

Warren County Schools



BIOLOGY PACING GUIDE 2017 – 2018 (Semester/Year)

Philosophical approach to the process of teaching and learning science in the Warren County School District (WCS).

In WCS there is an emphasis on both traditional and innovative teaching methodologies of science curriculum. Whereas traditional laboratory experiences provide opportunities to demonstrate how science is constant, historic, probabilistic, and replicable; intuitive-practical solutions to scientific problem solving are encouraged. Even though there are no fixed steps that all scientists follow, scientific investigations usually involve collections of relevant evidence, the use of logical reasoning, the application of imagination to devise hypotheses, and explanations to make sense of collected evidence. Student engagement in scientific investigation provides background for understanding the nature of scientific inquiry. In addition, the science process skills necessary for inquiry are acquired through active experience. The process skills support development of reasoning and problem-solving ability and are the core of scientific methodologies.

Biology End of the Grade Assessment and Standards

The Essential Standards for Biology were written to provide a deeper understanding of the life science content learned throughout Grades K–8. The unifying concepts for Biology include: o Structure and Function of Living Organisms, o Ecosystems, o Evolution and Genetics, and o Molecular Biology. Please table below:

Weight Distributions for Biology per category

| UNIFYING CONCEPT | BIOLOGY EOG % |
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| Structure of living Organisms | (18-22)% |
| Ecosystems | (18-22)% |
| Evolution and Genetics | (43-53)% |
| Molecular Biology | (15-19)% |
| Total | 100% |

Benchmark assessments will be administered each 9 weeks based upon the content covered in the pacing guide. Please note that the semester course will only have one benchmark assessment.

| Suggested Time Frame In weeks | STANDARD | KEY VOCABULARY | ESSENTIAL QUESTIONS/ LEARNING INTENTIONS | ASSESSMENTS BENCHMARKS - EOG DATES |
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| <p>SEM Weeks (1-2)</p> <p>YR. Weeks (1-4)</p> | <p>Bio.2.1.1 Analyze the flow of energy and cycling of matter (water, carbon, nitrogen and oxygen) through ecosystems relating the significance of each to maintaining the health and sustainability of an ecosystem.</p> <p>Ecosystems (18-22)%</p> <p>Bio.2.1.3 Explain various ways organisms interact with each other (including predation, competition, parasitism, and mutualism) and with their environments resulting in stability within ecosystems.</p> <p>Ecosystems (18-22)%</p> <p>Bio.2.1.4 Explain why ecosystems can be relatively stable over hundreds or thousands of years, even though populations may fluctuate (emphasizing availability of food, availability of shelter, number of predators and disease).</p> <p>Ecosystems (18-22)%</p> | <ul style="list-style-type: none"> • Abiotic factors • Biotic factors • Birth rate • Carbon cycle • Carrying capacity • Climate • Climate change • Commensalism • Communities • Consumers • Death rate • Decomposers • Deforestation • Ecosystems • Energy pyramid • Exponential growth • Food chain • Food web • Green House Effect • Habitat destruction • Limiting factors • Mutualism • Niche • Non-native species • Organisms • Parasitism • Pesticide • Population | <ul style="list-style-type: none"> • Why do we study ecology? • What is the relationship between organisms, populations, communities, and ecosystems? • What factors determine carrying capacity for a population? • How does carrying capacity change for predator and prey in an ecosystem? • What is the importance of abiotic and biotic factors to an ecosystem? • How do abiotic and biotic factors influence carrying capacity? • Compare and contrast commensalism, mutualism, and parasitism. • What is the relationship between abiotic and biotic factors and the cycling of energy? • What role do leaves play in transpiration? • What roles do cellular respiration and photosynthesis play in the carbon cycle? • How do trophic levels determine how energy is transferred through ecosystems? • How are trophic levels related to food webs and food chains? • How is energy lost as it cycles through the ecosystem? • What factors impact the growth of an ecosystem? • What is the difference between J-curve and S-curve population growth? • What factors influenced human population growth? • What is the Greenhouse effect and how does it play a part in Global Climate Change? • What is the difference between ozone depletion and | <p><i>TBD by Site Administration</i></p> |

