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| CENTRAL FLORIDA ASSESSMENT COLLABORATIVE |
| Individual Test Item Specifications |
| Genetics |
| 2014 |

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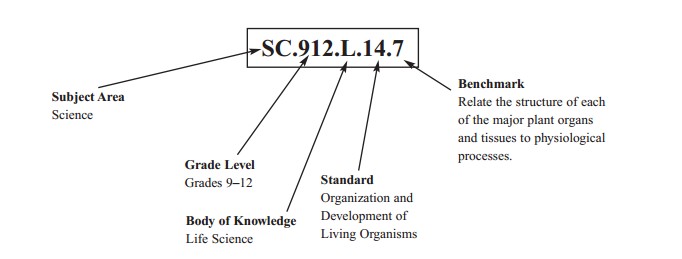
**I. Guide to the Individual Benchmark Specifications**

Content specific guidelines are given in the *Individual Benchmark Specifications* for each course. The *Specifications* contains specific information about the alignment of items with the NGSSS and the Florida Standards. It identifies the manner in which each benchmark is assessed, provides content limits and stimulus attributes for each benchmark, and gives specific information about content, item types, and response attributes.

**Benchmark Classification System**

Each NGSSS benchmark is labeled with a system of letters and numbers.

* The two letters in the *first position* of the label identify the **Subject Area**.
* The number(s) in the *second position* represents the **Grade Level**.
* The letter in the *third position* represents the **Strand** or **Body of Knowledge.**
* The number in the *fourth position* represents the **Standard**.
* The number in the *last position* identifies the specific **Benchmark**.



**Each MAFS benchmark is labeled with a system of letters and numbers.**

 The four letters in the *first position* of the label identify the **Subject**.

 The number(s) in the *second position* represents the **Grade Level**.

 The letter(s) in the *third position* represents the **Category**.

 The number in the *fourth position* shows the **Domain**.

 The number in the *fifth position* identifies the **Cluster**.

 The number in the *last position* identifies the specific **Benchmark**.



**Definitions of Benchmark Specifications**

The *Individual Benchmark Specifications* provides standard-specific guidance for assessment item development for CFAC item banks. For each benchmark assessed, the following information is provided:

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| **Reporting Category** | is a grouping of related benchmarks that can be used to summarize and report achievement. |
| **Standard** | refers to the standard statement presented in the NGSSS or in the Florida Standards. |
| **Benchmark**  **Also Assesses** | refers to the benchmark statement presented in the NGSSS or standard statement in the Florida Standards. In some cases, two or more related benchmarks are grouped together because the assessment of one benchmark addresses another benchmark. Such groupings are indicated in the Also Assesses statement.  refers to the benchmarks that are closely related to the benchmark (see description above) |
| **Item Types**  **Cognitive**  **Complexity** | are used to assess the benchmark or group of benchmark.  ideal level at which item should be assessed. |
| **Benchmark Clarifications** | explain how achievement of the benchmark will be demonstrated by students. In other words, the clarification statements explain what the student will do when responding to questions. |
| **Content Limits** | define the range of content knowledge and that should be assessed in the items for the benchmark. |
| **Stimulus Attributes** | define the types of stimulus materials that should be used in the items, including the appropriate use of graphic materials and item context or content. |
| **Response Attributes**  **Content Focus** | define the characteristics of the answers that a student must choose or provide.  defines the content measured by each test item. Content focus addresses the broad content and skills associated with the examples found in the standards, benchmarks, or benchmark clarifications. |
| **Sample Items** | are provided for each type of question assessed. The correct answer for all sample items is provided. |

**II. Individual Benchmark Specifications**

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| **Reporting Category** | Life Science |
| **Standard** | Organization & Development of Living Organisms |
| **Benchmark Number** | SC.912.L.14.1 |
| **Benchmark** | Describe the scientific theory of cells (cell theory) and relate the history of its discovery to the process of science. |
| **Also Assesses** | None Specified |
| **Item Types** | Selected Response |
| **Cognitive Complexity** | Moderate |
| **Benchmark Clarification** | Students will identify, describe, and/or explain the components of the cell theory.  Students will describe how the formation of the cell theory involved the scientific method.  Students will focus on identifying the properties of cells. |
| **Content Limits** | The item does not require the knowledge of specific scientists or their  individual discoveries.  The item does not require the knowledge of cell processes, components, or cellular reproduction. |
| **Stimulus Attributes** | Chart, diagram, or text |
| **Response Attributes** | Only one choice should include principles from the cell theory. The distracters should involve cells or cellular functions, but contain none of the principles of the cell theory. |
| **Content Focus** | Cell theory, cell properties |
| **Sample** **Item** | The following list of observations is recorded in a biology lab.  I. Mature red blood cells do not contain a nucleus.  II. The bacteria staphylococcus can be cultured on nutrient agar.  III. Muscle cells contain many nuclei.  IV. Red blood cells develop from hemocytoblasts located in the  red bone marrow.  Which of these observations support the cell theory?  A) I and III only  B) I and IV only  C) II and III only  D) III and IV only  Correct Answer: B |

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| **Reporting** **Category** | Life Science |
| **Standard** | Organization & Development of Living Organisms |
| **Benchmark** **Number** | SC.912.L.14.6 |
| **Benchmark** | Explain the significance of genetic factors, environmental factors, and  pathogenic agents to health from the perspectives of both individual and public health. |
| **Also Assesses** | None Specified |
| **Item Types** | Selected Response |
| **Cognitive Complexity** | High |
| **Benchmark**  **Clarification** | Students will explain how genetic mutations or environmental factors such as the use of antibiotics may result in resistant bacteria.  Students will evaluate what role genetic and environmental factors have on public health as it relates to pathogenic agents. |
| **Content Limits** | Limited to not requiring the knowledge of any specific bacteria or any  specific knowledge of historical events related to this issue. |
| **Stimulus Attributes** | Chart, diagram, or text |
| **Response Attributes** | None Specified |
| **Content Focus** | Genetic and environmental factors, pathogens, bacteria |
| **Sample Item** | After a recent outbreak of a flu-like virus that nearly shut down the campus of Washington High School, it was decided to put hand sanitizer stations in every classroom and to make hand sanitizer available to students in the bathroom and cafeteria. This way students can constantly clean their hands with an antibacterial and antiviral solution and reduce the chance of a similar outbreak in the future. Some members of the community are against this new policy.  Which of the following would cause these people to be resistant to the new policy?   1. There is little proof that these sanitizing solutions will harm a   wide range of pathogens.  B) The antibiotics and antiviral agents will increase mutations in the  pathogens and result in more deadly disease causing agents.   1. The increased cost does not justify the potential benefit of   keeping everyone healthy. Students can contract diseases at home also.  D) A high concentration of antibiotics could result in highly resistant  bacteria and actually create a worse problem than it is trying to  solve.  Correct Answer: D |

