

Florida Tutorials are designed specifically for the New Florida Standards for Math and English Language Arts and the Next Generation Sunshine State Standards (NGSSS) for science and social studies to prepare students for the Florida Standards Assessments and the NGSSS End-of-Course (EOC) exams.

Biology Tutorials offer targeted instruction, practice, and review designed to help students develop fluency, deepen conceptual understanding, and apply scientific thinking skills. Students engage with the content in an interactive, feedback-rich environment as they progress through standards-aligned modules. By constantly honing their ability to explain and analyze biological scenarios, students build the depth of knowledge and higher-order skills required to demonstrate their mastery when put to the test.

In each module, the Learn It and Try It make complex ideas accessible through focused content, guided analysis, multi-modal representations, and personalized feedback as students reason through increasingly challenging problems. The Review It offers a high-impact summary of key concepts and relates those concepts to students' lives. The Test It assesses students' mastery of the module's concepts, providing granular performance data to students and teachers after each attempt. To help students focus on the content most relevant to them, unit-level pretests and posttests can quickly identify where students are strong and where they're still learning.

## 1. CHEMISTRY OF LIFE

### • BIOMOLECULES

- **SC.912.L.18.A** All living things are composed of four basic categories of macromolecules and share the same basic needs for life.
- **SC.912.L.18.1** Describe the basic molecular structures and primary functions of the four major categories of biological macromolecules.
- **SC.912.L.18.2** Describe the important structural characteristics of monosaccharides, disaccharides, and polysaccharides and explain the functions of carbohydrates in living things.
- **SC.912.L.18.4** Describe the structures of proteins and amino acids. Explain the functions of proteins in living organisms. Identify some reactions that amino acids undergo. Relate the structure and function of enzymes.
- **SC.912.L.18.3** Describe the structures of fatty acids, triglycerides, phospholipids, and steroids. Explain the functions of lipids in living organisms. Identify some reactions that fatty acids undergo. Relate the structure and function of cell membranes.

### • ENZYMES

- **SC.912.L.18.C** Chemical reactions in living things follow basic rules of chemistry and are usually regulated by enzymes.
- **SC.912.L.18.4** Describe the structures of proteins and amino acids. Explain the functions of proteins in living organisms. Identify some reactions that amino acids undergo. Relate the structure and function of enzymes.
- **SC.912.L.18.11** Explain the role of enzymes as catalysts that lower the activation energy of biochemical reactions. Identify factors, such as pH and temperature, and their effect on enzyme activity.

## 2. CELL STRUCTURE AND FUNCTION

### • PROKARYOTIC AND EUKARYOTIC CELLS

- **SC.912.L.14.1** Describe the scientific theory of cells (cell theory) and relate the history of its discovery to the process of science.
- **SC.912.L.14.5** Explain the evidence supporting the scientific theory of the origin of eukaryotic cells (endosymbiosis).
- **SC.912.L.14.A** Cells have characteristic structures and functions that make them distinctive.
- **SC.912.L.14.B** Processes in a cell can be classified broadly as growth, maintenance, reproduction, and homeostasis.
- **SC.912.L.14.2** Relate structure to function for the components of plant and animal cells. Explain the role of cell membranes

as a highly selective barrier (passive and active transport).

- **SC.912.L.14.3** Compare and contrast the general structures of plant and animal cells. Compare and contrast the general structures of prokaryotic and eukaryotic cells.
- **SC.912.L.18.3** Describe the structures of fatty acids, triglycerides, phospholipids, and steroids. Explain the functions of lipids in living organisms. Identify some reactions that fatty acids undergo. Relate the structure and function of cell membranes.
- **SC.912.L.18.7** Identify the reactants, products, and basic functions of photosynthesis.
- **SC.912.L.18.8** Identify the reactants, products, and basic functions of aerobic and anaerobic cellular respiration.
- **SC.912.L.14.6** Explain the significance of genetic factors, environmental factors, and pathogenic agents to health from the perspectives of both individual and public health.

