Course Outline
Biology

Module/ Topic	Topic Name	Subtopics	2010 Virginia Standards of Learning
Developmental Module: *The purpose of this module is to review skills that students need in order to be successful in other areas of the course.*			
Module 1: Fundamentals of Biology			
Topic 1	What is Biology?	• Description of Biology • Properties of Life	BIO 1.A BIO 1.M
Topic 2	Scientific Investigation	• The Scientific Method • Experimental Design • Hypotheses, Theories, and Laws • Inferences vs. Observations	BIO 1.A BIO 1.B BIO 1.C BIO 1.D BIO 1.E BIO 1.F BIO 1.G BIO 1.I BIO 1.J BIO 1.K BIO 1.L BIO 1.M
Topic 3	Measurement	• SI Units • Qualitative and Quantitative Data • Graphing and Graph Types	BIO 1.D BIO 1.G BIO 1.I BIO 1.L BIO 1.M
Topic 4	Laboratory Equipment and Techniques	• Laboratory Equipment • Important Techniques • Laboratory Safety	BIO 1.H BIO 1.I
Module 2: Biochemistry			
Topic 1	Water	• Properties of water • Importance of water	BIO 2.A
Topic 2	Acids and Bases	• Impact of pH on living systems and cell function	BIO 2.A
Topic 3	Organic Molecules	• Types, functional groups, functions, and structure of organic molecules • Condensation and hydrolysis reactions	BIO 2.B
Topic 4	Chemical Reactions and Enzymes	• Composition and structure • Function • Rates of reaction • Induced fit	BIO 2.C
Module 3: Cell Biology – Structure and Function			
Topic 1	Cell Theory	• Cell origins	BIO 3.A
Topic 2	Cell Types – Prokaryotic vs. Eukaryotic	• Cellular evolution • Cell classification	BIO 3.A BIO 3.B BIO 3.C
Topic 3	Cell Structure	• Organelle structure and function	BIO 3.C
Topic 4	Cellular Membranes	• Fluid Mosaic Model • Functions	BIO 3.D BIO 3.E

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		• Cellular transport • Osmosis	
Topic 5	Photosynthesis and Respiration	• Autotrophic vs. heterotrophic • ATP • Photosynthetic pathways/Light reactions • Chloroplasts and mitochondria • Anaerobic respiration (glycolysis, fermentation) • Aerobic respiration (glycolysis, Krebs Cycle)	BIO 2.D BIO 3.A BIO 4.A BIO 4.B BIO 4.C BIO 4.D
Module 4: Cell Biology – Growth and Reproduction			
Topic 1	The Cell Cycle and Mitosis	• Cell cycle • Cellular reproduction • Mitosis • Cytokinesis	BIO 5.A
Topic 2	Cell Specialization	• Cell specialization	BIO 5.C
Topic 3	Meiosis	• Segregation • Meiosis • Fertilization • Variation	BIO 5.B
Module 5: Mendelian Genetics and Genetic Disorders			
Topic 1	Origins of Genetics	• Laws of Inheritance • Mendelian crosses and ratios • Probability • Punnett squares	BIO 5.D
Topic 2	Non-Mendelian Inheritance	• Non-Mendelian inheritance	BIO 5.D
Topic 3	Genetic Disorders		BIO 5.J
Module 6: DNA, RNA, and Molecular Genetics			
Topic 1	The Discovery of DNA	• History • Scientists	BIO 5.E
Topic 2	DNA – Structure, Function, and Replication	• Structure • Function • Replication	BIO 5.G
Topic 3	RNA – Transcription, Translation, and Protein Synthesis	• Transcription • Translation • Protein Synthesis	BIO 5.H
Topic 4	Genetic Diversity and Mutations	• Transmission of heredity information • Gene expression • Chromosome number mutations • Chromosome structure mutations	BIO 5.E BIO 5.F BIO 5.H
Topic 5	DNA Technologies	• Isolation, restriction/ligation, vectors, cloning, sequencing, PCR • Genetic engineering • Human genome	BIO 5.H BIO 5.I BIO 5.J