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| **Reporting** **Category** | Classification/Heredity/Evolution |
| **Standard** | Diversity & Evolution of Living Organisms |
| **Benchmark** **Number** | SC.912.L.15.8 |
| **Benchmark** | Describe the scientific explanations of the origin of life on Earth. |
| **Also Assesses** | None Specified |
| **Item Types** | Selected Response; Short Response |
| **Cognitive Complexity** | Moderate |
| **Benchmark**  **Clarification** | Students will describe scientific explanations of the origin of life on Earth.  Students will explain the evolution of genetic material within the origin of life. |
| **Content Limits** | Limited to being conceptual in its format but not requiring specific  knowledge of Earth ages, or time periods, individual scientists and their unique contributions.  Specific topics related to this such as origin of organic molecules, cells, and multicellular organisms should also be conceptual in nature. |
| **Stimulus Attributes** | Chart, diagram, or text |
| **Response Attributes** | None Specified |
| **Content Focus** | Origin of cells, RNA, DNA |
| **Sample Item** | Scientists theorize that RNA was the original genetic material and appeared before DNA. Which of the following does not provide evidence for this theory?  A) RNA is a single stranded  B) RNA is required for DNA replication  C) DNA requires RNA for gene expression  D) DNA does not require RNA for gene expression  Correct Answer: D |

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| **Reporting** **Category** | Classification/Heredity/Evolution |
| **Standard** | Diversity & Evolution of Living Organisms |
| **Benchmark** **Number** | SC.912.L.15.9 |
| **Benchmark** | Explain the role of reproductive isolation in the process of speciation. |
| **Also Assesses** | None Specified |
| **Item Types** | Selected Response  . |
| **Cognitive Complexity** | Moderate |
| **Benchmark**  **Clarification** | Students will define speciation in terms of the inability to reproduce with other organisms due to physical, behavior or geographical constraints.  Students will explain that a species must be able to produce viable offspring via sexual (or asexual) reproduction. |
| **Content Limits** | Limited to being conceptual in nature. |
| **Stimulus Attributes** | Diagram, map, or text |
| **Response Attributes** | None Specified |
| **Content Focus** | Sexual or asexual reproduction, genetic variation |
| **Sample Item** | A large-scale strip mall is built in a wooded area in Louisiana. The large complex effectively divided a large plot of trees into two groups. A population of small, gray lizards thrived as part of the ecosystem in this wooded area. The strip mall has divided these lizards into two populations with one group on either side of the complex with no means of reaching each other. Geneticists begin to monitor the two populations.  What is the prediction most geneticists would probably make about the two lizard populations?  A) Without the ability to interbreed, the two populations will die out.  B) The population of lizards will remain unchanged but develop  different behaviors due to their isolation from each other.  C) One population will develop a mutation that the other population  will not, resulting in two different looking groups of lizards.  D) The isolation from each other will result in speciation  because the two populations of lizards may develop varying  characteristics unique to each population.  Correct Answer: D |

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| **Reporting** **Category** | Classification/Heredity/Evolution |
| **Standard** | Diversity & Evolution of Living Organisms |
| **Benchmark** **Number** | SC.912.L.15.12 |
| **Benchmark** | List the conditions for Hardy-Weinberg equilibrium in a population and why these conditions are not likely to appear in nature.  Use the Hardy-Weinberg equation to predict genotypes in a population from observed phenotypes. |
| **Also Assesses** | None Specified |
| **Item Types** | Selected Response |
| **Cognitive Complexity** | High |
| **Benchmark**  **Clarification** | Students will list the five conditions necessary for Hardy-Weinberg  equilibrium.  Students will explain why those five conditions are unlikely to ever occur in a population.  Students will identify and predict traits caused by various modes of inheritance.  Students will use the Hardy-Weinberg equation to calculate if a population is in the Hardy-Weinberg equilibrium and make predictions of possible genotypic or allelic frequencies when given the phenotypes of the population. |
| **Content Limits** | Limited to not requiring a chi-square test.  Inheritance patterns should be limited to simple dominance, co-dominance, and incomplete dominance. |
| **Stimulus Attributes** | Chart, diagram, or textual information involving a population of organisms and allelic frequencies |
| **Response Attributes** | None Specified |
| **Content Focus** | Dominance, co-dominance, incomplete dominance, Hardy-Weinberg equilibrium, genotypes, phenotypes |

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| **Sample Item** | This is a classic data set on wing coloration in the scarlet tiger moth (*Panaxia dominula*). Coloration in this species had been previously shown to behave as a single-locus, two-allele system with incomplete dominance. Data for 1612 moths are given below:  white-spotted (AA) =1469  intermediate (Aa) =138  little spotting (aa) =5  What would the frequency be for the recessive ‘a’ allele in the population according to the Hardy-Weinberg equilibrium model and what would you expect to happen to this frequency in twenty years if male spotted moths were desired more for mating among females than males with few spots?  A) 95% and the frequency would decrease in twenty years  B) 91% and it would increase in twenty years  C) 4% and it would increase slightly in twenty years  D) 2% and it would decrease over twenty years  Correct Answer: D  A lower-level complexity problem may look like this:  If the assumptions of the Hardy-Weinberg equilibrium include a large population, random mating, no natural selection, no immigration/emigration, then which of the following is also an assumption in this genetic principle?   1. no meiosis 2. no methylmalonic acidemia   C) no mitosis  D) no mutation  Correct Answer: D |

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| **Reporting** **Category** | Classification/Heredity/Evolution |
| **Standard** | Diversity & Evolution of Living Organisms |
| **Benchmark** **Number** | SC.912.L.15.13 |
| **Benchmark** | Describe the conditions required for natural selection, including: overproduction of offspring, inherited variation, and the struggle to survive, which result in differential reproductive success. |
| **Also Assesses** | None Specified |
| **Item Types** | Selected Response; Extended Response |
| **Cognitive Complexity** | Moderate |
| **Benchmark**  **Clarification** | Students will describe the driving forces for natural selection including  producing more offspring than needed, variation in the offspring, and survival of the offspring that are most fit. |
| **Content Limits** | Limited to not requiring the identification of which variations make an  offspring most fit.  The item is conceptual in nature and should not require specific vocabulary knowledge to answer the question such as r or k selected species. |
| **Stimulus Attributes** | Chart, diagram, or text |
| **Response Attributes** | None Specified |
| **Content Focus** | Natural selection, overproduction, genetic variation |
| **Sample Item** | The Asian shore crab invaded parts of the eastern coast of the United States about 15 years ago. The Asian shore crab preys on blue mussels.  In the time since the Asian shore crab arrived, the average shell thickness has increased in the blue mussel population. Which of the following is the most likely reason that this increase in shell thickness has occurred?  A) Blue mussels with thick shells attract more crabs than mussels  without thick shells.  B) Blue mussels with thick shells grow in larger colonies than  mussels without thick shells.  C) Blue mussels with thick shells catch more food per day than  mussels without thick shells.  D) Blue mussels with thick shells survive and reproduce more  successfully than mussels without thick shells.  Correct Answer: D |

