

COURSE OUTLINE

NAME OF COURSE: BIOLOGY

COURSE NUMBER: SCI 202

WRITTEN / REVISED : SEPTEMBER, 2011

LEVEL OF COURSE: COLLEGE PREP A

NUMBER OF CREDITS: SIX (6)

PREREQUISITES: "C" IN ENVIRONMENTAL SCIENCE A

GRADE LEVELS OFFERED TO: 9th & 10th

COURSE DESCRIPTION:

This course is a lab oriented college prep course in biology. It requires an in-depth knowledge of the life sciences with emphasis on hands-on activities and sound environmental values. A Year-long science service project is required for this course. Twenty hours of science service to the community is required. These hours can also count for the community service hours for the school. Failure to hand in a service project will result in a permanent incomplete for the course.

COURSE OBJECTIVES:

The student should be expected to succeed in the following objectives to the satisfaction of both the teacher and student.

1. Demonstrates the ability to set reasonable goals.
2. Demonstrates the responsibility for carrying out self-set goals.
3. Demonstrates cooperation by working constructively with other students.
4. Demonstrates cooperation with the instructor by using time constructively and with purpose, relative to course oriented goals.
5. Demonstrates cooperation with the instructor by performing requested special program oriented tasks.
6. Demonstrates independence by exploring all possible avenues in the solution of problems with the minimum of help.
7. Demonstrates independence and scholastic growth by using resources efficiently.
8. Progresses at a rate satisfactory to the teacher.

CORE CURRICULUM CONTENT STANDARDS ADDRESSED:

5.1 - Scientific Practices

5.2 - Physical Science

5.3 - Life Science

SPECIFIC BEHAVIORAL OBJECTIVES/PROFICIENCIES AND TIME LINES:

Chapter 1 – The Nature of Life

Time = 7 days

Goal: The student will gain an understanding of the methods of science and the characteristics of living organisms.

Objectives:

1. Explain what the goal of science is.
2. Explain what a hypothesis is.
3. Describe how scientists test hypotheses.
4. Explain how a scientific theory develops.
5. Describe some characteristics of living things.
6. Explain how life can be studied at different levels.
7. Describe the measurement system that scientists use.
8. Explain how light microscopes and electron microscopes are similar and different.
9. Explain why it is important to work safely in biology.

Terminology covered: spontaneous generation, controlled experiment, manipulated variable, responding variable, theory, biology, cell, sexual reproduction, asexual reproduction, metabolism, stimulus, homeostasis, evolution, metric system, microscope, compound light microscope, electron light microscope

Chapter 2 - The Chemistry of Life

Time = 11 days

Goal: The student will recognize the basic concepts in Biochemistry including; chemical compounds, bonds, chemical reactions, and organic molecules of life.

Objectives:

1. Identify the three subatomic particles in atoms.
2. Explain isotopes and their use in biology.
3. Explain what chemical compounds are.
4. Describe the two main types of chemical bonds.
5. Differentiate between solutions and suspensions.
6. Explain what acidic and basic solutions are.
7. Describe the functions of each group of organic compounds.
8. Explain how chemical reactions affect chemical bonds in compounds.
9. Explain why enzymes are important to living things.

Terminology covered: atom, nucleus, electron, element, isotope, compound, ionic bond, ion, covalent bond, molecule, cohesion, adhesion, mixture, solution, solute, solvent, suspension, pH scale, acid, base, buffer, monomer, polymer, carbohydrate, monosaccharide, polysaccharide, lipid, nucleic acid, nucleotide, ribonucleic acid, deoxyribonucleic acid, protein, amino acid, chemical reaction, reactant, product, activation energy, catalyst, enzyme, substrate, *active site*, *dehydration synthesis*, *lock and key*, *pH*

Chapter 3 – The Biosphere

Goal: The students will identify relationships among various types of organisms that they have observed in their immediate environment.

Objectives:

1. Identify the levels of organizations that ecologists study.
2. Describe the methods used to study ecology.
3. Identify the sources of energy for life processes.
4. Trace the flow of energy through living systems.
5. Evaluate the efficiency of energy transfer among organisms in an ecosystem.