#### • PLANT AND ANIMAL CELLS

- **SC.912.L.14.2** Relate structure to function for the components of plant and animal cells. Explain the role of cell membranes as a highly selective barrier (passive and active transport).
- **SC.912.L.14.3** Compare and contrast the general structures of plant and animal cells. Compare and contrast the general structures of prokaryotic and eukaryotic cells.
- **SC.912.L.14.A** Cells have characteristic structures and functions that make them distinctive.
- **SC.912.L.14.B** Processes in a cell can be classified broadly as growth, maintenance, reproduction, and homeostasis.

#### • PASSIVE TRANSPORT

- **SC.912.L.14.A** Cells have characteristic structures and functions that make them distinctive.
- **SC.912.L.14.B** Processes in a cell can be classified broadly as growth, maintenance, reproduction, and homeostasis.
- **SC.912.L.14.2** Relate structure to function for the components of plant and animal cells. Explain the role of cell membranes as a highly selective barrier (passive and active transport).
- **SC.912.L.14.3** Compare and contrast the general structures of plant and animal cells. Compare and contrast the general structures of prokaryotic and eukaryotic cells.
- **SC.912.L.18.3** Describe the structures of fatty acids, triglycerides, phospholipids, and steroids. Explain the functions of lipids in living organisms. Identify some reactions that fatty acids undergo. Relate the structure and function of cell membranes.

#### • ACTIVE TRANSPORT

- **SC.912.L.14.A** Cells have characteristic structures and functions that make them distinctive.
- **SC.912.L.14.B** Processes in a cell can be classified broadly as growth, maintenance, reproduction, and homeostasis.
- **SC.912.L.14.2** Relate structure to function for the components of plant and animal cells. Explain the role of cell membranes as a highly selective barrier (passive and active transport).
- **SC.912.L.14.3** Compare and contrast the general structures of plant and animal cells. Compare and contrast the general structures of prokaryotic and eukaryotic cells.

### 3. CELLULAR ENERGETICS

#### • PHOTOSYNTHESIS

- **SC.912.L.18.7** Identify the reactants, products, and basic functions of photosynthesis.
- **SC.912.L.18.9** Explain the interrelated nature of photosynthesis and cellular respiration.
- **SC.912.L.18.10** Connect the role of adenosine triphosphate (ATP) to energy transfers within a cell.
- **SC.912.L.14.2** Relate structure to function for the components of plant and animal cells. Explain the role of cell membranes as a highly selective barrier (passive and active transport).
- **SC.912.L.14.3** Compare and contrast the general structures of plant and animal cells. Compare and contrast the general structures of prokaryotic and eukaryotic cells.
- **SC.912.L.18.5** Discuss the use of chemiosmotic gradients for ATP production in chloroplasts and mitochondria.

#### • CELLULAR RESPIRATION

- **SC.912.L.18.B** *Living organisms acquire the energy they need for life processes through various metabolic pathways (primarily photosynthesis and cellular respiration).*
- **SC.912.L.18.6** *Discuss the role of anaerobic respiration in living things and in human society.*
- **SC.912.L.18.8** *Identify the reactants, products, and basic functions of aerobic and anaerobic cellular respiration.*
- **SC.912.L.18.9** *Explain the interrelated nature of photosynthesis and cellular respiration.*
- **SC.912.L.18.10** *Connect the role of adenosine triphosphate (ATP) to energy transfers within a cell.*
- **SC.912.L.14.2** *Relate structure to function for the components of plant and animal cells. Explain the role of cell membranes as a highly selective barrier (passive and active transport).*
- **SC.912.L.14.3** *Compare and contrast the general structures of plant and animal cells. Compare and contrast the general structures of prokaryotic and eukaryotic cells.*
- **SC.912.L.14.A** *Cells have characteristic structures and functions that make them distinctive.*