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| | <p>Bio.2.2.1 Infer how human activities (including population growth, pollution, global warming, burning of fossil fuels, habitat destruction and introduction of nonnative species) may impact the environment.</p> <p>Ecosystems (18-22)%</p> <p>Bio.2.2.2 Explain how the use, protection and conservation of natural resources by humans impact the environment from one generation to the next.</p> <p>Ecosystems (18-22)%</p> | <ul style="list-style-type: none"> • Population density • Predator • Prey • Producers • Symbiosis • Trophic levels | <p>Global Climate Change?</p> | |
| <p>SEM Week 3</p> <p>YR. Weeks (5-7)</p> | <p>Bio.2.1.2 Analyze the survival and reproductive success of organisms in terms of behavioral, structural, and reproductive adaptations.</p> <p>Ecosystems (18-22)%</p> | <ul style="list-style-type: none"> • Behavior • Conditioning • Courtship • Estivation • Habituation • Hibernation • Imprinting • Innate behavior • Instinct • Learned behavior • Migration • Pheromones • Social behavior | <ul style="list-style-type: none"> • Compare and contrast innate and learned behavior • Compare and contrast migration, estivation, and hibernation • What role does imprinting play in an organism's life cycle? • What type of behavior is conditioning? | <p><i>TBD by Site Administration</i></p> |

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| <p>SEM Week 4</p> <p>YR. Weeks (8-9)</p> | <p>Bio.4.1.1 Compare the structures and functions of the major biological molecules (carbohydrates, proteins, lipids, and nucleic acids) as related to the survival of living organisms.</p> <p>Molecular Biology (15-19)%</p> <p>Bio.4.1.3 Explain how enzymes act as catalysts for biological reactions.</p> <p>Molecular Biology (15-19)%</p> | <ul style="list-style-type: none"> • Amino acids • Carbohydrate • Catalyst • Catalyze • Cellulose • DNA • Enzymes • Fats • Function • Glucose • Glycogen • Glycolysis • Hemoglobin • Iodine test • Lipids • Monomer • Nucleic Acids • Organic molecules • pH • polymer • proteins • RNA • Starch • Subunits | <ul style="list-style-type: none"> • What is the most basic chemical of living things? • What is the organization of the chemical basis of living things? • Describe an organic molecule. • What synonym can be used to describe the difference between monomers and polymers? • How are lipids important to polar bears? • Which organic compound would be best in a supplement for a marathon runner? • What is the monomer of Lipids? Proteins? Carbohydrates? Nucleic Acids? • What is a chemical “indicator?” • How would you test an unknown substance for starch? • What is the polymer of Lipids? Proteins? Carbohydrates? Nucleic Acids? • Hemoglobin is a structural polymer that carries oxygen in red blood cells. What are the monomers that make up hemoglobin? • How are proteins important in the regulation of chemical reactions in living organisms? • To which group of organic molecules do enzymes belong? • If you compared an enzyme-substrate complex to a lock and a key, which is the lock and which is the key? • What factors influence the effectiveness of enzymes? • How do enzymes help with digestion? | <p><i>TBD by Site Administration</i></p> |
| <p>SEM Weeks (5-6)</p> | <p>Bio.1.1.2 Compare prokaryotic and eukaryotic cells in terms of their general structures (plasma membrane and genetic material) and degree of complexity.</p> <p>Structures and Functions of</p> | <ul style="list-style-type: none"> • Active transport • Animal cells • ATP • Cell organization • Cell specialization • Cell organelles | <ul style="list-style-type: none"> • Cells are the basic unit of life. What enables cells to be suitable to exist as single-cell organisms? • How do cells work together to make an organism? • What is an organelle? • Make analogies for the functions of the following organelles using everyday objects: nucleus, ribosome, mitochondria, vacuole, cell membrane, | |