Terminology covered: ecology, biosphere, species, population, community, ecosystem, biome, autotroph, producer, photosynthesis, chemosynthesis, heterotroph, consumer, herbivore, carnivore, omnivore, detritovore, decomposer, food chain, food web, trophic level, ecological pyramid, biomass, *water cycle*

Chapter 4 – Ecosystems and Communities

Goal: Students will be able to identify relationships among different organisms and between organisms and nonliving factors in a model ecosystem.

Objectives:

1. Identify the causes of climate.
2. Explain how the Earth's temperature range is maintained.
3. Describe the greenhouse effect.
4. Explain how biotic and abiotic factors influence an ecosystem.
5. Identify the interactions that occur within communities.
6. Describe how ecosystems recover from a disturbance.
7. Review the biomes found around the world.

Terminology covered: weather, climate, greenhouse effect, biotic factor, abiotic factor, habitat, niche, resource, competitive exclusion principle, predation, symbiosis, mutualism, commensalism, parasitism, ecological succession, primary succession, pioneer species, secondary succession, biome, *competition*

Chapter 6 – Humans in the Biosphere

Goal: Students will understand the difference between renewable and nonrenewable resources.

Objectives:

1. Explain how environmental resources are classified.
2. Describe how human activities affect land, air, and water resources.
3. Describe two types of global change that are of concern to biologists.

Terminology covered: agriculture, monoculture, green revolution, renewable resource, nonrenewable resource, sustainable development, soil erosion, desertification, deforestation, aquaculture, smog, pollutant, acid rain, ozone layer, global warming, *indicator*

Chapter 7 – Cell Structure and Function

Time = 9 days

Goal: The students will be able to form an operational definition of the term cell and classify them into two or more groups.

Objectives:

1. Explain what the cell theory is.
2. Describe how researchers explore the living cell.
3. Distinguish between eukaryotes and prokaryotes.
4. Describe the function of the cell nucleus.
5. Describe the functions of the major cell organelles.
6. Identify the major roles of the cytoskeleton.
7. Identify the major functions of the cell membrane and the cell wall.
8. Describe what happens during diffusion.
9. Explain the process of osmosis, facilitated diffusion, and active transport.
10. Describe cell specialization.
11. Identify the organizational levels in multicellular organisms.

Terminology covered: cell, cell theory, nucleus, eukaryote, prokaryote, organelle, cytoplasm, nuclear envelope, chromatin, chromosome, nucleolus, ribosome, endoplasmic reticulum, golgi apparatus, lysosome, vacuole, mitochondrion, chloroplast, cytoskeleton, centriole, cell membrane, cell wall, lipid bilayer, concentration, diffusion, equilibrium, osmosis, isotonic, hypertonic, hypotonic, facilitated diffusion, active transport, Endocytosis, phagocytosis, pinocytosis, Exocytosis, cell specialization, tissue, organ, organ system

Chapter 8 - Photosynthesis

Time = 5 days

Goal: The students will be able to understand how photosynthetic organisms obtain energy from sunlight.

Objectives:

1. Explain where plants get the energy that they need to produce food.
2. Describe the role of ATP in cellular activities.
3. State the overall equation for photosynthesis.

Terminology covered: autotroph, heterotroph, adenosine triphosphate, photosynthesis, pigment, chlorophyll, thylakoid, photosystem, stoma, NADP⁺, light-dependent reactions, ATP synthase, Calvin cycle (light-independent reaction)

Chapter 9 – Cellular Respiration

Time = 2 days

Goal: The students will be able to understand how organisms obtain energy through cellular respiration.

Objectives:

1. Explain what cellular respiration is.
2. State the overall equation for cellular respiration.

Terminology covered: calorie, glycolysis, cellular respiration, NAD⁺, fermentation, anaerobic, aerobic, Krebs cycle, electron transport chain

Chapter 10 – Cell Growth and Division

Time = 11 days

Goal: The students will gain an understanding of the basic cell processes, optimum size of cells, phases of Mitosis, Cell Cycle and cell specialization.

Objectives:

1. Describe how cell division solves the problems of cell growth.
2. Name the main events of the cell cycle.
3. Describe what happens during the four phases of Mitosis.
4. Identify a factor that can stop cells from growing.
5. Describe how the cell cycle is regulated.
6. Explain how cancer cells are different from regular cells.