## 4. CELL GROWTH AND REPRODUCTION

### • THE CELL CYCLE

- **SC.912.L.14.B** *Processes in a cell can be classified broadly as growth, maintenance, reproduction, and homeostasis.*
- **SC.912.L.16.14** *Describe the cell cycle, including the process of mitosis. Explain the role of mitosis in the formation of new cells and its importance in maintaining chromosome number during asexual reproduction.*
- **SC.912.L.16.3** *Describe the basic process of DNA replication and how it relates to the transmission and conservation of the genetic information.*
- **SC.912.L.16.15** *Compare and contrast binary fission and mitotic cell division.*
- **SC.912.L.14.2** *Relate structure to function for the components of plant and animal cells. Explain the role of cell membranes as a highly selective barrier (passive and active transport).*
- **SC.912.L.14.3** *Compare and contrast the general structures of plant and animal cells. Compare and contrast the general structures of prokaryotic and eukaryotic cells.*
- **SC.912.L.14.6** *Explain the significance of genetic factors, environmental factors, and pathogenic agents to health from the perspectives of both individual and public health.*
- **SC.912.L.16.8** *Explain the relationship between mutation, cell cycle, and uncontrolled cell growth potentially resulting in cancer.*

### • MITOSIS

- **SC.912.L.14.B** *Processes in a cell can be classified broadly as growth, maintenance, reproduction, and homeostasis.*
- **SC.912.L.16.14** *Describe the cell cycle, including the process of mitosis. Explain the role of mitosis in the formation of new cells and its importance in maintaining chromosome number during asexual reproduction.*
- **SC.912.L.16.15** *Compare and contrast binary fission and mitotic cell division.*
- **SC.912.L.16.17** *Compare and contrast mitosis and meiosis and relate to the processes of sexual and asexual reproduction and their consequences for genetic variation.*

## 5. DNA STRUCTURE AND FUNCTION

### • COMPONENTS OF DNA

- **SC.912.L.16.A** *DNA stores and transmits genetic information. Genes are sets of instructions encoded in the structure of DNA.*
- **SC.912.L.16.B** *Genetic information is passed from generation to generation by DNA in all organisms and accounts for similarities in related individuals.*
- **SC.912.L.16.3** *Describe the basic process of DNA replication and how it relates to the transmission and conservation of the genetic information.*
- **SC.912.L.18.A** *All living things are composed of four basic categories of macromolecules and share the same basic needs for life.*
- **SC.912.L.18.1** *Describe the basic molecular structures and primary functions of the four major categories of biological macromolecules.*

- **SC.912.L.14.1** Describe the scientific theory of cells (cell theory) and relate the history of its discovery to the process of science.

- **THE GENETIC CODE**

- **SC.912.L.16.A** DNA stores and transmits genetic information. Genes are sets of instructions encoded in the structure of DNA.
- **SC.912.L.16.B** Genetic information is passed from generation to generation by DNA in all organisms and accounts for similarities in related individuals.
- **SC.912.L.16.9** Explain how and why the genetic code is universal and is common to almost all organisms.
- **SC.912.L.16.3** Describe the basic process of DNA replication and how it relates to the transmission and conservation of the genetic information.
- **SC.912.L.16.5** Explain the basic processes of transcription and translation, and how they result in the expression of genes.
- **SC.912.L.16.6** Discuss the mechanisms for regulation of gene expression in prokaryotes and eukaryotes at transcription and translation level.
- **SC.912.L.16.10** Evaluate the impact of biotechnology on the individual, society and the environment, including medical and ethical issues.

- **DNA REPLICATION**

- **SC.912.L.16.3** Describe the basic process of DNA replication and how it relates to the transmission and conservation of the genetic information.

## 6. GENE EXPRESSION

- **TRANSCRIPTION**

- **SC.912.L.16.A** DNA stores and transmits genetic information. Genes are sets of instructions encoded in the structure of DNA.
- **SC.912.L.16.B** Genetic information is passed from generation to generation by DNA in all organisms and accounts for similarities in related individuals.
- **SC.912.L.16.3** Describe the basic process of DNA replication and how it relates to the transmission and conservation of the genetic information.
- **SC.912.L.16.5** Explain the basic processes of transcription and translation, and how they result in the expression of genes.
- **SC.912.L.18.A** All living things are composed of four basic categories of macromolecules and share the same basic needs for life.
- **SC.912.L.18.1** Describe the basic molecular structures and primary functions of the four major categories of biological macromolecules.
- **SC.912.L.16.6** Discuss the mechanisms for regulation of gene expression in prokaryotes and eukaryotes at transcription and translation level.