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		• Ethics	
Module 7: Organ Systems and Homeostasis			
Topic 1	Circulatory and Respiratory Systems	• Circulation • Respiration • Thermoregulation	BIO 4.A BIO 4.B BIO 4.C BIO 4.D
Topic 2	Digestive and Excretory System	• Metabolism • Excretion	BIO 4.A BIO 4.B BIO 4.C BIO 4.D
Topic 3	The Nervous System	• Nervous system • Endocrine control	BIO 4.A BIO 4.B BIO 4.C BIO 4.D
Topic 4	The Immune System	• Immune Response	BIO 4.A BIO 4.B BIO 4.C BIO 4.D BIO 4.F
Module 8: Evolution and Natural Selection			
Topic 1	The Fossil Record and the Origin of Life	• Relative dating and radioactive decay • Relative and absolute dating	BIO 3.B BIO 6.B BIO 7.A
Topic 2	The Theory of Evolution	• Charles Darwin • Ernest Mayr • Jean-Baptiste Lamarck • Evidence for evolution o Paleontology o Comparative anatomy o Comparative embryology o Biochemistry o Geographical distribution	BIO 7.A - E
Topic 3	Natural Selection, Adaptations, and Patterns of Evolution	• Natural selection • Environmental pressures • Punctuated equilibrium vs. gradualist (Stephen Jay Gould) • Isolating mechanisms • Genetic mutations	BIO 7.B BIO 7.C BIO 7.D
Module 9: Classification – The Basics			
Topic 1	Taxonomy	• Taxonomic structure • Linnaeus • Binomial nomenclature	BIO 6.A – E
Topic 2	Cladograms and Dichotomous Keys	•	BIO 6.B BIO 6.E
Topic 3	Species Identification	• Bases for separation – cell types, metabolic activities, DNA, reproduction, and homologies • Biological vs. morphological	BIO 6.C BIO 6.D
Topic 4	Domains and Kingdoms	• Three domain system (descriptions)	BIO 4.C BIO 6.C

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		• Six kingdom system (descriptions)	BIO 6.D
Module 10: Classification – Diversity in the Six Kingdoms			
Topic 1	Microorganisms	• Bacteria • Viruses o Germ theory o Pasteur and Koch o Modern health practices • Protists • Fungi	BIO 3.B BIO 4.A - F BIO 6.C BIO 6.D
Topic 2	Kingdom Plantae	• Nonvascular plants • Vascular plants • Plant homeostasis and responses	BIO 4.A BIO 4.B BIO 4.C
Topic 3	Subphylum Invertebratae	• Porifera • Cnidaria • Platyhelminthes • Nemathelminthes • Annelida • Mollusca • Arthropoda • Echinodermata	BIO 4.A BIO 4.B BIO 4.C
Topic 4	Subphylum Vertebratae	• Fish • Amphibians • Reptiles • Birds • Mammals	BIO 4.A BIO 4.B BIO 4.C
Module 11: Ecology			
Topic 1	Ecosystems and Communities	• Describing ecosystems • Describing communities • Interactions in communities (symbiosis)	BIO 8.A BIO 8.B
Topic 2	Population Dynamics	• Abiotic and biotic factors impacting populations • Carrying capacity • Limiting factors • Population growth curves	BIO 8.A
Topic 3	Energy and Nutrients in Ecosystems	• Energy flows in ecosystems • Nutrient cycles in ecosystems • Tropic levels • Food chains, webs, pyramids	BIO 8.B
Topic 4	Ecological Succession and Ecosystems in Virginia	• Similarities and differences between primary and secondary succession • The characteristics of a climax community	BIO 8.C BIO 8.D BIO 8.E
Topic 5	Disruptions to Ecosystems	• Natural disturbances to ecosystems • Human disturbances to ecosystems	BIO 8.D