between systems. (HS-LS1-7, HS-LS2-4)

Systems and System Models

- Models (e.g., physical, mathematical, computer models) can be used to simulate systems and interactions— including energy, matter, and information flows—within and between systems at different scales. (HS-LS1-2, HS-LS1-4, HS-LS2-5)

Stability and Change

- Feedback (negative or positive) can stabilize or destabilize a system. (HS-LS1-3)
- Much of science deals with constructing explanations of how things change and how they remain stable. (HS-LS2-6)

Scale, Proportion, and Quantity

- The significance of a phenomenon is dependent on the scale, proportion, and quantity at which it occurs. (HS-LS2-1)
- Using the concept of orders of magnitude allows one to understand how a model at one scale relates to a model at another scale. (HS-LS2-2)
- Algebraic thinking is used to examine scientific data and predict the effect of a change in one variable on another (e.g., linear growth vs. exponential growth). (HS-LS3-3)

Structure and Function

- Investigating or designing new systems or structures requires a detailed examination of the properties of different materials, the structures of different components, and connections of components to reveal its function and/or solve a problem. (HS-LS1-1)