- **TRANSLATION**

- **SC.912.L.16.3** Describe the basic process of DNA replication and how it relates to the transmission and conservation of the genetic information.
- **SC.912.L.16.4** Explain how mutations in the DNA sequence may or may not result in phenotypic change. Explain how mutations in gametes may result in phenotypic changes in offspring.
- **SC.912.L.16.5** Explain the basic processes of transcription and translation, and how they result in the expression of genes.
- **SC.912.L.16.16** Describe the process of meiosis, including independent assortment and crossing over. Explain how reduction division results in the formation of haploid gametes or spores.
- **SC.912.L.18.1** Describe the basic molecular structures and primary functions of the four major categories of biological macromolecules.
- **SC.912.L.14.17** List the steps involved in the sliding filament of muscle contraction.
- **SC.912.L.18.C** Chemical reactions in living things follow basic rules of chemistry and are usually regulated by enzymes.

- **SC.912.L.18.4** Describe the structures of proteins and amino acids. Explain the functions of proteins in living organisms. Identify some reactions that amino acids undergo. Relate the structure and function of enzymes.

## 7. MUTATIONS

### • GENETIC CHANGES IN DNA

- **SC.912.L.14.6** Explain the significance of genetic factors, environmental factors, and pathogenic agents to health from the perspectives of both individual and public health.
- **SC.912.L.15.15** Describe how mutation and genetic recombination increase genetic variation.
- **SC.912.L.16.4** Explain how mutations in the DNA sequence may or may not result in phenotypic change. Explain how mutations in gametes may result in phenotypic changes in offspring.

### • GENETIC CHANGES IN CHROMOSOMES

- **SC.912.L.15.15** Describe how mutation and genetic recombination increase genetic variation.
- **SC.912.L.16.10** Evaluate the impact of biotechnology on the individual, society and the environment, including medical and ethical issues.
- **SC.912.L.16.16** Describe the process of meiosis, including independent assortment and crossing over. Explain how reduction division results in the formation of haploid gametes or spores.
- **SC.912.L.16.17** Compare and contrast mitosis and meiosis and relate to the processes of sexual and asexual reproduction and their consequences for genetic variation.
- **SC.912.L.14.6** Explain the significance of genetic factors, environmental factors, and pathogenic agents to health from the perspectives of both individual and public health.
- **SC.912.L.16.4** Explain how mutations in the DNA sequence may or may not result in phenotypic change. Explain how mutations in gametes may result in phenotypic changes in offspring.

## 8. HEREDITY

### • MENDELIAN LAWS OF HEREDITY

- **SC.912.L.16.1** Use Mendel's laws of segregation and independent assortment to analyze patterns of inheritance.
- **SC.912.L.16.2** Discuss observed inheritance patterns caused by various modes of inheritance, including dominant, recessive, codominant, sex-linked, polygenic, and multiple alleles.
- **SC.912.L.16.17** Compare and contrast mitosis and meiosis and relate to the processes of sexual and asexual reproduction and their consequences for genetic variation.

### • MULTIPLE ALLELES AND ALLELES WITHOUT DOMINANCE

- **SC.912.L.16.2** Discuss observed inheritance patterns caused by various modes of inheritance, including dominant, recessive, codominant, sex-linked, polygenic, and multiple alleles.

## 9. REPRODUCTION

### • SEXUAL AND ASEQUAL REPRODUCTION

- **SC.912.L.15.13** Describe the conditions required for natural selection, including: overproduction of offspring, inherited variation, and the struggle to survive, which result in differential reproductive success.
- **SC.912.L.15.15** Describe how mutation and genetic recombination increase genetic variation.
- **SC.912.L.16.D** Reproduction is characteristic of living things and is essential for the survival of species.
- **SC.912.L.16.14** Describe the cell cycle, including the process of mitosis. Explain the role of mitosis in the formation of new cells and its importance in maintaining chromosome number during asexual reproduction.
- **SC.912.L.16.17** Compare and contrast mitosis and meiosis and relate to the processes of sexual and asexual reproduction and their consequences for genetic variation.
- **SC.912.L.16.15** Compare and contrast binary fission and mitotic cell division.
- **SC.912.L.16.16** Describe the process of meiosis, including independent assortment and crossing over. Explain how

reduction division results in the formation of haploid gametes or spores.

