

#404 MCAS BIOLOGY

GRADE: 10

LEVEL: 1/2

CREDITS: 5

PREREQUISITES: Instructor's Approval

BASIC TEXT: Glencoe Biology 2007

SUPPLEMENTAL READINGS: Glencoe Reading Essentials

REQUIRED MATERIALS: 2.5 – 3.0 inch three ring hard cover binder

COURSE DESCRIPTION: This eighteen-week, single-semester course is a review of Biology topics included on the MCAS Biology test for those students whose original performance on the examination was below the required score for passing. Included in the course will be a review of scientific methods, the characteristics of life, cellular organization, the flow of energy and nutrients in ecosystems, photosynthesis and cellular respiration, genetics, evolution, diversity of life and systems of the body. Practice with actual MCAS questions and instruction in the best approach to standardized test-taking will be employed to improve performance on the MCAS Biology retest.

MISSION RELATED GOALS:

This course promotes intellectual curiosity through student guided scientific investigations and discussion of biological science current events. Academic excellence is emphasized through critical assessment of higher order thinking skills and application of broad scientific principles in lab activities and responses to homework/discussion questions.

STUDENT EXPECTATIONS FOR LEARNING ADDRESSED:

The course will reinforce the application of problem-solving skills gained from prior science courses. Students will learn to work toward a common goal during cooperative group and oral presentation activities. As individual members of cooperative groups, students will learn to respect the rights of others, as they are encouraged to accept other group members' right to express differing opinions/views. The course promotes personal growth and accepting responsibility, as individuals are held accountable for their contributions to the group. The combined accomplishment of these expectations will effectively result in the acquisition of life skills necessary for students to become successful contributing members of society.

GENERAL PERFORMANCE OBJECTIVES:

1. Analyze / interpret data shown in tables and graphs.
2. Describe form and function in prokaryotic and eukaryotic cells.
3. Interpret chemical structural formulas and be able to identify four categories of organic compounds.
4. Describe energy transfer at both the cellular and molecular level through the interaction of selected metabolic and catabolic chemical reactions.
5. Compare and contrast mitotic and meiotic cell division.
6. Apply principles of genetics to predict hereditary outcomes.
7. Apply knowledge of population genetics to explain evolutionary theory.
8. Classify and compare organisms in 7 taxa and 2 domains. Describe evolutionary relationships as depicted by cladistic diagrams.
9. Describe the structure and function of organ systems. Identify selected systems through observations of lab specimens and interactive visual media.

MASSACHUSETTS FRAMEWORK STRANDS: Biology, Grades 9 or 10

1. The Chemistry of Life
2. Structure and function of cells
3. Genetics
4. Human Anatomy and Physiology
5. Evolution and Biodiversity
6. Ecology

CURRICULUM FRAMEWORK LEARNING STANDARDS:

1. The Chemistry of Life

Broad Concept: Living things are made of atoms bonded together to form organic Molecules.

- 1.1. Explain the significance of carbon in organic molecules.
- 1.2. Recognize the six most common elements in organic molecules (C, H, N, O, P, S).
- 1.3. Describe the composition and functions of the four major categories of organic molecules (carbohydrates, lipids, proteins, and nucleic acids).*
- 1.4. Describe how dehydration synthesis and hydrolysis relate to organic molecules.
- 1.5. Explain the role of enzymes in biochemical reactions.

2. Structure and Function of Cells

Broad Concept: All living things are composed of cells. Life processes in a cell are based on molecular interactions.