Terminology covered: cell division, mitosis, cytokinesis, chromatid, centromere, interphase, cell cycle, prophase, centriole spindle, metaphase, anaphase, telophase, cyclin, cancer

Chapter 11 – Intro to Genetics

Time = 22 days

Goal: The student will discuss genetics and describe where chromosomes and genes are located and what their jobs are.

Objectives:

1. Describe how Mendel studied inheritance in peas.
2. Summarize Mendel's conclusions about inheritance.
3. Explain the principle of dominance.
4. Describe what happens during segregation.
5. Explain how geneticists use the principles of probability.
6. Describe how geneticists use Punnett squares.
7. Describe the inheritance patterns that exist aside from simple dominance.
8. Explain how Mendel's principles apply to all organisms.
9. Contrast the chromosome number of body cells and gametes.
10. Summarize the events of meiosis.
11. Contrast the processes of mitosis and meiosis.

Terminology covered: genetics, fertilization, true-breeding, trait, hybrid, gene, allele, segregation, gamete, probability, Punnett square, homozygous, heterozygous, phenotype, genotype, independent assortment, incomplete dominance, codominance, multiple alleles, polygenic traits, homologous, diploid, haploid, meiosis, tetrad, crossing-over, gene map, *dihybrid*, *F1 cross*, *F2 cross*, *recombinant*, *recombination*, *test-cross*

Molecular Biology – Chapters 12-14

Time = 39 days

Chapter 12 – DNA and RNA

Goal: The students will examine the appearance and function of DNA, RNA, and the possible errors in the DNA code.

Objectives:

1. Summarize the relationship between genes and DNA.
2. Describe the overall structure of DNA.
3. Summarize the events of DNA replication.

4. Relate the DNA molecule to chromosome structure.
5. Tell how RNA differs from DNA.
6. Name the three main types of RNA.
7. Identify the genetic code.
8. Describe transcription.
9. Summarize translation.
10. Explain the relationship between genes and proteins.
11. Contrast gene mutations and chromosomal mutations.

Terminology covered: transformation, bacteriophage, nucleotide, base pairing, chromatin, histone, replication, DNA polymerase, gene, messenger RNA, ribosomal RNA, Transfer RNA, transcription, RNA polymerase, promoter, intron, exon, codon, translation, anticodon, mutation, point mutation, frameshift mutation, polyploidy, *adenine, cytosine, deletion, guanine, nitrogen base, purine, pyrimidine, thymine, uracil*

Chapter 13 – Genetic Engineering

Goal: The students will be able to understand breeding and how to manipulate DNA.

Objectives:

1. Explain the purpose of selective breeding.
2. Describe two techniques used in selective breeding.
3. Tell why breeders try to induce mutation.
4. Explain how scientists manipulate DNA.

Terminology covered: selective breeding, hybridization, inbreeding, genetic engineering, restriction enzyme, gel electrophoresis, recombinant DNA, polymerase chain reaction, plasmid, genetic marker, transgenic, clone

Chapter 14 – The Human Genome

Goal: The students will understand human heredity and factors that affect the human genome.

Objectives:

1. Identify the types of human chromosomes in a karyotype.
2. Explain how sex is determined.
3. Explain how pedigrees are used to study human traits.
4. Describe examples of the inheritance of human traits.
5. Explain how small changes in DNA cause genetic disorders.
6. Identify characteristics of human chromosomes.
7. Describe some sex linked disorders, and explain why they are more common in males than females.
8. Summarize non-disjunction and the problems it causes.
9. Summarize methods of human DNA analysis.
10. State the goal of the Human Genome Project.
11. Describe how researchers are attempting to cure genetic disorders.

Terminology covered: karyotype, sex chromosome, autosome, pedigree, sex-linked gene, nondisjunction, DNA fingerprinting

Chapter 15 – Darwin’s Theory of Evolution

Time = 7 days

Goal: The students will be introduced to natural selection, mutations and species formation. Evidence supporting evolution will also be examined.