- **MEIOSIS**

- **SC.912.L.16.16** Describe the process of meiosis, including independent assortment and crossing over. Explain how reduction division results in the formation of haploid gametes or spores.
- **SC.912.L.16.17** Compare and contrast mitosis and meiosis and relate to the processes of sexual and asexual reproduction and their consequences for genetic variation.
- **SC.912.L.15.15** Describe how mutation and genetic recombination increase genetic variation.
- **SC.912.L.16.1** Use Mendel's laws of segregation and independent assortment to analyze patterns of inheritance.
- **SC.912.L.15.D** Natural selection is a primary mechanism leading to evolutionary change.
- **SC.912.L.15.13** Describe the conditions required for natural selection, including: overproduction of offspring, inherited variation, and the struggle to survive, which result in differential reproductive success.

## 10. EVOLUTION

- **MULTIPLE LINES OF EVIDENCE**

- **SC.912.L.15.A** The scientific theory of evolution is the fundamental concept underlying all of biology.
- **SC.912.L.15.B** The scientific theory of evolution is supported by multiple forms of scientific evidence.
- **SC.912.L.15.C** Organisms are classified based on their evolutionary history.
- **SC.912.L.15.1** Explain how the scientific theory of evolution is supported by the fossil record, comparative anatomy, comparative embryology, biogeography, molecular biology, and observed evolutionary change.
- **SC.912.L.15.4** Describe how and why organisms are hierarchically classified and based on evolutionary relationships.
- **SC.912.L.15.8** Describe the scientific explanations of the origin of life on Earth.
- **SC.912.L.14.10** Discuss the relationship between the evolution of land plants and their anatomy.
- **SC.912.L.16.9** Explain how and why the genetic code is universal and is common to almost all organisms.

- **THE FOSSIL RECORD**

- **SC.912.L.15.A** The scientific theory of evolution is the fundamental concept underlying all of biology.
- **SC.912.L.15.B** The scientific theory of evolution is supported by multiple forms of scientific evidence.
- **SC.912.L.15.C** Organisms are classified based on their evolutionary history.
- **SC.912.L.15.1** Explain how the scientific theory of evolution is supported by the fossil record, comparative anatomy, comparative embryology, biogeography, molecular biology, and observed evolutionary change.
- **SC.912.L.15.4** Describe how and why organisms are hierarchically classified and based on evolutionary relationships.

## 11. MECHANISMS OF EVOLUTION

- **NATURAL SELECTION**

- **SC.912.L.15.13** Describe the conditions required for natural selection, including: overproduction of offspring, inherited variation, and the struggle to survive, which result in differential reproductive success.
- **SC.912.L.15.14** Discuss mechanisms of evolutionary change other than natural selection such as genetic drift and gene flow.
- **SC.912.L.15.D** Natural selection is a primary mechanism leading to evolutionary change.

- **EVOLUTION OF SPECIES**

- **SC.912.L.15.B** The scientific theory of evolution is supported by multiple forms of scientific evidence.
- **SC.912.L.15.D** Natural selection is a primary mechanism leading to evolutionary change.
- **SC.912.L.15.9** Explain the role of reproductive isolation in the process of speciation.
- **SC.912.L.15.A** The scientific theory of evolution is the fundamental concept underlying all of biology.
- **SC.912.L.15.1** Explain how the scientific theory of evolution is supported by the fossil record, comparative anatomy,

*comparative embryology, biogeography, molecular biology, and observed evolutionary change.*

- **SC.912.L.15.13** *Describe the conditions required for natural selection, including: overproduction of offspring, inherited variation, and the struggle to survive, which result in differential reproductive success.*
- **SC.912.L.15.14** *Discuss mechanisms of evolutionary change other than natural selection such as genetic drift and gene flow.*

