Science Department Curriculum Guide **Biology – H**

Course Description
The **Honors Biology** course is based upon the study of biological concepts, unifying principles and interrelationships. Living organisms are studied in their unity, including connections to the environment and current biological concerns. The laboratory investigations correlate to the six major units explored during the year: Cells, Genetics, Evolution and Biodiversity, Ecology, Anatomy and Physiology and Biochemistry, and present the students with hands-on and virtual exploration of scientific investigations. The laboratory investigations and class work are designed to provide students with the opportunity to work collaboratively and develop critical thinking, communication and problem solving skills. Outside written research is required including formal laboratory investigations and reports. The honors course is inquiry-based and designed to prepare students for future honors science courses by moving at an accelerated pace, exploring the key concepts in great depth, using mathematical models, and engaging students with independent work where appropriate. This course is designed to prepare students for the Biology MCAS Exam.

Four Core Ideas of Biology
From **molecules to organisms:** structures and processes standards help students formulate an answer to the question, "How do organisms live and grow?" Students demonstrate that they can use investigations and gather evidence to support explanations of cell function and reproduction. They understand the role of proteins as essential to the work of the cell and living systems. Students can use models to explain photosynthesis, respiration, and the cycling of matter and flow of energy in living organisms. The cellular processes is as a model for understanding organisms.
Standards focused on **ecosystems: interactions, energy, and dynamics** help students formulate an answer to the question, "How and why do organisms interact with their environment, and what are the effects of these interactions?" Students can use mathematical reasoning to demonstrate understanding of fundamental concepts of carrying capacity, factors affecting biodiversity and populations, and the cycling of matter and flow of energy among organisms in an ecosystem. These models support students' conceptual understanding of systems and their ability to develop design solutions to reduce the impact of human activities on the environment and maintain biodiversity.
Heredity: inheritance and variation of traits standards help students formulate answers to the questions: "How are characteristics of one generation passed to the next? How can individuals of the same species and even siblings have different characteristics?" Students are able to ask questions, make and defend a claim, and use concepts of probability to explain the genetic variation in a population. Students demonstrate understanding of why individuals of the same species vary in how they look and function. Students can explain the mechanisms of genetic inheritance and describe the environmental and genetic causes of gene mutation and the alteration of gene expression.
The high school biology standards place particular emphasis on **science and engineering practices** of developing and using models; constructing explanations; engaging in argumentation from evidence; and obtaining, evaluating, and communicating information. Students are expected to use multiple types of models, including mathematical models, to make predictions and develop explanations, analyze and identify flaws in the model, and communicate ideas that accurately represent or simulate the biological system. Students are asked to construct and revise explanations and claims based on valid and reliable evidence and apply scientific reasoning to evaluate complex real-world problems such as the effects of human activity on biodiversity and ecosystem health. Students must be able to find and interpret scientific literature to compare, integrate, and evaluate sources and communicate phenomena related to genetics, the functioning of organisms, and interrelationships between organisms, populations, and the environment.

Subject: Biology

Units	Topics / Standards	Activities May Include
Experimental Design 3 weeks	Focus on experimental design and good science practices	▪ Sunflower Lab ▪ Modeling experimental design ▪ Pogil
Chemistry of Life 3-4 weeks	LS1.C Organization for matter and energy flow in organisms LS2.B Cycles of matter and energy transfer in ecosystems	▪ Enzyme lab ▪ Pogil ▪ Biomolecule models ▪ Macromolecule lab
The Cell 6-8 weeks	LS1.A Structure and function LS1.C Organization for matter and energy flow in organisms LS2.B Cycles of matter and energy transfer in ecosystems LS3.A Inheritance of traits	▪ Cell Project ▪ Microscope lab ▪ Pogil ▪ Cellular respiration lab ▪ Osmosis lab
Anatomy 2-3 weeks	LS1.A Structure and function LS1.B Growth and development of organisms LS1.C Organization for matter and energy flow in organisms LS3.B Variation of traits	▪ Body System Mapping ▪ Case studies (human body) ▪ Pogil ▪ Exercise Physiology project
DNA and Protein Synthesis 4 weeks	LS3.A Inheritance of traits LS3.B Variation of traits	▪ Protein Synthesis models ▪ Pogils ▪ DNA modeling
Genetics 4 weeks	LS1.A Structure and function LS1.B Growth and development of organisms LS3.A Inheritance of traits LS3.B Variation of traits LS4.A Evidence of common ancestry and diversity LS4.C Adaptation	▪ Punnett Squares ▪ Pogils ▪ Probability lab ▪ Dragon Genetics ▪ Pedigree charts

Units	Topics / Standards	Activities May Include
Evolution 4-6 weeks	LS1.B Growth and development of organisms LS1.C Organization for matter and energy flow in organisms LS3.A Inheritance of traits LS3.B Variation of traits LS4.A Evidence of common ancestry and Diversity LS4.B Natural selection LS4.C Adaptation	▪ Finch evolution lab ▪ Pogils ▪ Natural Selection lab ▪ Whale evolution ▪ Artificial selection projects
Ecology 4 weeks	LS1.C Organization for matter and energy flow in organisms LS2.A Interdependent relationships in ecosystems LS2.B Cycles of matter and energy transfer in ecosystems LS2.C Ecosystem dynamics, functioning, and resilience LS4.A Evidence of common ancestry and diversity LS4.B Natural selection LS4.C Adaptation	▪ Pogil ▪ Energy movement maps ▪ Population lab ▪ Carrying capacity lab

Textbook
▪ ***Biology***, by Kenneth Miller and Joseph Levine; published by Prentice Hall, 2007