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| **Reporting** **Category** | Classification/Heredity/Evolution |
| **Standard** | Diversity & Evolution of Living Organisms |
| **Benchmark** **Number** | SC.912.L.15.14 |
| **Benchmark** | Discuss mechanisms of evolutionary change other than natural selection such as genetic drift and gene flow. |
| **Also Assesses** | SC.912.L.15.12 |
| **Item Types** | Selected Response; Short Response |
| **Cognitive Complexity** | Moderate |
| **Benchmark**  **Clarification** | Students will discuss how factors such as genetic drift or gene flow prompt changes in a population and are not subject to selective pressures from the environment.  Students will explain how allelic frequencies in populations change over time and how gene flow and genetic drift cause violations in assumptions made by the Hardy-Weinberg theorem. |
| **Content Limits** | Limited to not requiring defining or explaining specific population changes such as balancing or directional selection. |
| **Stimulus Attributes** | Chart, diagram, or text |
| **Response Attributes** | None Specified |
| **Content Focus** | Genetic drift, gene flow, allele frequency, Hardy-Weinberg Theory |
| **Sample Item** | Genetic drift, given enough time and no other evolutionary forces, will lead to which result?  A) an increase in the mutation rate  B) reduced genetic variation in a population  C) increased genetic variation in a population  D) no change in allele frequencies in a population  Correct Answer: B |

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| **Reporting** **Category** | Classification/Heredity/Evolution |
| **Standard** | Diversity & Evolution of Living Organisms |
| **Benchmark** **Number** | SC.912.L.15.15 |
| **Benchmark** | Describe how mutation and genetic recombination increase genetic variation. |
| **Also Assesses** | SC.912.L.16.4 |
| **Item Types** | Selected Response |
| **Cognitive Complexity** | Moderate |
| **Benchmark**  **Clarification** | Students will define mutation and explain its role in increasing genetic  variation.  Students will define and explain the role of genetic recombination during mitosis or meiosis results in genetic variation. |
| **Content Limits** | Limited to not requiring identifying specific mutations in regard to  molecular or chromosomal mutations, i.e. point mutations, translocation, etc. |
| **Stimulus Attributes** | Chart, diagram, pedigree or text |
| **Response Attributes** | None Specified |
| **Content Focus** | Genetic variations, gene flow, genetic drift, mutation |
| **Sample Item** | Milkweed plants in Northern Indiana are eaten by a parasitic insect known as the milkweed worm. The worm has stripes on its back to help it blend in with the milkweed plant. This helps it escape being eaten by a predatory wasp. However, a scientist noticed that in one particular field of milkweed plants, the worms had suddenly lost those stripes. What are the two most likely explanations for this change in genetic variations?  A) gene flow and immigration  B) genetic drift and mutations  C) mutation and recombination  D) the founder effect and recombination  Correct Answer: C |

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| **Reporting** **Category** | Classification/Heredity/Evolution |
| **Standard** | Heredity & Reproduction |
| **Benchmark** **Number** | SC.912.L.16.1 |
| **Benchmark** | Use Mendel's laws of segregation and independent assortment to analyze patterns of inheritance. |
| **Also Assesses** | SC.912.L.16.2 |
| **Item Types** | Selected Response |
| **Cognitive Complexity** | High |
| **Benchmark**  **Clarification** | Students will successfully evaluate pedigrees or a Punnett square to  describe the pattern of inheritance using Mendel's laws of segregation and independent assortment.  Students will make predictions regarding phenotypes and genotypes based on Mendel’s laws. |
| **Content Limits** | Limited to referring about general dominant and recessive traits.  The item should not address factors that are not predicted by Mendel’s laws such as co-dominance, incomplete dominance, multiple alleles, or sex-linked genes. |
| **Stimulus Attributes** | Chart, pedigree, Punnett square, or text indicating phenotypes of a particular genetic trait |
| **Response Attributes** | None Specified |
| **Content Focus** | Dominant, recessive, phenotypes, genotypes |
| **Sample Item** | In guinea pigs, black fur is dominant to white fur, and spotted coats are  dominant to pure coats. An animal breeder mates a black furred, spotted coat male with a white furred, pure coated female. All ten offspring from this mating have black fur and are spotted. What are the genotypes of the parents based on the offspring?  A) male BBSS; female bbss  B) male BBSs; female BBss  C) male BbSs; female BbSs  D) male BbSs; female bbss  Correct Answer: A |

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| **Reporting** **Category** | Classification/Heredity/Evolution |
| **Standard** | Heredity & Reproduction |
| **Benchmark** **Number** | SC.912.L.16.2 |
| **Benchmark** | Discuss observed inheritance patterns caused by various modes of inheritance, including dominant, recessive, co-dominant, sex-linked, polygenic, and multiple alleles. |
| **Also Assesses** | SC.912.L.16.1 |
| **Item Types** | Selected Response |
| **Cognitive Complexity** | High |
| **Benchmark**  **Clarification** | Students will identify the inheritance patterns of various modes  of inheritance such as dominant and recessive genes, co-dominant and sex- linked genes, polygenic and multiple alleles.  Students will identify commonly taught examples of each mode of inheritance, including yellow/green pea color inheritance and sickle cell anemia (dominant/recessive), MN blood types or red and white flowers = red/white speckled flowers for co-dominant inheritance, colorblindness and hemophilia for sex-linked, red and white = pink for incomplete dominance, and human skin color for polygenic inheritance, ABO (IA, IB and i) for multiple alleles. |
| **Content Limits** | Limited to not including items that discuss modes of inheritance outside those listed in the benchmark.  The item is not dependent on doing a Punnett square. |
| **Stimulus Attributes** | Chart, diagram, pedigree, or text |
| **Response Attributes** | None Specified |
| **Content Focus** | Dominant, recessive, co-dominance, phenotype, genotype, genetic variation, alleles |
| **Sample Item** | A plant with red flowers is crossed with a white-flowered plant of the same species. All the seeds, when grown, produce plants with red and white flowers. Assuming that a single pair of alleles controls the flower color, what inheritance pattern would this be classified as?  A) co-dominance  B) incomplete dominance  C) sex-linked genes  D) simple dominance and recessive  Correct Answer: A |