Objectives:

1. Describe the pattern that Darwin observed among organisms of the Galapagos Islands.
2. State how Hutton and Lyle described geological change.
3. Identify how Lamarck thought species evolved.
4. Describe Malthus’s theory of population growth.
5. List events leading to Darwin’s publication of *On the Origin of Species*.
6. Describe how natural variation is used in artificial selection.
7. Explain how natural selection is related to species’ fitness.
8. Identify evidence Darwin used to present his case for evolution.
9. State Darwin’s theory of evolution by natural selection.

Terminology covered: evolution, theory, fossil, artificial selection, struggle for existence, fitness, adaptation, survival of the fittest, natural selection, descent with modification, common descent, homologous structure, vestigial organ, *analogous structure*, *natural selection*

Chapter 18 – Classification

Time = 5 days

Goal: Students will be able to demonstrate the classification scheme and discover the basic characteristics of domains and kingdoms.

Objectives:

1. Explain how living things are organized for study.
2. Describe binomial nomenclature.
3. Explain Linnaeus’s system of classification.
4. Name the six kingdoms of life as they are now identified.
5. Describe the three domain system of classification.

Terminology covered: taxonomy, binomial nomenclature, genus, taxon, family, order, class, phylum, kingdom, phylogeny, evolutionary classification, derived character, cladogram, molecular clock, domain, Bacteria, Eubacteria, Archaea, Archaeobacteria, Eukarya, Protista, Fungi, Plantae, Animalia

Chapter 19 – Bacteria and Viruses

Time = 11 days

Goal: Students will discover the main characteristics of bacteria and viruses and how they cause disease.

Objectives:

1. Explain how the two groups of prokaryotes differ.
2. Describe the factors that are used to identify prokaryotes.
3. Describe the structure of a virus.
4. Explain how viruses cause infection.
6. Explain how bacteria and viruses cause disease.

Terminology covered: prokaryote, bacillus, coccus, spirillum, chemoheterotroph, photoheterotroph, photoautotroph, chemoautotroph, binary fission, conjugation, endospore, virus, capsid, bacteriophage, lytic infection, lysogenic infection, prophage, retrovirus, pathogen, vaccine, antibiotic, viroid, prion

Systems Unit – Chapters 35-40

Time = 17 days

Chapter 35 – Nervous System

Goal: Students will explore the body's major system of communication, the nervous system.

Objectives:

1. Describe how the human body is organized.
2. Explain homeostasis.
3. Identify the functions of the nervous system.
4. Describe how a nerve impulse is transmitted.
5. Identify the functions of the Central Nervous System.
6. Describe the functions of the two divisions of the Peripheral Nervous System.
7. Name the five types of sensory receptors.
8. Identify the five sense organs.

Terminology covered: specialized cell, epithelial tissue, connective tissue, nervous tissue muscle tissue, homeostasis, feedback inhibition, neuron, cell body, dendrite, axon, myelin sheath, resting potential, action potential, threshold, synapse, neurotransmitter, meninges, cerebrospinal fluid, cerebrum, cerebellum, brain stem, thalamus, hypothalamus, reflex, reflex arc, sensory receptor, pupil, lens, retina, rod, cone, cochlea, semicircular canal, taste bud, drug, stimulant, depressant, fetal alcohol syndrome, drug abuse, addiction

Chapter 36 – Skeletal, Muscular and Integumentary

Goal: Students will study the structure, function, and associated problems of the skeletal and muscular systems.

Objectives:

1. State the functions of the skeletal system.
2. Describe the structure of a typical bone.
3. Explain how bones develop.
4. Identify the three different kinds of joints.
5. Describe the three types of muscular tissue.
6. Explain how muscles contract.
7. Explain why exercise is important.
8. State the functions of the Integumentary system.
9. Describe the structure of hair and nails.

Terminology covered: periosteum, Haversian canal, bone marrow, cartilage, ossification, joint, ligament, myosin, actin, neuromuscular junction, acetylcholine, tendon, epidermis, keratin, melanin, dermis, hair follicle

Chapter 37 – Circulatory and Respiratory Systems

Goal: The students will examine the roles of the circulatory system and the respiratory system in the human body, and illnesses associated with both.

Objectives:

1. Identify the functions of the human circulatory system.
2. Describe the structures of the circulatory system.
3. Name the three types of blood vessels in the circulatory system.
4. Describe blood pressure.
5. Describe blood plasma.
6. Explain the functions of white blood cells, red blood cells, and platelets.
7. Describe respiration.
8. Identify the function of the respiratory system.
9. Describe gas exchange in breathing.
10. Explain how smoking affects the respiratory system.

