Science GE DOK Alignment Chart **LIFE SCIENCE** **Grades 9-12** **GE 30**

DOK & NECAP Release Item Codes	GE Statement with Ceiling DOK	Science Concepts	Examples/Practice Items
Enduring Knowledge: All living organisms and their component cells have identifiable characteristics that allow for survival.			
DOK 3 **LS1(9-11) INQ + SAE + FAF-1** **DOK 3** **LS1(9-11) INQ + SAE + FAF-1** **DOK 2** **DOK 3** **LS1(9-11) FAF + POC-2**	**S79-12:30** **(DOK 3)** **Students demonstrate their understanding of Structure and Function-Survival Requirements by…** • Predicting, explaining and drawing conclusions about the direction of movement of substances across a membrane. **AND** • Developing a model that illustrates the interdependence of cellular organelles (**mitochondria, ribosomes, lysosomes, endoplasmic reticulum**, cytoplasm) in biochemical pathways within the cell (e.g. **mitochondria** and chloroplasts: cellular respiration and photosynthesis; nucleus and ribosomes: DNA **transcription** and **protein synthesis**). **AND** • Explaining how the basic (general) shape and structure of each of the four types of organic molecules relates to its role in maintaining cell survival (i.e., Simple carbohydrates [monosaccharides] can be an energy source as a single molecule and a storage/structural molecule when multiple units are chemically combined—[starch, cellulose, chitin].). **AND** • Explaining how a specific sequence of amino acids determines the shape of a protein (i.e., hemoglobin molecule—normal vs. Sickle cell).	Science Concepts: a. There are four basic types of organic compounds found in a cell (**proteins, carbohydrates, lipids and nucleic acids**). b. **Enzymes**, proteins that regulate biochemical reactions, are critical to the survival of cells. c. The molecular structure of a cell membrane allows for selective transfer of substances into and out of the cell (i.e., diffusion, **osmosis**, **facilitated diffusion, active transport**). d. The shape of proteins in a cell determines the structure and function of that cell, hence survival of the organism (i.e., cytoskeleton, biochemical functions, catalysts).	**(DOK 2)** • Compare and contrast the structures and functions of the mitochondrion and chloroplast organelles. **(DOK 3)** • Develop scientific model that illustrates the interdependence of structure and functioning six cellular organelles using an analogy to everyday objects or systems. **(DOK 1)** • Identify and describe the four basic types of organic molecules found in living organisms. **(DOK 3)** • Use evidence to justify how the sequence of amino acids affects the structure and functioning of the hemoglobin molecule.

Science GE DOK Alignment Chart **LIFE SCIENCE** **Grades 9-12** **GE 31-32**

DOK & NECAP Release Item Codes	GE Statement with Ceiling DOK	Science Concepts	Examples/Practice Items
Enduring Knowledge: All living organisms and their component cells have identifiable characteristics that allow for survival.			
DOK 3 **LS1(5-8) SAE + FAF-2** **DOK 2** **LS1(5-8) SAE + FAF-2**	**S7-8:31** **(DOK 3)** **Students demonstrate their understanding of Reproduction by …** • Creating a model which illustrates how the DNA of all cells/tissues in an organism is produced from a single fertilized egg cell (mitosis). **AND** • Explaining how the **nucleotide** sequence in DNA (gene) directs the synthesis of specific proteins needed by a cell (e.g., **protein synthesis**) and cell division.	Science Concepts: a. Every body cell in an organism contains the identical **genome** (DNA) which is maintained from one cell generation to the next by mitosis and **DNA replication**. b. Transmission of genetic information to offspring occurs through egg and sperm cells that contain only one representative from each chromosome pair. c. The genetic information in a cell's DNA is used to direct the synthesis of the thousands of proteins that each cell requires, however only portions of the genome are active in any one cell. d. Genetic variation in organisms arises from gamete formation and sexual reproduction.	**(DOK 1)** • Describe the steps in the process of DNA replication. **(DOK 2)** • Determine the sequence of amino acids in of a protein produced from the following DNA code.
Enduring Knowledge: All living organisms and their component cells have identifiable characteristics that allow for survival.			
DOK 2 **DOK 2**	**S9-12:32** **(DOK 2)** **Students demonstrate their understanding of Differentiation by…** • Predicting the change in an embryo caused by disruption of the **ectoderm** or **mesoderm** or **endoderm** during embryonic development (e.g., Fetal Alcohol Syndrome, drugs, injury). **AND** • Comparing the role of various sub-cellular units in unicellular organisms to comparable structures in multicellular organisms (i.e., oral groove, gullet, food vacuole in *Paramecium* compared to digestive systems in multicellular organisms).	Science Concepts: a. Cell differentiation is regulated through the expression of different genes within the embryo cells. During embryonic development of complex multicellular organisms, chemicals within the cells activate and deactivate portions of the genetic code as influenced by the cell's environment and past history. b. Unicellular organisms lack differentiation, but sub-cellular units carry out all life functions.	