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| <p>YR. Weeks (10-13)</p> | <p>Living Organisms (18-22)%</p> <p>Bio.1.1.3 Explain how instructions in DNA lead to cell differentiation and result in cells specialized to perform specific functions in multicellular organisms.</p> <p>Structures and Functions of Living Organisms (18-22)%</p> <p>Bio.1.1.1 Summarize the structure and function of organelles in eukaryotic cells (including: the nucleus, plasma membrane, cell wall, mitochondria, vacuoles, chloroplasts, and ribosomes) and ways that these organelles interact with each other to perform the function of the cell.</p> <p>Structures and Functions of Living Organisms (18-22)%</p> <p>Bio.1.2.1 Explain how homeostasis is maintained in the cell and within an organism in various environments (including: temperature and pH).</p> <p>Structures and Functions of Living Organisms (18-22)%</p> | <ul style="list-style-type: none"> • Cell wall • Cells • Cellular • Chloroplast • Diffusion • Guard cells • Homeostasis • Hypertonic • Hypotonic • Mitochondria • Muscle cell • Nerve cell • Nucleus • Organ systems • Organisms • Organs • Osmosis • Osmotic pressure • Passive transport • plant cell • plasma membrane • receptor proteins • ribosomes • Semi-permeable membrane • Stomata • Tissues • Vacuoles | <p>chloroplast, cell wall, and lysosome.</p> <ul style="list-style-type: none"> • In what type of cell would you expect to find a large amount of mitochondria? • What would happen if a cell lacked ribosomes? • What is the difference between a prokaryotic and a eukaryotic cell? • What is cell specialization? How is it related to your own body? • How are plant and animal cells different? • How do cells interact with their environment? • What is the most important structure for moving materials in and out of the cell? • What is the difference between active and passive transport? What determines the direction of movement of solute in a passive transport situation? • What is the difference between diffusion and osmosis? • What is the role of the cell membrane in maintaining homeostasis? | <p><i>TBD by Site Administration</i></p> |
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| | <p>Bio.4.2.2 Explain ways that organisms use released energy for maintaining homeostasis (active transport).</p> <p>Molecular Biology (15-19)%</p> | | | |
| <p>SEM Week -7</p> <p>YR. Weeks (14-19)</p> | <p>Bio.4.2.1 Analyze photosynthesis and cellular respiration in terms of how energy is stored, released, and transferred within and between these systems.</p> <p>Molecular Biology (15-19)%</p> | <ul style="list-style-type: none"> • ADP • Aerobic Respiration • Alcoholic • Fermentation • Anaerobic Respiration • ATP • Chloroplast • Glycolysis • Homeostasis • Lactic Acid • Fermentation • Mitochondria • Photosynthesis • Stomata • Thylakoid membrane • Vacuole | <ul style="list-style-type: none"> • How is the carbon-oxygen cycle related to cellular functions in plants and animals? What are the functions of the organelles that are essential to the processes? • What are the reactants of the photosynthesis equation? The products? • Name the components of photosynthesis that are inorganic? Which components are organic? • What are the reactants of the equation for cell respiration? The products? • What is the role of plants in the carbon-oxygen cycle? • What is the difference between aerobic and anaerobic respiration? • Which type of cell respiration would you expect to be carried out by yeast? • In terms of ATP production is aerobic or anaerobic respiration more effective? • What would happen if all the mitochondria in a cell were destroyed by cyanide? • What type of cell respiration is carried out by your muscle cells? What factors could change this? | <p><i>TBD by Site Administration</i></p> |
| <p>SEM Weeks (8-9)</p> | <p>Semester/Year Review/Benchmark</p> | | | <p><i>TBD by Site Administration</i></p> <p>Semester benchmark and year benchmark assessments will</p> |

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| | | | | differ in content covered for the same period. |
| <p>SEM Weeks -9</p> <p>YR. Weeks (20-22)</p> | <p>Bio.3.1.1 Explain the double-stranded, complementary nature of DNA as related to its function in the cell.</p> <p>Evolution and Genetics (43-53)%</p> <p>Bio.3.1.2 Explain how DNA and RNA code for proteins and determine traits.</p> <p>Evolution and Genetics (43-53)%</p> <p>Bio.1.1.3 Explain how instructions in DNA lead to cell differentiation and result in cells specialized to perform specific functions in multicellular organisms.</p> <p>Structures and Functions of Living Organisms (18-22)%</p> <p>Bio.4.1.2 Summarize the relationship among DNA, proteins and amino acids in carrying out the work of cells and how this is similar in all organisms.</p> <p>Molecular Biology (15-19)%</p> | <ul style="list-style-type: none"> • Amino acids • Anticodon • Codon • Complimentary Base • Pairing • DNA Replication • Gene Regulation • mRNA • Nitrogen bases • Nucleotides • Protein • Protein Synthesis • Ribosomal (rRNA) • RNA • Semi-conservative • Replication • Transcription • Translation • tRNA | <ul style="list-style-type: none"> • What is the relationship between nucleic acids and proteins? • Why is DNA referred to as the molecular basis for heredity? • What is monomer of DNA and RNA? • How does DNA replicate? • Why is DNA replication referred to as semi-conservative? • Compare and contrast DNA and RNA? • What is Chargaff's rule? How does it change for RNA? • How do transcription and translation relate to protein synthesis? • What is the importance of mRNA to protein synthesis? • Contrast the processes of transcription and translation to include differences in the product made and location in the cell. • Which process of protein synthesis would be slowed if almost all ribosomes in a cell were disabled? • How does gene regulation lead to cell specialization? | <p><i>TBD by Site Administration</i></p> |