Terminology covered: myocardium, atrium, ventricle, pulmonary circulation, systemic circulation, systemic circulation, valve, pacemaker, aorta, artery, capillary, vein, atherosclerosis, plasma, hemoglobin, lymphocyte, platelet, lymph, pharynx, trachea, larynx, bronchus, alveolus, diaphragm, nicotine, emphysema

Chapter 38 – Digestive and Excretory Systems

Goal: Students will understand the roles of the digestive and excretory systems and the disorders associated with both.

Objectives:

1. Explain how food provides energy.
2. Describe the nutrients your body needs.
3. State why water is such an important nutrient.
4. Explain how to use the food guide pyramid.
5. Identify the organs of the digestive system.
6. Describe the function of the digestive system.
7. Identify the functions of the kidneys.
8. Explain how blood is filtered.

Terminology covered: Calorie, carbohydrate, fat, protein, vitamin, mineral, amylase, esophagus, peristalsis, stomach, chyme, small intestine, pancreas, liver, villus, large intestine, kidney, ureter, urinary bladder, nephron, filtration, urethra

Ch 39 Section 1 and 2 – The Endocrine Systems

Goal: The students will be able to state the function of the endocrine system and list the major organs.

Objectives:

1. Describe hormones and glands.
2. Explain how the endocrine system maintains homeostasis.
3. Identify the functions of the major endocrine glands

Terminology covered: hormone, target cell, exocrine gland, endocrine gland, prostaglandin, pituitary gland, diabetes mellitus, ovary, testis

Chapter 40 – Immune Systems

Goal: Students will understand the role of the immune system and the diseases associated with it.

Objectives:

1. Identify the causes of disease.
2. Explain how infectious diseases are transmitted.
3. Describe how antibiotics fight infection.
4. Identify the body's nonspecific defenses against invading pathogens.
5. Describe the function of the immune system.
6. State what happens when the immune system overreacts.
7. Explain what an autoimmune disease is.

Terminology covered: disease, pathogen, germ theory of disease, Koch's postulates, vector, antibiotic, immunity, inflammatory response, fever, interferon, immune response, antigen, humoral immunity, cell-mediated immunity, antibody, vaccination, active immunity, passive immunity, allergy, histamine, asthma, risk factor, tumor, carcinogen

MATERIALS / RESOURCES:

Text: Prentice Hall Biology – Miller, Levine - 2006

Labs: Teacher generated and selected.

Audio-Visual: As selected by instructor.

EVALUATION:

A. STUDENT PROGRESS:

The evaluation of student progress in the objectives cited on the previous pages will be primarily by, but not limited to, the following criteria:

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|-----------------------------------|---------|
| 1. Classroom/Homework performance | 20%-30% |
| 2. Unit Tests and Quizzes | 35%-50% |
| 3. Laboratory Reports | 25%-35% |

B. PERIODIC EVALUATION OF OBJECTIVES AND GUIDE:

Next evaluation due June, 2014

C. SPECIAL COURSE POLICIES:

The emphasis on laboratory discovery of scientific principles requires active student participation by students. The student is responsible for outside reading of the textbook, laboratory book, or worksheets and to question the teacher during lecture, if necessary. The typical week in Biology might include a division of the six periods of instruction in the following way: three periods of lecture-demonstrations, two periods of laboratory work and one-half period of independent research/reading and one-half period for audiovisual aids, i.e., filmstrips, film, or slides.

A Year-long science service project is required for this course. Twenty hours of science service to the community is required. These hours can also count for the community service hours for the school. Failure to hand in a service project will result in a permanent incomplete for the course.

D. DATE MID-TERM / FINAL REVISED

1. Mid-term – January 2011
2. Final – June 2011

High Point Regional High School's curriculum and instruction are aligned to the State's Core Curriculum Content Standards and address the elimination of discrimination by narrowing the achievement gap, by providing equity in educational programs and by providing opportunities for students to interact positively with others regardless of race, creed, color, national origin, ancestry, age, marital status, affectionate or sexual orientation, gender, religion, disability or socioeconomic status.