SCIENCE DEPARTMENT **FUNDAMENTALS OF SCIENCE (SP): COURSE #902**

Contact Information

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The Department's Educational Philosophy

We believe that students should be exposed to the process of scientific inquiry so they can acquire and interpret scientific knowledge, and begin to realize the wider applicability of scientific problem-solving methods. By making the laboratory the focal point of learning, we seek to foster students' appreciation for the experience of doing science.

Guiding Principles

- Students must be able to collect and analyze data and formulate hypotheses.
- Inductive and deductive problem-solving skills are central to science education.
- An effective program in science addresses the limitations of data and conclusions.
- Students should be able to use or design a strategy for testing scientific concepts.
- A comprehensive science program will emphasize the delicate checks and balances in man's abiotic and biotic environments and the stresses upon these ecosystems, which could affect the destiny of the world.
- Science is integrally related to mathematics.
- An effective science program builds students' ability to communicate accurately and precisely.
- An effective science program stresses both cooperative and independent learning.

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Course Frequency: Full-year course, five times per week
Credits Offered: Five credits
Prerequisites: By Recommendation of the Department

Background to the Curriculum

Fundamentals of Science (SP) will cover the following topics in detail: chemistry of life, cells heredity, genetics, evolution, ecology, human body systems. The focus of this course is to prepare students to take and pass the MCAS Biology Test. This course is offered to freshman and sophomores.

Core Topics/Questions/Concepts/Skills

Core Topics	Questions	Concepts
I. Chemistry of Life	• How does life utilize matter and energy? • What are the elements of life? • What are the major classes of macromolecules? • How do enzymes function?	general chemistry, conservation of matter and energy, enzymes, ATP, macromolecules
II. Cells	• What are the basic structures of cells and their functions? • How do cells of the different kingdoms of life compare and how are they different? • How have complex cells evolved from simpler cells? • How do cells obtain and use energy? • How do cells grow, divide, and transport substances essential for life?	characteristics of life, cell structure and function, prokaryotes/eukaryotes, viruses surface area/volume, diffusion, osmosis, active/passive transport, mitosis, cancer, endosymbiotic theory, origin of life, photosynthesis and cell respiration, six kingdoms of life
III. Heredity and Genetics	• How is hereditary information housed in your cells? • How is the hereditary information passed on from parent to offspring? • How does variation in a species increase? • What is the structure of DNA and where is it located? • How are proteins made?	Mendel's experiments, inheritance, genotype vs. phenotype, probability, laws of segregation and independent assortment, pedigree, asexual and sexual reproduction, chromosomal theory of inheritance, meiosis, mutations, DNA

		and RNA structures
IV. Evolution and Natural Selection	• How do species evolve over time? • How does variation in a species relate to evolution? • How do populations evolve? • What are the patterns of evolution? • What is the evidence for evolution? • How can cladistic analysis help explain evolutionary relationships?	Darwin vs. Lamarck, variation, reproduction, environmental influence, adaptation, homologous/analogous structures, convergent, divergent and coevolution, adaptive radiation, speciation, extinction, taxonomy, cladistics
VI. Ecology	• How do organisms in New England ecosystems and other ecosystems interact? • How do matter and energy move through ecosystems? • How do populations interact in their environment?	Niches, habitats, biomes, biosphere, Ecological succession, competition, predator-prey, symbiosis, food web, energy pyramid
V. Human Body Systems	• How do structure and function relate in the human body systems? • What is homeostasis and how is it disrupted in each of the human body systems?	structure versus function, major bones, bone formation, types of muscle, movement, nerve impulse, neuron structure, synapse, hormones, glands, cardiovascular, pulmonary and systemic circuits, immune response, disease, reproductive cycles

Course-End Learning Objectives:

Learning Objectives	**Corresponding state standards, *where applicable***
Ecology	
1] What are the factors that influence population size?	Biology 6.1
2] How do matter and energy move through ecosystems?	Biology 6.4
3] What is the role of human activity, climate change, natural causes and non-indigenous species?	Biology 6.2
4] What is a food web and how are the different organisms at different trophic levels related?	Biology 6.3
Chemistry of Life	
1] Why is carbon important to living organisms?	Biology 1.1
2] Describe the six most common elements in organic molecules.	Biology 1.1

3] Describe the composition and function of the macromolecules.	Biology 1.2
4] How do enzymes affect chemical reactions?	Biology 1.3
Cells	
1] What are the basic structures of cells and their functions?	Biology 2.1, 2.2
2] How do molecules move in and out of cells?	Biology 2.1
3] How do cells grow and divide?	Biology 2.6, 2.7
4] Using cellular evidence and modes of nutrition, how do the six kingdoms compare?	Biology 2.3
5] How do cells obtain and use energy?	Biology 2.4
6] Compare and contrast bacteria and viruses.	Biology 2.8
Genetics	
1] What are the patterns of inheritance that Mendel observed?	Biology 3.4, 3.5, 3.6
2] What are some of the exceptions to Mendel's principals?	Biology 3.4
3] How are Punnett squares used to predict the probable outcomes of genetic crosses?	Biology 3.6
4] What is the structure of DNA and what is its function in genetic inheritance?	Biology 3.1
5] How is DNA replicated?	Biology 3.1, 3.2
6] How are proteins made?	Biology 3.1, 3.2
7] What are gene mutations and chromosomal mutations?	Biology 3.3
Evolution and Biodiversity	
1] What evidence is there for the theory of evolution?	Biology 5.1
2] What is the mechanism for evolution and what are some examples?	Biology 5.1
3] What are some sources of variation in a population?	Biology 5.3
4] What are the levels of taxonomy and how do they apply to evolution?	Biology 5.2
5] What is the role that geographic isolation has on speciation?	Biology 5.2
Human Body Systems	
1] How do the important anatomical structures relate to function in each of the human systems?	Biology 4.1-4.6
2] What is homeostasis and how is it disrupted in each of the human body systems?	Biology 4.7
3] What is the basic function of a physiological feedback loop?	Biology 4.8

Assessment

- Tests: written based on curriculum covered; focus on terms and concepts; written in format similar to MCAS
- Quizzes: vocabulary; in format similar to MCAS
- Laboratory activities and reports: some formal typed with hypotheses, procedure, materials, data, discussion and conclusion; some informal with questions.
- Homework: practice problems; format similar to MCAS

Technology and Health Learning Objectives Addressed in This Course

(This section is for faculty and administrative reference; students and parents may disregard.)

Course activity: skills &/or topics taught	Standard(s) addressed through this activity
1] Word processing, PowerPoint presentations, internet-based activities, internet research, computer probes, databases, spread sheets, computer simulations, microscope skills **2]** The following topics related to health are covered in the core biology curriculum: the role of macromolecules in nutrition, common genetic disorders, pathogenic/parasitic viruses, bacteria, protists, fungi, vaccines, antibiotics, and diseases (e.g., AIDS, Influenza, diabetes) that disrupt homeostasis to the systems of the human body.	

Materials and Resources

Student text

- DeSalle & Heithaus, Biology, 2008, Holt, Rinehart and Winston.

Content notes; directed reading; audio-visual, web sites, and lab materials to supplement the material taught in this course.