**Classifying Objects**

**Benchmark:**

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| SC.912.L.15.6 | Discuss distinguishing characteristics of the domains and kingdoms of living organisms. |
| 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.N.1.3 | Recognize that the strength or usefulness of a scientific claim is evaluated through scientific argumentation, which depends on critical and logical thinking, and the active consideration of alternative scientific explanations to explain the data presented. |
| SC.912.N.1.6 | Describe how scientific inferences are drawn from scientific observations, and provide examples from the content being studied. |
| SC.912.N.3.1 | Explain that a scientific theory is the culmination of many scientific investigations drawing together all the current evidence concerning a substantial range of phenomena; thus, a scientific theory represents the most powerful explanation scientists have to offer. |
| 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.14.2 | 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.14.4 | Compare and contrast structure and function of various types of microscopes. |

**Relevant Achievement Level Descriptions**

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| Analyze the development of a scientific theory (cell theory) and contrast theories and laws |
| Compare structures and describe related functions in different types of cells |
| Interpret, analyze, and synthesize data to determine causal relationships in a complex investigation |
| Make predictions and defend conclusions based on experimental design or scientific argumentation |

**Students should be able to:**

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| **Know** | **Understand** |
| One of the characteristics that differentiate nonliving things from living things is the presence of cells.  The cell theory describes how current science understands cells.  Cells are classified as prokaryotic or eukaryotic.  Plant and animal cells are examples of eukaryotic cells. | Cells are the basic functional unit of living things.  The cell theory states: (a) all living things are composed of cells, and living things may be unicellular or multicellular, (b) the cell is the basic unit of life, and (c) all cells arise from pre-existing cells.  Prokaryotic cells lack a true nucleus and membrane-bound organelles  Eukaryotic cells have a true nucleus and membrane-bound organelles.  Plant cells have large vacuoles, a cell wall, and chloroplasts, whereas animal cells do not.  Animal cells have lysosomes, whereas plant cells do not. |

**Cell Transport**

**Benchmark:**

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| 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.18.1 | Describe the basic molecular structures and primary functions of the four major categories of biological macromolecules. |
| SC.912.N.1.1 | Define a problem based on a specific body of knowledge, for example: biology, chemistry, physics, and Earth/space science, and do the following:  o Pose questions about the natural world  o Conduct systematic observations  o  Examine books and other sources of information to see what already known  o Review what is known in light of empirical evidence  o Plan investigations  o Use tools to gather, analyze, and interpret data (this includes the use of measurement in metric and other systems, and also the generation and interpretation of graphical representations of data, including data tables and graphs)  o Pose answers, explanations, or descriptions of events  o Generate explanations that explicate or describe natural phenomena (inferences)  o Use appropriate evidence and reasoning to justify these explanations to others  o Communicate results of scientific investigations  o Evaluate the merits of the explanations produced by others. |
| SC.912.N.1.3 | Recognize that the strength or usefulness of a scientific claim is evaluated through scientific argumentation, which depends on critical and logical thinking, and the active consideration of alternative scientific explanations to explain the data presented. |
| SC.912.N.1.6 | Describe how scientific inferences are drawn from scientific observations, and provide examples from the content being studied. |

**Relevant Achievement Level Descriptions**

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| Compare structures and describe related functions in different types of cells. |
| Interpret, analyze, and synthesize data to determine causal relationships in a complex investigation. |
| Make predictions and defend conclusions based on experimental design or scientific argumentation. |
| Use scientific reasoning to justify abstract explanations. |
| Make sound scientific inferences based on natural phenomena. |

**Students should be able to:**

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| **Know** | **Understand** |
| The cell membrane controls what materials enter and exit the cell.      Materials enter and exit the cell via diffusion, osmosis, facilitated diffusion, and active transport. | The cell membrane’s structure is related to its function (ex: phospholipid bilayer and carrier proteins)    Diffusion, osmosis, and facilitated diffusion move materials through the cell membrane from a high to low concentration and do not require input of energy.  Facilitated diffusion requires the assistance of a carrier protein.    Active transport moves materials through the cell membrane from a low to high concentration and does require the input of energy.  Active transport requires the assistance of a carrier protein. |