- 2.1. Relate cell parts/organelles to their functions.*
- 2.2. Differentiate between prokaryotic cells and eukaryotic cells, in terms of their general structures and degrees of complexity.*
- 2.3. Distinguish between plant and animal cells.*
- 2.4. Describe how cells function in a narrow range of physical conditions, such as temperature and pH, to perform life functions that help to maintain homeostasis.
- 2.5. Explain the role of cell membranes as a highly selective barrier (diffusion, osmosis, and active transport).*
- 2.6. Identify the reactants and products in the general reaction of photosynthesis. Describe the use of isotopes in this identification.
- 2.7. Provide evidence that the organic compounds produced by plants are the primary source of energy and nutrients for most living things.*
- 2.8. Identify how cellular respiration is important for the production of ATP.
- 2.9. Explain the interrelated nature of photosynthesis and cellular respiration.*
- 2.10. Describe and compare the process of mitosis and meiosis, and their roll in the cell cycle.*

3. Genetics

Broad Concept: Genes are a set of instructions encoded in the DNA sequence of each organism that specify the sequence of amino acids in proteins characteristic of that organism.

- 3.1. Describe the structure and function of DNA, and distinguish among replication, transcription, and translation.*
- 3.2. Describe the processes of replication, transcription, and translation and

how they relate to each other in molecular biology.

3.3. Describe the general pathway by which ribosomes synthesize proteins by using tRNAs to translate genetic information encoded in mRNAs.

3.4. Explain how mutations in the DNA sequence of a gene may be silent or result in phenotypic change in an organism and in its offspring.

3.5. Differentiate between dominant, recessive, codominant, polygenic, and sex-linked traits.

3.6. State Mendel's laws of segregation and independent assortment.

3.7. Use a Punnett Square to determine the genotype and phenotype of monohybrid crosses.*

3.8. Explain how zygotes are produced in the fertilization process.

3.9. Recognize that while viruses lack cellular structure, they have the genetic material to invade living cells.

4. Human Anatomy and Physiology

Broad Concept: There is a relationship between structure and function in organ systems of humans.

4.1 Explain how major organ systems in humans (e.g., kidney, muscle, lung) have the function of that organ system.

4.2 Describe how the function of individual systems within humans are integrated to maintain a homeostatic balance in the body.

5. Evolution and Biodiversity

Broad Concept: Evolution and biodiversity are the result of genetic changes that occur in constantly changing environments.

5.1. Explain how the fossil record, comparative anatomy, and other evidence support the theory of evolution.

5.2. Illustrate how genetic variation is preserved or eliminated from a population through Darwinian natural selection (evolution) resulting in biodiversity.

5.3. Describe the taxonomic system classifies living things into domains (eubacteria, archaeobacteria, and eukaryotes) and kingdoms (animals, plants, fungi, etc.).* [Note: there is an ongoing scientific debate about the number of kingdoms and which organisms should be included in each.

The following websites provide more information: Brave New Biosphere Tree of Life Project Root Page phylogeny Arizona edu/tree/life.html.]

6. Ecology

Broad Concept: Ecology is the interaction between living organisms and their environment.

6.1 Explain how biotic and abiotic factors cycle in an ecosystem (water, carbon, oxygen, and nitrogen).*

6.2 Use a food web to identify and distinguish producers, consumers, and decomposers, and explain the transfer of energy through trophic levels.*

6.3 Identify the factors in an ecosystem that influence fluctuations in population size.

6.4 Analyze changes in an ecosystem resulting from natural causes, changes in climate, human activity, or introduction of non-native species.

6.5 Explain how symbiotic behavior produces interactions within ecosystems.

UNITS AND THEMES:

The Science of Biology/ Inquiry methods/ 1 week

The Chemistry of Life 1 week

Strands: 1.1, 1.2, 1.3, 1.4, 1.5

The Biosphere/ Ecology/ Energy Flow 1 week

Strands: 6.1, 6.2, 6.3, 6.4, 6.5, 6.6

Structure and Function of Cells/ Transport/ Microscopy 2 weeks

Strands: 2.1, 2.2, 2.3, 2.4, 2.5

Photosynthesis/ Autotrophy/ Energy Transfer 1.5 week

Strands: 2.6, 2.7

Cellular Respiration/ Chemical Pathways/ Metabolism 1.5 week

Strands: 2.8, 2.9

Cell Growth and Division/ Cell Cycle 1 week

Strands: 2.10, 2.5

Mendelian Genetics/ Heredity/ Meiosis 2 weeks

Strands: 3.5, 3.6, 3.7, 3.8, 3.9, 2.10

DNA Replication/ Protein Synthesis/ Mutations 2 weeks

Strands: 3.1, 3.2, 3.3, 3.4

Theory of Evolution/ Genes and Variation 1 week

Strands: 5.2

Evidence of Evolution/ Patterns of Evolution 1 week

Strands: 5.1

Classification/ Diversity 1 week

Strands: 5.3

Human Anatomy and Physiology/ Organ Systems 2 weeks

Strands: 4.1, 4.2

COURSE OUTLINE:

I. The Science of Biology

- a. What is science?
- b. How scientists work.
- c. Studying Life.

II. The Chemistry of Life

- a. The nature of matter.
- b. Properties of water.
- c. Carbon compounds
- d. Chemical reactions and enzymes.

III. The Biosphere

- a. What is ecology?
- b. Energy flow
- c. Cycles of Matter

IV. Ecosystems and Communities

- a. The role of climate
- b. What shapes an ecosystem?

V. Cells Structure and Function

- a. The cellular level of organization.
- b. Cell structures.

- c. Movement through the membrane.
- d. The diversity of cellular life.
- VI. Photosynthesis
 - a. Energy and life.
 - b. The reactions of Photosynthesis.
- VII. Cellular Respiration
 - a. Chemical pathways
 - b. B. The Krebs cycle and electron transport.
- VIII. Cell Growth and Division
 - a. Cell growth limitations.
 - b. Cell division.
 - c. Regulating the cell cycle.
- IX. Introduction to Genetics
 - a. The work of Gregor Mendel
 - b. Probability and Punnett squares
 - c. Exploring Mendelian genetics
 - d. Meiosis
 - e. Linkage and gene maps
- X. DNA and RNA
 - a. DNA
 - b. Chromosomes and DNA replication
 - c. RNA and protein synthesis
 - d. Mutations
 - e. Gene regulation
- XI. Darwin's Theory of Evolution
 - a. The principles of Darwin's Theory of Evolution
 - b. Genes and Variation
 - c. Evolution as genetic change
 - d. The process of speciation
 - e. Evidence of evolution.
- XII. Classification
 - a. Modern evolutionary classification
 - b. Kingdoms and domains
- XIII. The Human Body
 - a. Human Body Systems
 - b. The nervous system

SUGGESTED INSTRUCTIONAL STRATEGIES:

1. Students are required to maintain notebooks.
2. Utilize textbook companion websites for animations, practice chapter tests, learning games, etc.
3. Lessons on goal-setting, study skills, test-taking skills, etc.
4. MCAS test practice: multiple choice and essay questions for each course topic are examined
5. Use Think-Pair Share Strategies to do exercises
6. Use cooperative groups of 3 or 4 for activities
7. Use a peer evaluation form/rubric to assess cooperative group's vs individual credit on

projects

8. Maximize on-task work by assigning students to work in pairs.

9. Give students cooperative roles when working in groups and require a written product.

Example: butcher paper with bullets of major discussion points presented to class.

10. Use the John Collins Method to write an essay which critically evaluates a “scientific” claim or topic.

SUGGESTED INTEGRATED ACTIVITIES:

1. Current Events Presentations in the Field of Biological Science.

2. Debating Bioethical Issues, charting conflicts between goals and responsibilities

3. Invite guest speakers in fields of biotechnology to share career advice and describe.

4. Applications of biological science in the workplace.

5. Students write a children’s storybook that explains a complex biological concept in the form of an allegory and visual presentation.

USE OF TECHNOLOGY:

Online webquests to efficiently guide students through a set of genetic probability demonstrations and problems, digital projector videos (organic molecules, genetics studies, evolution), overhead projector visual aids, models, preserved specimens, internet/computer lab

ASSESSMENTS:

All assessments follow the school wide rubric.

Unit Quizzes and/or Tests

Short Projects

Short Essay

Oral Presentations

Homework and Participation is 20% of grade

Standardized Departmental Final Exam is 20% of grade