## 12. CLASSIFICATION

### • TAXONOMY

- **SC.912.L.14.53** *Discuss basic classification and characteristics of plants. Identify bryophytes, pteridophytes, gymnosperms, and angiosperms.*
- **SC.912.L.15.C** *Organisms are classified based on their evolutionary history.*
- **SC.912.L.15.4** *Describe how and why organisms are hierarchically classified and based on evolutionary relationships.*
- **SC.912.L.15.5** *Explain the reasons for changes in how organisms are classified.*
- **SC.912.L.15.6** *Discuss distinguishing characteristics of the domains and kingdoms of living organisms.*
- **SC.912.L.15.7** *Discuss distinguishing characteristics of vertebrate and representative invertebrate phyla, and chordate classes using typical examples.*
- **SC.912.L.16.10** *Evaluate the impact of biotechnology on the individual, society and the environment, including medical and ethical issues.*

### • THE SIX KINGDOMS

- **SC.912.L.14.3** *Compare and contrast the general structures of plant and animal cells. Compare and contrast the general structures of prokaryotic and eukaryotic cells.*
- **SC.912.L.14.9** *Relate the major structure of fungi to their functions.*
- **SC.912.L.14.53** *Discuss basic classification and characteristics of plants. Identify bryophytes, pteridophytes, gymnosperms, and angiosperms.*
- **SC.912.L.15.C** *Organisms are classified based on their evolutionary history.*
- **SC.912.L.15.4** *Describe how and why organisms are hierarchically classified and based on evolutionary relationships.*
- **SC.912.L.15.5** *Explain the reasons for changes in how organisms are classified.*
- **SC.912.L.15.6** *Discuss distinguishing characteristics of the domains and kingdoms of living organisms.*

## 13. FUNCTIONS OF ANIMAL SYSTEMS

### • HOMEOSTASIS AND DYNAMIC EQUILIBRIUM

- **SC.912.L.14.B** *Processes in a cell can be classified broadly as growth, maintenance, reproduction, and homeostasis.*
- **SC.912.L.14.6** *Explain the significance of genetic factors, environmental factors, and pathogenic agents to health from the perspectives of both individual and public health.*

### • THE IMMUNE AND LYMPHATIC SYSTEMS

- **SC.912.L.14.D** *Most multicellular organisms are composed of organ systems whose structures reflect their particular function.*
- **SC.912.L.14.42** *Describe the anatomy and the physiology of the lymph system.*
- **SC.912.L.14.52** *Explain the basic functions of the human immune system, including specific and nonspecific immune response, vaccines, and antibiotics.*
- **SC.912.L.14.B** *Processes in a cell can be classified broadly as growth, maintenance, reproduction, and homeostasis.*
- **SC.912.L.14.6** *Explain the significance of genetic factors, environmental factors, and pathogenic agents to health from the perspectives of both individual and public health.*

### • THE NERVOUS SYSTEM

- **SC.912.L.14.D** *Most multicellular organisms are composed of organ systems whose structures reflect their particular*



function.

- **SC.912.L.14.21** Describe the anatomy, histology, and physiology of the central and peripheral nervous systems and name the major divisions of the nervous system.
- **SC.912.L.14.50** Describe the structure of vertebrate sensory organs. Relate structure to function in vertebrate sensory systems.
- **SC.912.L.14.25** Identify the major parts of a cross section through the spinal cord.
- **SC.912.L.14.26** Identify the major parts of the brain on diagrams or models.
- **SC.912.L.14.27** Identify the functions of the major parts of the brain, including the meninges, medulla, pons, midbrain, hypothalamus, thalamus, cerebellum and cerebrum.
- **SC.912.L.14.28** Identify the major functions of the spinal cord.
- **SC.912.L.14.49** Identify the major functions associated with the sympathetic and parasympathetic nervous systems.

## 14. FUNCTIONS OF PLANT SYSTEMS

### • PLANT TISSUES

- **SC.912.L.14.2** Relate structure to function for the components of plant and animal cells. Explain the role of cell membranes as a highly selective barrier (passive and active transport).
- **SC.912.L.14.7** Relate the structure of each of the major plant organs and tissues to physiological processes.