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| <p>SEM Weeks - 10</p> <p>YR. Weeks (23-25)</p> | <p>Bio.1.2.2 Analyze how cells grow and reproduce in terms of interphase, mitosis and cytokinesis.</p> <p>Structures and Functions of Living Organisms (18-22)%</p> <p>Bio.3.2.1 Explain the role of meiosis in sexual reproduction and genetic variation.</p> <p>Evolution and Genetics (43-53)%</p> | <ul style="list-style-type: none"> • Asexual Reproduction • Cell Cycle • Cell division • Chromosome Number • Crossing Over • Cytokinesis • Daughter cells • Differentiation • Diploid • DNA • DNA replication • Gamete • Genetic Variation • Haploid • Heredity • Inheritance • Interphase • Meiosis • Mitosis • Parental DNA • Sexual reproduction | <ul style="list-style-type: none"> • How do cells reproduce? • How does one single cell with a set number of chromosomes become thousands of different types of cells in mature multi-cellular organism? • How do cells from two parents combine to make a new organism? • What is the function of mitosis? • How is mitosis related to growth, repair, and asexual reproduction? • What happens during the four main phases of mitosis? • What is the difference between haploid and diploid cells? • How do mitosis and meiosis relate to sexual and asexual reproduction? • Compare and contrast mitosis and meiosis. • What is the relationship between DNA and chromosomes? • What type of cell reproduction takes place in human skin cells? • What type of cell reproduction do bacteria carry out? | <p><i>TBD by Site Administration</i></p> |
| <p>SEM Week-11</p> <p>YR. Weeks (26-28)</p> | <p>Bio.3.2.2 Predict offspring ratios based on a variety of inheritance patterns (including: dominance, co-dominance, incomplete dominance, multiple alleles, and sex-linked traits).</p> <p>Evolution and Genetics (43-53)%</p> | <ul style="list-style-type: none"> • Allele • Carrier • Co-Dominance • Dominant traits • Genes • Genotype • Heterozygous • Homozygous • Incomplete | <ul style="list-style-type: none"> • How do genes determine the traits of an organism? • What is the relationship between genotypes and phenotypes? • What is the difference between alleles and genes? • What is the purpose of a punnett square? • How are Mendel's three laws related to punnett squares? • What is the law of independent assortment and how does it relate to genetic variation? • What is the difference between the heterozygous | |

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| | | <ul style="list-style-type: none"> • Dominance • Independent Assortment • Mendel's laws • Monohybrid cross • Multicellular organism • Phenotype • Punnet squares • Recessive traits • Sex-Linked Traits • Test cross • Traits | <ul style="list-style-type: none"> • form of codominance and incomplete dominance? • Why do males have a higher prevalence of sex-linked traits? • Explain how an offspring can inherit a phenotype that neither parent displays? • How does blood type relate to codominance? • What is the significance of codominance to sickle-cell resistance to malaria? • How does the law of segregation influence sex-determination in humans? | <i>TBD by Site Administration</i> |
| <p>SEM Weeks (12-13)</p> <p>YR. Weeks (29-30)</p> | <p>Bio.3.2.2 Predict offspring ratios based on a variety of inheritance patterns (including: dominance, co-dominance, incomplete dominance, multiple alleles, and sex-linked traits).</p> <p>Evolution and Genetics (43-53)%</p> <p>Bio.3.3.1 Interpret how DNA is used for comparison and identification of organisms.</p> <p>Evolution and Genetics (43-53)%</p> <p>Bio.3.3.2 Summarize how transgenic organisms are engineered to benefit society.</p> | <ul style="list-style-type: none"> • Autosomal Inheritance • Autosomes • Bacterial Plasmid • Biotechnology • Blood types • Chromosomal Abnormalities • Codominance • Color-blindness • Cystic fibrosis • DNA fingerprinting • Dominant Trait • Enzymes • Gel electrophoresis • Gene mutation • Gene regulation • Gene therapy • Genetic diversity | <ul style="list-style-type: none"> • What are some of the uses of DNA technology? • What conclusions can be drawn by analyzing a DNA fingerprint? • What was the purpose of the Human Genome Project? • What is the role of restriction enzymes to biotechnology? • Describe in basic terms how you could clone your favorite teacher • How do you create a transgenic organism? • How do you use DNA fingerprinting for forensic science? • How can biotechnology improve agriculture? Name one food you eat that has been bioengineered? | <i>TBD by Site Administration</i> |