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| **Reporting** **Category** | Molecular & Cellular Biology |
| **Standard** | Heredity & Reproduction |
| **Benchmark** **Number** | SC.912.L.16.3 |
| **Benchmark** | Describe the basic process of DNA replication and how it relates to the  transmission and conservation of the genetic information. |
| **Also Assesses** | SC.912.L.16.4; SC.912.L.16.5; SC.912.L.16.9 |
| **Item Types** | Selected Response |
| **Cognitive Complexity** | High |
| **Benchmark**  **Clarification** | Students will describe the basic process of DNA replication and how  it results in a duplication and exact copy of the existing genetic information.  Students will focus on the basic processes of transcription and translation.  Students will explain DNA replication in the semi-conservative model. Students will explain the antiparallel nature of DNA. |
| **Content Limits** | Limited to not requiring naming enzymes involved in this process or factors that interfere with DNA replication. |
| **Stimulus Attributes** | Chart, diagram, picture, or text |
| **Response Attributes** | None Specified |
| **Content Focus** | DNA replication, transcription, translation |
| **Sample Item** | If a specific DNA sequence is 5' ATGCTAGAT 3', what would the matching DNA sequence be?  A) 3’ TACGATCTA 5'  B) 3’ UACGAUCUA 5’ C) 5' ATGCTAGAT 3'  D) 5' UACGAUCUA 3'  Correct Answer: A |

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| **Reporting** **Category** | Molecular & Cellular Biology |
| **Standard** | Heredity & Reproduction |
| **Benchmark** **Number** | SC.912.L.16.4 |
| **Benchmark** | 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. |
| **Also Assesses** | SC.912.L.16.5 |
| **Item Types** | Selected Response |
| **Cognitive Complexity** | High |
| **Benchmark**  **Clarification** | Students will define mutation as a change in the DNA sequence and  can explain how this change may or may not affect the phenotype of the individual.  Students will distinguish between somatic mutations and sex cell mutations.  Students will explain how sex cell mutations will possibly affect the offspring.  Students will determine how different types of mutations may affect phenotype. Different types of mutations may include point mutations, insertions and deletions.  Students will explain how mutations may result in an incorrect genetic code being utilized in translation.  Students will explain how this change may affect the folding of proteins and deem a protein nonfunctional.  Students will explain how non-disjunction in meiosis can lead to chromosomal abnormalities leading to genetic disorders in offspring. |
| **Content Limits** | Limited to not addressing somatic cell changes and cancer.  The item does not address chromosomal abnormalities. |
| **Stimulus Attributes** | Diagram, picture, or text |
| **Response Attributes** | None Specified |
| **Content Focus** | Somatic and sex cell mutations, insertions, deletions, genetic  variations, meiosis, mitosis, phenotypes |
| **Sample Item** | On moths, a dominant gene creates a grey pigment in the moth's wings. The recessive allele causes little to no pigment. If a mutation occurred in the recessive gene and was passed on to an offspring, what would be the most likely effect on the phenotype for those offspring receiving this mutated allele?  A) They would have darker wings.  B) There would be no visible change.  C) The moths would have transparent wings.  D) They would probably suffer an early death.  Correct Answer: B  A specific DNA sequence is 5' ATGCTAGGCTAG 3'. The following  mutation occurs: 5' ATGCAAGGCTAG 3'. Which of the following may  occur as a result of this mutation?  A) There will be no effect.  B) A frame shift will occur and the DNA will not be transcribed or  translated resulting in no protein.  C) The codon for CAA in the mutated strand will bring in two amino  acids in translation resulting in a larger protein.  D) The codon for CAA in the mutated strand will bring in the  incorrect amino acid in translation resulting in an incorrectly  folding protein.  Correct Answer: D |

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| **Reporting** **Category** | Molecular & Cellular Biology |
| **Standard** | Heredity & Reproduction |
| **Benchmark** **Number** | SC.912.L.16.5 |
| **Benchmark** | Explain the basic processes of transcription and translation, and how they result in the expression of genes. |
| **Also Assesses** | SC.912.L.16.6; SC.912.L.16.9; SC.912.L.18.1 |
| **Item Types** | Selected Response |
| **Cognitive Complexity** | High |
| **Benchmark**  **Clarification** | Students will describe the process of transcription and translation as it  relates to expressing the genetic code as a functioning protein.  Students will explain the differences between prokaryotes and eukaryotes.  Students will explain modifications to eukaryotic mRNA after transcription and prior to translation.  Students will focus on the role DNA replication has on transmission and conservation of genetic material.  Given a chart with the genetic code, students will determine the amino acid sequence of a protein given the original DNA template.  Students will demonstrate the understanding of 5' versus 3' in the transcription process. |
| **Content Limits** | None Specified |
| **Stimulus Attributes** | Diagram, picture, or text |
| **Response Attributes** | None Specified |
| **Content Focus** | DNA replication, transcription, translation, prokaryotes, eukaryotes |
| **Sample Item** | If a specific prokaryotic DNA sequence is 3' ATGCTAGTA 5', which of the following represents the mRNA transcript?  A) 3' ATGCUAGCT 5'  B) 3' UACGAUCAU 5'  C) 5' ATGCUAGCT 3'  D) 5' UACGAUCAU 3'  Correct Answer: D |

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| **Reporting** **Category** | Molecular & Cellular Biology |
| **Standard** | Heredity & Reproduction |
| **Benchmark** **Number** | SC.912.L.16.6 |
| **Benchmark** | Discuss the mechanisms for regulation of gene expression in prokaryotes and eukaryotes at transcription and translation level. |
| **Also Assesses** | SC.912.L.16.5; SC.912.L.16.9 |
| **Item Types** | Selected Response |
| **Cognitive Complexity** | High |
| **Benchmark**  **Clarification** | Students will discuss the mechanisms involved in regulating gene  expression in both eukaryotes and prokaryotes.  Students will discuss how these mechanisms are involved at the transcription and translation levels in protein synthesis.  Students will explain how modifications to mRNA may be involved in gene regulation. |
| **Content Limits** | Limited to not requiring details of specific prokaryotic operons. |
| **Stimulus Attributes** | Diagram, picture, or text |
| **Response Attributes** | None Specified |
| **Content Focus** | DNA transcription, translation, messenger RNA, eukaryotes, prokaryotes, genetic variations |
| **Sample Item** | Which of the following can affect transcription in eukaryotic cells?  A) operons  B) formation of ribosomes  C) removal of introns from pre-mRNA  D) wrapping of DNA around histone proteins  Correct Answer: D |