Science GE DOK Alignment Chart **LIFE SCIENCE** **Grades 9-12** **GE 33-34**

DOK & NECAP Release Item Codes	GE Statement with Ceiling DOK	Science Concepts	Examples/Practice Items
Enduring Knowledge: All living organisms and their component cells have identifiable characteristics that allow for survival.			
DOK 2 **LS1(5-8) INQ + SAE-1** **DOK 3** **LS1(5-8) FAF-4** **DOK 2**	**S9-12:33** **(DOK 3)** **Students demonstrate their understanding of how Energy Flow Within Cells Supports an Organism's Survival by…** • Comparing and contrasting the structure of **mitochondria** and chloroplasts as cell organelles, the interrelatedness of their functions, and their importance to the survival of all cells. **AND** • Describing and justifying a possible flow of energy from the environment through an organism to the cellular level, and through the cell from assimilation through storage in ATP. **AND** • Investigating and describing **enzyme** action under a variety of chemical and physical conditions.	Science Concepts: a. In living systems, energy flows through matter and is stored and released through chemical reactions. Basic survival energy transformations between cells and their environment include aerobic and anaerobic respiration and photosynthesis reactions. Energy is necessary for work to be accomplished and life to be sustained (e.g., At the cellular level, this work can be growth, repair, reproduction, and synthesis). b. Energy is stored in living systems in ATP molecules. Energy is transformed through living systems from the environment through specific cell organelles and specific chemical processes. **c.** Energy transformations in living systems are enzyme dependent.	
Enduring Knowledge: Energy enters an ecosystem in the form of sunlight and flows through the system to each cell. Matter interacts, changes and recycles in an ecosystem. Populations of organisms survive by maintaining interdependent relationships with one another and by utilizing biotic and abiotic resources from the environment.			
DOK 3 **LS1(5-8) FAF-4**	**9-12:34** **(DOK 3)** **Students demonstrate their understanding of Energy Flow in an Ecosystem by…** • Diagramming or developing a model that compares the energy at different **trophic levels** in a given ecosystem	Science Concept: a. Energy from the sun enters all ecosystems through photosynthesis, is passed through **trophic levels** (producers, consumers, decomposers) with energy released as heat at every level until all the original energy is eventually released as heat (i.e., Energy Pyramid and 10% Rule).	**(DOK 2)** Use a model or diagram to demonstrate the energy flow through trophic levels in a Northern Hardwood forest ecosystem. **(DOK 3)** Devise/develop an **original** model to illustrate the energy flow through trophic levels in a Northern Hardwood forest ecosystem.