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| | <p>Evolution and Genetics (43-53)%</p> <p>Bio.3.3.3 Evaluate some of the ethical issues surrounding the use of DNA technology (including: cloning, genetically modified organisms, stem cell research, and Human Genome Project).</p> <p>Evolution and Genetics (43-53)%</p> | <ul style="list-style-type: none"> • Genetic engineering • Genetically Modified Organisms • Genomics • Genotype • Human Genome Project • Incomplete Dominance • Intermediate traits • Karyotypes • Multiple Alleles • Nondisjunction • Pedigree • Phenotype • Polygenic Inheritance • Punnett Squares • Recessive Trait • Sex chromosomes • Sex-linked Traits • Sexual Reproduction • Sickle Cell Anemia • Stem cell research • Transgenic organism | | |
| <p>SEM Weeks (13.5)</p> <p>YR. Week-31</p> | <p>Bio.3.2.3 Explain how the environment can influence the expression of genetic traits.</p> <p>Evolution and Genetics (43-53)%</p> | <ul style="list-style-type: none"> • Active Immunity • Antibodies • Antigens • B-Cells • HIV • Influenza • Immune response | <ul style="list-style-type: none"> • How is society affected by disease? • How do both environmental and biological factor affect your health? • What is influenza? • What is the difference between a cold/flu and a bacterial infection? What would be the treatment for each? • How does a vaccine function within an immune | |

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| | | <ul style="list-style-type: none"> • Parasites • Passive immunity • Skin cancer • t-cells • Toxins • Treatments • Vaccines • Vector • Viruses | <p>system?</p> <ul style="list-style-type: none"> • What is the difference between passive and active immunity? • Are viruses living organisms? Why or why not? • What characteristics of viruses result in epidemic outbreaks or diseases such as HIV? • Do different populations respond differently to diseases? Why? • What does it mean to be immune to a disease? How does an individual obtain immunity? | <p><i>TBD by Site Administration</i></p> |
| <p>SEM Week -14</p> <p>YR. Weeks (32-33)</p> | <p>Bio.3.4.1 Explain how fossil, biochemical, and anatomical evidence support the theory of evolution.</p> <p>Evolution and Genetics (43-53)%</p> <p>Bio.3.4.2 Explain how natural selection influences the changes in species over time.</p> <p>Evolution and Genetics (43-53)%</p> <p>Bio.3.4.3 Explain how various disease agents (bacteria, viruses, chemicals) can influence natural selection.</p> <p>Evolution and Genetics (43-53)%</p> | <ul style="list-style-type: none"> • Antibiotic resistance • Evolution • Fossil evidence • Geographic isolation • Homologous • Structure • Mutations • Natural selection • Pesticides • Shared anatomical • Structures • Theory of Evolution • Vaccines • Variation | <ul style="list-style-type: none"> • What is some evidence that evolution is still occurring? • What is the relationship between natural selection and evolution? • What determines a favorable trait? • What is the relationship between adaptation and fitness? • What are the sources of variation within a population? What is the advantage of variations within a population? • How are natural selection and antibiotic resistance related? • How does geographical isolation drive evolution? • How does evolution change allelic frequencies? • Why does a species change? • Do individuals evolve? | <p><i>TBD by Site Administration</i></p> |