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| **Reporting** **Category** | Molecular & Cellular Biology |
| **Standard** | Heredity & Reproduction |
| **Benchmark** **Number** | SC.912.L.16.7 |
| **Benchmark** | Describe how viruses and bacteria transfer genetic material between cells and the role of this process in biotechnology. |
| **Also Assesses** | SC.912.N.1.1 |
| **Item Types** | Selected Response |
| **Cognitive Complexity** | High |
| **Benchmark**  **Clarification** | Students will explain the processes of transduction, transformation and  transduction involved with bacterial transfer of DNA along with viral processes of DNA transfer.  Students will explain how these processes are utilized in the field of biotechnology.  Students will explain conjugation.  Students will explain how viruses infect host cells.  Students will interpret data to determine if genetic materials have been transferred. |
| **Content Limits** | Limited to not referring to Hfr bacteria. |
| **Stimulus Attributes** | Diagram, picture, or text |
| **Response Attributes** | None Specified |
| **Content Focus** | DNA transduction, transformation, conjugation, binary fission |
| **Sample Item** | Which of the following utilizes a pili bridge to transfer genetic material into a bacterium?  A) binary fission  B) conjugation  C) transduction  D) transformation  Correct Answer: D |

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| **Reporting** **Category** | Molecular & Cellular Biology |
| **Standard** | Heredity & Reproduction |
| **Benchmark** **Number** | SC.912.L.16.8 |
| **Benchmark** | Explain the relationship between mutation, cell cycle, and uncontrolled cell growth potentially resulting in cancer. |
| **Also Assesses** | None Specified |
| **Item Types** | Selected Response; Short Response |
| **Cognitive Complexity** | Moderate |
| **Benchmark**  **Clarification** | Students will define cancer that shows an understanding of the  relationship between mutation, the cell cycle, and uncontrolled cell growth.  Students will explain that checkpoints in the cell cycle determine whether or not the cell cycle and cell decision will proceed.  Students will understand that failure to abide by these checkpoints can lead to uncontrolled cell growth. |
| **Content Limits** | Limited to not requiring the student to list agents of mutation.  The item does not address oncogenes or tumor suppression genes.  The item does not require students to identify specific molecules involved in the continuation of the cell cycle. |
| **Stimulus Attributes** | Diagram, picture, or text |
| **Response Attributes** | None Specified |
| **Content Focus** | Cell division, RNA transcription, DNA mutations, cancer cells |
| **Sample Item** | Genes that malfunction can cause cancer. What would be the normal function for these genes?    A) regulate cell division  B) control RNA transcription  C) are responsible for sex determination  D) code for enzymes that repair damaged DNA  Correct Answer: A |

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| **Reporting** **Category** | Organisms/Populations/Ecosystems |
| **Standard** | Heredity & Reproduction |
| **Benchmark** **Number** | SC.912.L.16.9 |
| **Benchmark** | Explain how and why the genetic code is universal and is common to almost all organisms. |
| **Also Assesses** | None Specified |
| **Item Types** | Selected Response; Short Response |
| **Cognitive Complexity** | Moderate |
| **Benchmark**  **Clarification** | Students will explain that DNA is found in almost all living things and  serves as a universal genetic code for information.  Students will explain that the genetic code (codon chart) represents the DNA sequences found in all living things.  Students will explain that each codon represents a specific amino acid utilized in the translation process.  Students will focus on understanding the basic aspects of DNA in living things.  Students will explain that the genetic code is utilized to determine the amino acids in specific proteins for a specific species.  Students will explain the sequence of these amino acids is determined by the DNA sequence in the organism.  Students will explain it is the DNA sequence that determines differences in organisms rather than the genetic code. |
| **Content Limits** | Limited to not involving details related to the processes of transcription  and translation. |
| **Stimulus Attributes** | Charts, diagrams |
| **Response Attributes** | None Specified |
| **Content Focus** | DNA, translation, amino acids, codon |
| **Sample Item** | If the codon UUU calls for phenylalanine in the translation process for corn, in what else will the codon UUU for phenylalanine be found?  A) E. coli  B) lizards  C) both a and b  D) neither a or b  Correct Answer: C |

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| **Reporting** **Category** | Nature of Science |
| **Standard** | Heredity & Reproduction |
| **Benchmark** **Number** | SC.912.L.16.10 |
| **Benchmark** | Evaluate the impact of biotechnology on the individual, society, and the  environment, including medical and ethical issues. |
| **Also Assesses** | None Specified |
| **Item Types** | Selected Response; Short Response |
| **Cognitive Complexity** | High |
| **Benchmark**  **Clarification** | Students will discuss the impact that technological advances, such as  DNA finger printing, PCR, genetically modified crops, and gene therapy, have had on the individual, society, and the environment.  Students will explain cloning of both genes and organisms.  Students will explain stem cells and research using stem cells. |
| **Content Limits** | Limited to those technologies and associated legal and ethical  issues addressed in the normal content of the genetics course. |
| **Stimulus Attributes** | Charts, diagrams |
| **Response Attributes** | None Specified |
| **Content Focus** | Gene cloning, stem cells, genetic technology, PCR, DNA fingerprinting |
| **Sample Item** | Which of the following has contributed to increased life spans in the human population?  A) cloning of Dolly the sheep  B) inserting freeze resistant genes into corn  C) inserting antibiotic resistant genes into bacteria  D) inserting human insulin genes into bacterial plasmids for  insulin production  Correct Answer: D |

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| **Reporting** **Category** | Nature of Science |
| **Standard** | Heredity & Reproduction |
| **Benchmark** **Number** | SC.912.L.16.11 |
| **Benchmark** | Discuss the technologies associated with forensic medicine and DNA  identification, including restriction fragment length polymorphism (RFLP) analysis. |
| **Also Assesses** | None Specified |
| **Item Types** | Selected Response; Short Response |
| **Cognitive Complexity** | High |
| **Benchmark**  **Clarification** | Students will describe and discuss the processes of preparing specimens for electrophoresis using restriction enzymes.  Students will describe and discuss the process of conducting electrophoresis.  Students will be able to interpret the results of electrophoresis testing. |
| **Content Limits** | Limited to not addressing applications not discussed in genetics class or  fall outside of a normal genetics class. |
| **Stimulus Attributes** | Diagrams, graphics |
| **Response Attributes** | None Specified |
| **Content Focus** | Electrophoresis, gel, DNA fingerprinting |
| **Sample Item** | DNA fingerprinting has many applications in the legal world. Which of the following allows DNA fingerprinting to have an impact in the legal world?  A) DNA is positively charged.  B) Restriction enzymes will cut DNA at restriction sites.  C) Larger DNA fragments travel farther on and electrophoresis gel.  D) Smaller DNA fragments migrate farther on an electrophoresis gel.  Correct Answer: D |