Science GE DOK Alignment Chart **LIFE SCIENCE** **Grades 9-12** **GE 35-37**

DOK & NECAP Release Item Codes	GE Statement with Ceiling DOK	Science Concepts	Examples/Practice Items
Enduring Knowledge: Energy enters an ecosystem in the form of sunlight and flows through the system to each cell. Matter interacts, changes and recycles in an ecosystem. Populations of organisms survive by maintaining interdependent relationships with one another and by utilizing biotic and abiotic resources from the environment.			
DOK 2 **LS1(5-8) FAF-4**	**S9-12:35** **(DOK 2)** **Students demonstrate their understanding of Food Webs in an Ecosystem by…** • Tracing the cycling of matter (e.g. carbon compounds, nitrogen compounds) within the organisms of a food web from its source through its transformation in cellular, biochemical processes (e.g., cells, organs, organisms, communities).	Science Concept: a. Within ecosystems, the processes of **photosynthesis** and **cellular respiration** recycle matter (i.e., carbon compounds) found within organisms and the abiotic environment.	
DOK 3 **LS2(9-12)INQ + SAE-3**	**S9-12:36** **(DOK 3)** **Students demonstrate their understanding of Equilibrium in an Ecosystem by…** • Designing an investigation to compare a natural system with one altered by human activities (e.g., acid rain, eutrophication through agricultural runoff, fertilizer, pollution, solid waste, clear cutting, toxic emissions or conservation and habitat reclamation).	Science Concept: a. Human beings are part of the earth's many ecosystems. Human activities can deliberately or inadvertently alter the equilibrium in an ecosystem.	**(DOK 4)** • Design and conduct an investigation to determine the effect of stocking hatchery trout on the genetic variability of a wild trout population. Use your data and other information—such as economic, recreation, and conservation data—to justify a recommendation to the Fish and Wildlife Dept. on their stocking policy.
DOK 3	**S9-12:37** **(DOK 3)** **Students demonstrate their understanding of Recycling in an Ecosystem by…** • Developing and explaining a model that shows the recycling of inorganic compounds within a natural ecosystem (e.g., Compare worm compost with commercial fertilizer.).	Science Concept: a. Matter (inorganic compounds) used by living things on the molecular level is cycled from old life to new life through major chemical cycles of the earth (e.g., N, H_2O, C-O, P).	

Science GE DOK Alignment Chart **LIFE SCIENCE** **Grades 9-12** **GE 38-39**

DOK & NECAP Release Item Codes	GE Statement with Ceiling DOK	Science Concepts	Examples/Practice Items
Enduring Knowledge: All living things exhibit patterns of similarity in their structures, behaviors and biochemistry			
DOK 2 **LS3(5-8) SAE -6** **LS3(5-8)MAS +** **FAF-8**	**S9-12:38** **(DOK 2)** **Students demonstrate their understanding of Classification of Organisms by…** • Developing a graphic representation that illustrates and compares the degree of molecular similarity among several species (e.g., DNA or amino acid sequences).	Science Concepts: a. Formal classification systems of organisms (Domain, Kingdom, Phylum…) are based upon molecular similarities and differences among organisms. b. A species is the most fundamental unit of classification. Similarity of species (degree of kinship) can be substantiated by the molecular composition (e.g., DNA /amino acid sequences, biochemical similarity within **species**).	
DOK 3 **LS2(5-8) SAE -6** **LS2(5-8) SAE -7** **LS3(5-8)MAS +** **FAF-8**	**S9-12:39** **(DOK 3)** **Students demonstrate their understanding of Evolution/Natural Selection by…** • Using evidence to apply the theory of **Natural Selection** to a scenario depicting change within a given population over time/through many generations (e.g., bacterial resistance to antibiotics, neck length of the giraffe, animal camouflage).	Science Concepts: a. The diversity of present-day organisms resulted from changes over time in many ancestral organisms. b. Evolution (change over time) is based on variety within species. A greater variation within a species increases the possibility of species survival under changing conditions. Life on earth is thought to have begun four billion years ago, as simple, one-celled organisms about some of which still exist today. c. **Natural Selection** provides a mechanism for evolution and leads to organisms well-suited in a particular, existing environment. d. New species result from evolution due to: • overpopulation • genetic variability of offspring • a finite supply of resources, producing stress and competition • the selection (survival and subsequent reproduction) of offspring best suited to a particular environment e. Molecular structure provides additional evidence for evolution.	