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| <p>SEM Week - 15</p> | <p>Bio.2.1.2 Analyze the survival and reproductive success of organisms in terms of behavioral, structural, and reproductive adaptations.</p> <p>Ecosystems (18-22)%</p> | <ul style="list-style-type: none"> • Evolutionary • Phylogeny • Evolutionary • Relationships • Angiosperm • Embryology • Gymnosperm • Life cycle • Non-vascular plant • Phloem • Vascular Plant • Xylem • Binomial • Nomenclature • Classification • Dichotomous Keys • Kingdoms • Phylogenic trees (cladograms) • Taxonomic keys • Adaptations • Amphibians • Annelids • Autotrophic • Asexual • Excretion • Heterotrophic • Insect • Mammal • Metamorphosis • Morphology • Reptile | <ul style="list-style-type: none"> • Why do we put organisms in groups? • Compare and contrast Prokaryotic and Eukaryotic organisms. • What is the most significant difference between Fungi and Plants? • What characteristics make Animals distinct? • What characteristics make the following organisms unique: Unicellular protists, annelid worms, insects, amphibians, mammals, non-vascular plants, gymnosperms and angiosperms? • What evolutionary advantage do reptiles have over amphibians? • What feature of annelid worms and insects indicates that they may have a common ancestor? • At the cellular level what distinguishes vascular plants from non-vascular plants? • What type of plants have the most primitive transport system? • What type of plants have the most primitive reproductive system? • Compare and contrast gymnosperms and angiosperms. • What advantages do mammals have over other animal groups? • How do organisms accomplish essential life functions? • Consider Darwin's finches in the Galapagos Islands and explain how organism's survival is based upon adaptations? • What are the functions of leaves in plants? Roots? Stem? • Explain why scientists have to develop a new flu vaccine on a yearly basis. • Explain coevolution in terms of pollinators and plants. | <p><i>TBD by Site Administration</i></p> |
| <p>YR. Weeks (33.5-34)</p> | <p>Bio.3.5.1 Explain the historical development and changing nature of classification systems.</p> <p>Evolution and Genetics (43-53)%</p> <p>Bio.3.5.2 Analyze the classification of organisms according to their evolutionary relationships (including: dichotomous keys and phylogenetic trees).</p> <p>Evolution and Genetics (43-53)%</p> <p>Bio.3.5.1 Explain the historical development and changing nature of classification systems.</p> <p>Ecosystems (18-22)%</p> <p>Bio.2.1.2 Analyze the survival and reproductive success of organisms in terms of behavioral, structural, and reproductive adaptations.</p> <p>Ecosystems (18-22)%</p> | <ul style="list-style-type: none"> • Evolutionary • Phylogeny • Evolutionary • Relationships • Angiosperm • Embryology • Gymnosperm • Life cycle • Non-vascular plant • Phloem • Vascular Plant • Xylem • Binomial • Nomenclature • Classification • Dichotomous Keys • Kingdoms • Phylogenic trees (cladograms) • Taxonomic keys • Adaptations • Amphibians • Annelids • Autotrophic • Asexual • Excretion • Heterotrophic • Insect • Mammal • Metamorphosis • Morphology • Reptile | <ul style="list-style-type: none"> • Why do we put organisms in groups? • Compare and contrast Prokaryotic and Eukaryotic organisms. • What is the most significant difference between Fungi and Plants? • What characteristics make Animals distinct? • What characteristics make the following organisms unique: Unicellular protists, annelid worms, insects, amphibians, mammals, non-vascular plants, gymnosperms and angiosperms? • What evolutionary advantage do reptiles have over amphibians? • What feature of annelid worms and insects indicates that they may have a common ancestor? • At the cellular level what distinguishes vascular plants from non-vascular plants? • What type of plants have the most primitive transport system? • What type of plants have the most primitive reproductive system? • Compare and contrast gymnosperms and angiosperms. • What advantages do mammals have over other animal groups? • How do organisms accomplish essential life functions? • Consider Darwin's finches in the Galapagos Islands and explain how organism's survival is based upon adaptations? • What are the functions of leaves in plants? Roots? Stem? • Explain why scientists have to develop a new flu vaccine on a yearly basis. • Explain coevolution in terms of pollinators and plants. | <p><i>TBD by Site Administration</i></p> |

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| | | <ul style="list-style-type: none">• Sexual | | |
| SEM Weeks (16-18) | Review/ EOC | | | <i>TBD by Site Administration</i> |
| YR. Weeks (34-35) | | | | |