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| **Reporting** **Category** | Molecular & Cellular Biology |
| **Standard** | Heredity & Reproduction |
| **Benchmark** **Number** | SC.912.L.16.12 |
| **Benchmark** | 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). |
| **Also Assesses** | None Specified |
| **Item Types** | Selected Response; Short Response |
| **Cognitive Complexity** | Moderate |
| **Benchmark**  **Clarification** | Students will describe how recombinant DNA is constructed using the  technologies of restriction digestion, gel electrophoresis, polymerase chain reaction, ligation, and transformation.  Students will focus on basic DNA technology used to construct recombinant DNA molecules. |
| **Content Limits** | Limited to not requiring specific knowledge of the apparatus used in  these technologies or the knowledge of specific enzyme ligases or restriction enzymes. |
| **Stimulus Attributes** | Chart, diagram, or text |
| **Response Attributes** | None Specified |
| **Content Focus** | DNA fingerprinting, transformation, gel electrophoresis, PCR |
| **Sample Item** | Recombinant DNA technology is **not** used in which of the following?  A) culturing unknown organisms  B) human insulin production by bacterial cells  C) amplification of DNA for microbe identification  D) insertion of genes from humans or plants into bacteria or viruses  Correct Answer: A |

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| **Reporting** **Category** | Molecular & Cellular Biology |
| **Standard** | Heredity & Reproduction |
| **Benchmark** **Number** | SC.912.L.16.14 |
| **Benchmark** | 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. |
| **Also Assesses** | None Specified |
| **Item Types** | Selected Response |
| **Cognitive Complexity** | Moderate |
| **Benchmark**  **Clarification** | Students will explain the stages of cell growth, specifically mitosis.  Students will describe how mitosis results in two identical cells with the same number of chromosomes.  Students will explain why the results of mitosis, namely the creation of a daughter cell with the same number of chromosomes, is important.  Students will explain the phases of interphase, including the major events that take place in each phase.  Students will explain the role of checkpoints within the cell cycle that allow or prohibit cell division.  Students will explain that most cells do not continuously undergo cell division and remain at the Go, cell specialization, stage. |
| **Content Limits** | Limited to not addressing cell differentiation.  The item should not include statements regarding variability such as crossing over or mutation.  The item should not require naming the individual stages of mitosis or identifying them with the terms anaphase, interphase, metaphase, and telophase. |
| **Stimulus Attributes** | Chart, diagram, or text |
| **Response Attributes** | None Specified |
| **Content Focus** | Mitosis, chromosomes, cell cycle, cell division, diploid, haploid, chromosomes, crossing over |
| **Sample Item** | Which one of the following occurs during mitosis?  A) Double-stranded chromosomes move to the poles.  B) Chromosome number is reduced from diploid to haploid.  C) Cells genetically identical to the parental cell are produced.  D) Crossing-over takes place between homologous chromosomes.  Correct Answer: C |

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| **Reporting** **Category** | Molecular & Cellular Biology |
| **Standard** | Heredity & Reproduction |
| **Benchmark** **Number** | SC.912.L.16.16 |
| **Benchmark** | Describe the process of meiosis, including independent assortment and crossing over.  Explain how reduction division results in the formation of haploid gametes or spores. |
| **Also Assesses** | SC.912.L.16.17 |
| **Item Types** | Selected Response; Short Response; Extended Response |
| **Cognitive Complexity** | Moderate |
| **Benchmark**  **Clarification** | Students will explain the process of meiosis as it relates to the formation of haploid sex cells such as gametes and spores.  Students will describe how independent assortment and crossing over occur during this process and the effect it has on genetic variation in gametes and spores.  Students will explain how non-disjunction occurs in meiosis I or  meiosis II. |
| **Content Limits** | Limited to not addressing the specific phases of meiosis I and meiosis II. |
| **Stimulus Attributes** | Diagrams, models |
| **Response Attributes** | None Specified |
| **Content Focus** | Meiosis, haploid cells, gametes, spores, DNA replication, genetic variation, crossing over, independent assortment |
| **Sample Item** | Which of the following events does not contribute to increased genetic  diversity during meiosis?  A) DNA replication after meiosis I  B) reduction of diploid cells to haploid cells  C) crossing over during meiosis I, prophase I  D) independent sorting of homologs in meiosis I  Correct Answer: A |

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| **Reporting** **Category** | Molecular & Cellular Biology |
| **Standard** | Heredity & Reproduction |
| **Benchmark** **Number** | SC.912L.16.17 |
| **Benchmark** | Compare and contrast mitosis and meiosis and relate to the processes of  sexual and asexual reproduction and their consequences for genetic variation. |
| **Also Assesses** | SC.912.L.16.14; SC.912.L.16.16 |
| **Item Types** | Selected Response; Short Response |
| **Cognitive Complexity** | High |
| **Benchmark**  **Clarification** | Students will compare and contrast mitosis and meiosis in terms of  processes that are asexual or sexual reproduction.  Students will relate how meiosis increases genetic variation and mitosis does not.  Students are able to determine that mitosis leaves the genetic material the same (haploid to haploid n=n or diploid to diploid 2n=2n) while meiosis reduces the genetic material (diploid to haploid 2n to n).  Mitosis creates genetically identical daughter cells. Meiosis generates haploid cells genetically unique from the parent cell.  Gamete formation (in meiosis) can increase genetic variation via recombination during crossing over events in meiosis I, prophase I. Gametes are produced in diploid species to allow for sexual reproduction and the creation of a unique offspring genetically different from either parent.  Students will identify benefits of either process. |
| **Content Limits** | Limited to not assessing mutations. |
| **Stimulus Attributes** | Diagrams |
| **Response Attributes** | None Specified |
| **Content Focus** | Mitosis, meiosis, sexual and asexual reproduction, genetic variations, diploid, haploid |
| **Sample Item** | Which of the following is an accurate representation of meiosis rather than mitosis?  A) 1n 🡪 1n  B) 1n 🡪 2n  C) 2n 🡪 1n  D) 2n 🡪 2n  Correct Answer: C |