**Cell Division**

**Benchmarks:**

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| SC.912.N.1.1 | Define a problem based on a specific body of knowledge, for example: biology, chemistry, physics, and Earth/space science, and do the following:   * Pose questions about the natural world * Conduct systematic observations * Examine books and other sources of information to see what already known * Review what is known in light of empirical evidence * Plan investigations * Use tools to gather, analyze, and interpret data (this includes the use of measurement in metric and other systems, and also the generation and interpretation of graphical representations of data, including data tables and graphs) * Pose answers, explanations, or descriptions of events * Generate explanations that explicate or describe natural phenomena (inferences) * Use appropriate evidence and reasoning to justify these explanations to others * Communicate results of scientific investigations   Evaluate the merits of the explanations produced by others. |
| SC.912.N.1.3 | Recognize that the strength or usefulness of a scientific claim is evaluated through scientific argumentation, which depends on critical and logical thinking, and the active consideration of alternative scientific explanations to explain the data presented. |
| SC.912.N.1.6 | Describe how scientific inferences are drawn from scientific observations, and provide examples from the content being studied. |
| SC.912.L.16.4 | 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.16.8 | Explain the relationship between mutation, cell cycle, and uncontrolled cell growth potentially resulting in cancer. |
| 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.16.14 | 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.16.13 | Describe the basic anatomy and physiology of the human reproductive system. Describe the process of human development from fertilization to birth and major changes that occur in each trimester of pregnancy. |
| SC.912.L.14.7 | Relate the structure of each of the major plant organs (roots) and tissues (meristematic) to physiological processes (cell reproduction—mitosis-- and growth).    Relate the structure of major plant organs (flowers) to physiological processes (meiosis and sexual reproduction). |

**Relevant Achievement Level Descriptions**

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| Relate specific events occurring to each of the stages of the cell cycle |
| Assess how uncontrolled cell growth may result from mutations that affect the proteins that regulate the cell |
| Differentiate the processes of mitosis and meiosis and/or show how these processes may contribute to or limit genetic variation |
| Apply knowledge of gene and chromosomal mutations and interpret how these mutations may or may not result in a phenotypic change |
| Relate mutation and genetic recombinations to an increase in genetic variation |
| Relate structures of plant tissues and organs directly to their roles in physiological processes |
| Relate the basic anatomy to the physiology of the human reproductive system |

**Students should be able to:**

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| **Know** | **Understand** |
| Eukaryotic cells divide by mitosis and meiosis.          Mitosis and meiosis both undergo interphase, prophase, metaphase, anaphase, and telophase.                                  The cell cycle regulates the reproduction and growth of cells. Dysfunction of/failure to regulate the cell cycle may result in cancer. | Mitosis is associated with asexual reproduction and meiosis is associated with sexual reproduction, and therefore increased genetic variation.    Mitosis produces two daughter cells that have the same number of chromosomes as the parent cell after undergoing one division; They are diploid (2N).    Meiosis produces four daughter cells that have half of the number of chromosomes as the parent cell after undergoing two divisions; They are haploid (N).    Meiosis increases genetic variation through independent assortment and crossover.  Mutations may also result in genetic variation.        Oncogenes and Tumor Suppressor Factors are proteins associated with the development of cancer. |

**Molecular Genetics**

**Benchmark:**

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| 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.18.1 | Describe the basic molecular structures and primary functions of the four major categories of biological macromolecules. |
| 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. |
| SC.912.L.16.8 | Explain the relationship between mutation, cell cycle, and uncontrolled cell growth potentially resulting in cancer. |
| 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. |

**Relevant Achievement Level Descriptions**

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| Summarize the basic molecular structure and the primary function of macromolecules in organisms |
| Analyze how enzymes speed up the rate of a biochemical reaction and describe the effect of environmental factors on enzyme activity |
| Show that the basic components of DNA are universal in organisms and how similarities in the genetic codes of organisms are due to common ancestry |
| Distinguish among the cellular processes of DNA replication, transcription, and translation |
| Assess how uncontrolled cell growth may result from mutations that affect the proteins that regulate the cell cycle |
| Apply knowledge of gene and chromosomal mutations and interpret how these mutations may or may not result in a phenotypic change |
| Relate the significance of genetic factors, environmental factors, and pathogenic agents to health from the perspective of both individual and public health |

**Benchmarks not addressed in exemplar lessons**

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| [SC.912.L.16.12](http://www.cpalms.org/Public/PreviewStandard/Preview/2023) | Describe how basic DNA technology (restriction digestion by endonucleases, gel electrophoresis, polymerase chain reaction, ligation, and transformation) is used to construct recombinant DNA molecules (DNA cloning). |
| SC.912.L.16.15 | Compare and contrast binary fission and mitotic cell division. |