### • PLANT RESPONSES

- **SC.912.L.14.7** Relate the structure of each of the major plant organs and tissues to physiological processes.
- **SC.912.L.14.31** Describe the physiology of hormones including the different types and the mechanisms of their action.

## 15. CYCLES IN NATURE

### • THE CARBON CYCLE

- **SC.912.L.17.10** Diagram and explain the biogeochemical cycles of an ecosystem, including water, carbon, and nitrogen cycle.
- **SC.912.L.17.16** Discuss the large-scale environmental impacts resulting from human activity, including waste spills, oil spills, runoff, greenhouse gases, ozone depletion, and surface and groundwater pollution.
- **SC.912.L.17.4** Describe changes in ecosystems resulting from seasonal variations, climate change and succession.
- **SC.912.L.17.8** Recognize the consequences of the losses of biodiversity due to catastrophic events, climate changes, human activity, and the introduction of invasive, non-native species.
- **SC.912.L.17.20** Predict the impact of individuals on environmental systems and examine how human lifestyles affect sustainability.

### • THE NITROGEN AND PHOSPHORUS CYCLES

- **SC.912.L.17.10** Diagram and explain the biogeochemical cycles of an ecosystem, including water, carbon, and nitrogen cycle.
- **SC.912.L.17.B** Energy and nutrients move within and between biotic and abiotic components of ecosystems via physical, chemical and biological processes.
- **SC.912.L.17.C** Human activities and natural events can have profound effects on populations, biodiversity and ecosystem processes.
- **SC.912.L.17.20** Predict the impact of individuals on environmental systems and examine how human lifestyles affect sustainability.

## 16. MATTER AND ENERGY

### • FOOD CHAINS AND WEBS

- **SC.912.L.17.9** Use a food web to identify and distinguish producers, consumers, and decomposers. Explain the pathway of



energy transfer through trophic levels and the reduction of available energy at successive trophic levels.

- **SC.912.L.17.5** Analyze how population size is determined by births, deaths, immigration, emigration, and limiting factors (biotic and abiotic) that determine carrying capacity.
- **SC.912.L.17.A** The distribution and abundance of organisms is determined by the interactions between organisms, and between organisms and the non-living environment.
- **SC.912.L.17.8** Recognize the consequences of the losses of biodiversity due to catastrophic events, climate changes, human activity, and the introduction of invasive, non-native species.
- **SC.912.L.17.20** Predict the impact of individuals on environmental systems and examine how human lifestyles affect sustainability.

- **PYRAMIDS OF ENERGY, NUMBERS, AND BIOMASS**

- **SC.912.L.17.9** Use a food web to identify and distinguish producers, consumers, and decomposers. Explain the pathway of energy transfer through trophic levels and the reduction of available energy at successive trophic levels.
- **SC.912.L.17.5** Analyze how population size is determined by births, deaths, immigration, emigration, and limiting factors (biotic and abiotic) that determine carrying capacity.
- **SC.912.L.17.8** Recognize the consequences of the losses of biodiversity due to catastrophic events, climate changes, human activity, and the introduction of invasive, non-native species.
- **SC.912.L.17.20** Predict the impact of individuals on environmental systems and examine how human lifestyles affect sustainability.

## 17. ECOLOGY OF SUCCESSION

- **SUCCESSION IN COMMUNITIES**

- **SC.912.L.17.4** Describe changes in ecosystems resulting from seasonal variations, climate change and succession.

- **NATURAL IMPACTS ON ECOSYSTEMS**

- **SC.912.L.17.4** Describe changes in ecosystems resulting from seasonal variations, climate change and succession.
- **SC.912.L.17.C** Human activities and natural events can have profound effects on populations, biodiversity and ecosystem processes.
- **SC.912.L.17.8** Recognize the consequences of the losses of biodiversity due to catastrophic events, climate changes, human activity, and the introduction of invasive, non-native species.
- **SC.912.L.17.20** Predict the impact of individuals on environmental systems and examine how human lifestyles affect sustainability.
- **SC.912.L.15.3** Describe how biological diversity is increased by the origin of new species and how it is decreased by the natural process of extinction.