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| **Reporting** **Category** | Organisms/Populations/Ecosystems |
| **Standard** | Interdependence |
| **Benchmark** **Number** | SC.912.L.17.1 |
| **Benchmark** | Discuss the characteristics of populations, such as number of individuals, age, structure, density, and pattern of distribution. |
| **Also Assesses** | SC.912.L.15.12 |
| **Item Types** | Selected Response; Short Response |
| **Cognitive Complexity** | Moderate |
| **Benchmark**  **Clarification** | Students will determine that the population size can have a direct impact on the gene pool of the species.  Students will determine that the distribution and reproductive age of individuals in the population can have a direct impact on the gene pool of the species. |
| **Content Limits** | Limited to referring to the changes that occur as a result of changes in  allele frequency and the effect on phenotypes, i.e. genetic drift, gene flow, sexual selection, natural selection. |
| **Stimulus Attributes** | Diagrams |
| **Response Attributes** | None Specified |
| **Content Focus** | Genetic diversity, genetic drift, gene flow, sexual selection, natural selection, allele frequency, phenotypes, genetic code |
| **Sample Item** | Genetic diversity helps a population survive under variable environmental conditions. Which of the following statements will **increase** the ability for a population to survive?  A) Immigration increases genetics diversity.  B) A small population decreases in genetic diversity with each  generation.  C) In a species of birds, only males with red heads will be  selected to reproduce.  D) In a specific environment, a species of bugs only survives if  they are all the same color.  Correct Answer: A |

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| **Reporting** **Category** | Organisms/Populations/Ecosystems |
| **Standard** | Interdependence |
| **Benchmark** **Number** | SC.912.L.17.8 |
| **Benchmark** | Recognize the consequences of the losses of biodiversity due to catastrophic events, climate changes, human activity, and the introduction of invasive, non-native species. |
| **Also Assesses** | None Specified |
| **Item Types** | Selected Response; Short Response |
| **Cognitive Complexity** | High |
| **Benchmark**  **Clarification** | Students will explain how loss of biodiversity occurs through  catastrophic events, climate change, human activity, and introduction of invasive or non-native species to an ecosystem.  Students will predict the consequences that the loss of biodiversity has on the ecosystem.  Students will focus on the mechanisms of change within an ecosystem.  This content should be limited to items referring to genetic drift, gene flow, natural selection, random mating, and the lack of mutations. |
| **Content Limits** | Limited to restricting examples to be related only to gene flow, genetic drift, natural selection, random mating and the lack of mutations (Hardy-Weinberg Theory). |
| **Stimulus Attributes** | Chart, food web diagrams, text |
| **Response Attributes** | None Specified |
| **Content Focus** | Genetic drift, gene flow, natural selection, random mating, lack of mutations |
| **Sample Item** | In August, 2004, Hurricane Charley made its way across the state of Florida. In the process, Captiva Island, on the west coast of Florida, was separated into two different islands. What is a possible consequence for terrestrial animals that have been separated as a result?  A) A small population of mice on one island will all die.  B) A small population of mice on one island will increase the  number of genetic traits in their gene pool.  C) A same species of terrestrial snails might develop a way to  cross the water and reunite with their relatives.  D) A same species of terrestrial snails may eventually, over time,  evolve to be two different species of terrestrial snails.  Correct Answer: D |

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| **Reporting** **Category** | Molecular & Cellular Biology |
| **Standard** | Matter & Energy Transformations |
| **Benchmark** **Number** | SC.912.L.18.1 |
| **Benchmark** | Describe the basic molecular structures and primary functions of the four major categories of biological macromolecules. |
| **Also Assesses** | None Specified |
| **Item Types** | Selected Response |
| **Cognitive Complexity** | Moderate |
| **Benchmark**  **Clarification** | Students will name the four categories of biological macromolecules  and will distinguish the differences between them in regards to both structure and function.  Students will determine what each of the major categories is used for.  Students will distinguish between different types of nucleic acids, specifically DNA and RNA, both in structure and function.  Students will determine the different functions of different types of RNA.  Protein structure (primary, secondary, tertiary and quaternary) should be addressed.  Protein structure (enzymes and metabolic function, globulins) may be referred to under the context of DNA mutations. |
| **Content Limits** | Limited to requiring the identification of the basic structure of each  macromolecule.  It does not require the identification or names of specific molecules in each category, such as glucose, maltose, cholesterol, lysine, guanine, etc.  The item requires the identification of the primary structure and function of both DNA and RNA molecules. |
| **Stimulus Attributes** | Chart, diagram, or text |
| **Response Attributes** | None Specified |
| **Content Focus** | Macromolecules, DNA, mutations, RNA, protein structure, lipids, nucleic acids |
| **Sample Item** | A geneticist investigating the resistance of a particular type of bacteria to  antibiotic drugs isolates a molecule present in the bacteria that is not present in other related species. The molecule is large, made up of mostly carbon and hydrogen with some oxygen atoms. Which category of macromolecule would this isolated chemical most likely be classified as?  A) carbohydrates  B) lipids  C) nucleic acids  D) proteins  Correct Answer: B  Which of the following macromolecules is responsible for determining what characteristics are inherited from parental generations?  A) carbohydrates  B) lipids  C) nucleic acids  D) proteins  Correct Answer: C |

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| **Reporting** **Category** | Molecular & Cellular Biology |
| **Standard** | Matter & Energy Transformations |
| **Benchmark** **Number** | SC.912.L.18.11 |
| **Benchmark** | 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. |
| **Also Assesses** | SC.912.P.12.12 |
| **Item Types** | Selected Response; Short Response |
| **Cognitive Complexity** | Moderate |
| **Benchmark**  **Clarification** | Students will define an enzyme as a catalyst and explain how it functions in biochemical reactions by lowering the activation energy of the reaction.  Students will identify how the enzymes activity is dependent on such factors as pH and temperature.  Enzyme activity should be addressed as a consequence of DNA transcription and translation, specifically, primary protein structure that is dependent on DNA sequences.  Items may assess how these factors affect enzymatic processes in DNA replication, RNA processing and DNA technology. |
| **Content Limits** | Limited to relating to only biochemical reactions in living organisms.  The test item should not require identification of the enzyme substrate complex, enzyme specificity or include other factors of enzyme kinetics such as saturation, inhibitors, or positive / negative feedback controls. |
| **Stimulus Attributes** | Chart, diagram, or text |
| **Response Attributes** | None Specified |
| **Content Focus** | Catalyst, enzymes, DNA transcription, translation, replication, RNA processing, reaction rate, PCR |

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| **Sample Item** | A geneticist is assisting in a project to develop bacteria to break down biofuels such as wood chips and straw into smaller molecules that can be converted into ethanol. Certain varieties of bacteria produce an enzyme that will cleave cellulose into smaller molecules that can then be converted into ethanol; however, the process is very slow.  Which of the following factors could be changed that would possibly increase the rate at which cellulose is broken down by this enzyme?  A) keep pH levels neutral and the temperature about 28o Celsius  B) add acid to the wood biofuel first to help break down the cellulose  C) lower the levels of bacteria to reduce competition for food resources  D) increase the temperature to increase available energy for the reaction  Correct Answer: A  PCR is a process that allows scientists to amplify the amount of DNA when an original sample has a limited amount of DNA available for testing. PCR requires heating/cooling cycles that allow multiple replications of the original sample. This process requires the use of a heat resistant form of the enzyme DNA polymerase. What would be the reason for using heat resistant DNA polymerase?  A) Heat resistant DNA polymerase is easier to purchase.  B) Cooling normal DNA polymerase will cause the amplification process to go too fast.  C) Heat resistant DNA polymerase works more slowly than normal DNA Polymerase.  D) Heating normal DNA polymerase will destroy (denature) the enzyme and amplification cannot occur.  Correct Answer: D |

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| **Reporting** **Category** | Nature of Science |
| **Standard** | Practice of Science |
| **Benchmark** **Number** | SC.912.N.1.2 |
| **Benchmark** | Describe and explain what characterizes science and its methods. |
| **Also Assesses** | None Specified |
| **Item Types** | Selected Response; Short Response |
| **Cognitive Complexity** | Moderate |
| **Benchmark**  **Clarification** | Students will identify a scientific claim versus one that is not scientific.  Students will identify why a seemingly scientific study fails to qualify as a scientific statement. |
| **Content Limits** | Limited to addressing biological content and scientific statements. |
| **Stimulus Attributes** | Chart, diagrams, models, pictures, or text |
| **Response Attributes** | None Specified |
| **Content Focus** | Hypothesis, theory, reliability, science, non-science, evidence |
| **Sample Item** | A geneticist working with the H1 flu virus proposes a new hypothesis on how the virus is mutating to make it more deadly. What would other geneticists working in this field most likely do?  A) immediately reject this hypothesis  B) accept this hypothesis as a new theory  C) test the new hypothesis with new experiments  D) change their thinking and their hypothesis to incorporate this new  one  Correct Answer: C |

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| **Reporting** **Category** | Nature of Science |
| **Standard** | Characteristics of Scientific Knowledge |
| **Benchmark** **Number** | SC.912.N.2.1 |
| **Benchmark** | Identify what is science, what clearly is not science, and what superficially resembles science (but fails to meet the criteria for science). |
| **Also Assesses** | None Specified |
| **Item Types** | Selected Response; Short Response |
| **Cognitive Complexity** | High |
| **Benchmark**  **Clarification** | Students will identify a scientific claim versus one that is not scientific.  Students will identify why a seemingly scientific study fails to qualify as a scientific statement. |
| **Content Limits** | Limited to addressing biological content only. |
| **Stimulus Attributes** | Chart, diagrams, models, pictures, or text |
| **Response Attributes** | None Specified |
| **Content Focus** | Hypothesis, theory, reliability, science, non-science, evidence, validity |
| **Sample Item** | Which of the following claims would be considered a valid scientific  conclusion?     1. Two out of 100 people can communicate telepathically with each   other.  B) There are seven dominant genes that enhance the beauty of a human  being.  C) Barley strain B shows less stress and damage from strong storm winds due to a thicker stem.  D) Monkeys are happier when given bananas because they smile more than monkeys that do not get bananas.  Correct Answer: C |

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| **Reporting** **Category** | Nature of Science |
| **Standard** | Characteristics of Scientific Knowledge |
| **Benchmark** **Number** | SC.912.N.2.2 |
| **Benchmark** | Identify which questions can be answered through science and which questions are outside the boundaries of scientific investigation, such as questions addressed by other ways of knowing, such as art, philosophy, and religion. |
| **Also Assesses** | SC.912.N.2.1 |
| **Item Types** | Selected Response; Short Response |
| **Cognitive Complexity** | High |
| **Benchmark**  **Clarification** | Students will focus on science as the study of the natural world.  Students will identify the limits of scientific investigation as they relate to the natural world and cannot address questions outside that realm which are best answered in the disciplines of art, philosophy, and religion. |
| **Content Limits** | Limited to relating to the content covered in a genetics course and not outside the scope of a genetics course. |
| **Stimulus Attributes** | Diagrams |
| **Response Attributes** | None Specified |
| **Content Focus** | Probability, polygenic inheritance, genetic code |
| **Sample Item** | Which of the following explanations might be used to predict the probability of parents having a child with a specific genetic disease such as sickle cell anemia?  A) Genetic diseases skip generations.  B) Sickle cell anemia can be passed along by mosquitoes.  C) Sickle cell anemia can be passed along by blood transfusions.  D) Parent genotypes for the disease can determine the probability  of offspring with the disease.  Correct Answer: D |

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| **Reporting** **Category** | Molecular & Cellular Biology |
| **Standard** | Motion |
| **Benchmark** **Number** | SC.912.P.12.12 |
| **Benchmark** | Explain how various factors, such as concentration, temperature, and  presence of a catalyst affect the rate of a chemical reaction. |
| **Also Assesses** | SC.912.L.18.11 |
| **Item Types** | Selected Response; Short Response; Extended Response |
| **Cognitive Complexity** | High |
| **Benchmark**  **Clarification** | Students will explain how the concentration of reactants effects the  rate of a reaction.  Students will explain how the temperature affects the rate of a chemical reaction.  Students will explain how the presence of a catalyst lowers the activation energy of a reaction. |
| **Content Limits** | Limited to not extending to the concept of le Chatelier's principle.  The item does not rely on the student's knowledge of molarity or other concentration units.  The item should not address the concept of equilibrium.  The item should not focus on reactions outside the scope of a genetics course.  This item should be limited to the effects on processes involved in DNA replication, RNA processing, DNA technology. |
| **Stimulus Attributes** | Charts, diagram, or text |
| **Response Attributes** | None Specified |
| **Content Focus** | DNA replication, DNA technology, RNA processing, catalyst, reaction rate |
| **Sample Item** | Why is DNA replication able to take place during the S phase of the cell cycle?   1. Temperatures are low allowing enzymes to work faster.   B) Enzymes denature when replicating DNA in other phases of the cell cycle.  C) Enzymes allow DNA replication to occur more quickly than it  would without enzymes.  D) DNA replication can only take place during the cell cycle when no enzymes are present.  Correct Answer: C |