ADVANCED PLACEMENT BIOLOGY

LENGTH OF TIME: 90 minutes every other day, all year

GRADE LEVEL: 11-12, 10th with special recommendation

PRE-REQUISITES: Biology, Chemistry I, and approval of an Advanced Placement Application

COURSE STANDARDS:
Students will:

1. Develop a knowledge of the chemistry of important molecules and the function of these molecules within living systems. (PA Std 3.4.12a, 3.3.12b)
2. Demonstrate an understanding of the cellular basis of life and be able to describe cellular processes and their energetics. (PA Std 3.4.12b; 3.3.12a)
3. Interpret experimental data and apply it to related living systems. (PA Std 3.1.12.a,b,c,d,e, 3.2.12.a,b,c,d)
4. Demonstrate a knowledge of genetics and the laws of heredity on both a molecular and organism level. (PA Std 3.3.12.c)
5. Describe the theories of evolution and their implications in speciation and bio-diversity. (PA Std 3.3.12.d, 3.5.12.a)
6. Explain and compare the structure and function of animal and plant systems and their adaptations. (PA Std 3.3.12.a)
7. Develop an understanding of the dynamics of ecology. (PA Std 4.1.12.a,d; 4.2.12.b,c; 4.6.12.a,b,c; 4.7.12.a,b,c; 3.5.12.c)

RELATED PA ACADEMIC STANDARDS FOR SCIENCE AND TECHNOLOGY

3.1 Unifying Themes
- A. Systems
- B. Models
- C. Patterns
- D. Scale
- E. Change

3.2 Inquiry and Design
- A. Nature of Scientific Knowledge
- B. Process Knowledge
- C. Scientific Method
- D. Problem Solving in Technology

3.3 Biological Sciences
- A. Living Forms
- B. Structure and Function
- C. Inheritance
- D. Evolution

3.4 Physical Science, Chemistry and Physics

A. Matter
B. Energy

3.5 Earth Sciences
A Land Forms and Processes
C. Meteorology

RELATED PA ACADEMIC STANDARDS FOR ENVIRONMENT AND ECOLOGY

4.1 Watersheds and Wetlands
A. Cycles
D. Characteristics and functions of wetlands

4.2 Renewable and Nonrenewable Resources
B. Availability
C. Management

4.6 Ecosystems and their Interactions
A. Living and Nonliving Components
B. Cycles
C. Change over Time

4.7 Threatened, Endangered and Extinct Species
A. Diversity
B. Adaptation
C. Management Strategies

PERFORMANCE ASSESSMENTS:

Students will demonstrate achievement of the standards by:

1. Maintaining a daily journal of class related activities and information. (Course Standard 2, 4, 6)
2. Organizing information into essay format for self and group evaluation. (Course Standard 1, 4, 7)
3. Completing laboratory activities and preparing written laboratory reports for each of the required Advanced Placement Laboratory Activities. (Course Standard 1-7)
4. Successfully completing an individual (one student, one teacher) quarter oral exam for two of the four quarters.
5. Successfully completing standardized tests on information presented in the class. (Course Standard 1, 2, 4, 5, 6, 7)
6. Successfully completing various projects directly relating to course content. (Course Standard 1, 2, 4)

DESCRIPTION OF COURSE:

The course content follows the Units and Chapters presented in the course text, and is organized under each of the three overarching topics presented in the A.P. Course description. The first third of the class treats conceptualizations associated with organization of life at the molecular and cellular level. The middle third of the course is devoted to specific topics that relate to heredity and genetics. The final third of the class is organized around the presentation of content related to organisms and populations. The detailed unit descriptions and the time allocations to each topic are detailed later in this

syllabus. The eight major unifying themes of the course (Science as a Process; Evolution; Energy Transfer; Continuity and Change; Relationship of Structure to Function; Regulation; Interdependence in Nature; Science, Technology and Society) are threaded through the informational content of the course. In addition, all twelve required laboratory investigations are completed and are wrapped into the course content. An off-site field program is also presented to all students enrolled in the course, and students develop and present original lab protocols during their field experience. Students also participate in a protected online classroom site during the class. Web resources are hosted by the site and available for student use.

TITLES OF UNITS:

I. Molecules and cells--25% of course, to be taught during the first quarter (9 weeks)
   - A. Biological chemistry--3 weeks (7%)
     1. Review of atoms, molecules, bonding, pH, water
     2. Carbon, functional groups
     3. Carbohydrates, lipids, proteins, nucleic acids
     4. Chemical reactions, free-energy changes, equilibrium
     5. Enzymes: coenzymes, cofactors, rates of activity, regulation
   - B. Cells--3 weeks (10%)
     1. Prokaryotic and eukaryotic cells
     2. Plant and animal cells
     3. Structure and function of cell membranes
     4. Structure and function of organelles, sub-cellular components of motility, cytoskeleton
     5. Cell cycle: mitosis, cytokinesis
   - C. Energy transformations--3 weeks (8%)
     1. ATP, energy transfer, coupled reactions, chemiosmosis
     2. C_3 and C_4 photosynthesis
     3. Glycolysis, fermentation, aerobic respiration

II. Heredity and evolution--25% of the course, to be taught during the second quarter (9 weeks)
   - A. Molecular genetics--3 weeks (9%)
     1. DNA: structure and replication
     2. Eukaryotic chromosomal structure, nucleosome, transposable elements
     3. RNA: transcription, mRNA editing, translation
     4. Regulation of gene expression
     5. Mutations
     6. Recombinant DNA, DNA cloning, hybridization, DNA sequencing
     7. DNA and RNA viruses
   - B. Heredity--3 weeks (8%)
     1. Meiosis
     2. Mendel's laws, probability
     3. Inheritance patterns: chromosomes, genes, alleles; interactions
     4. Human genetic defects

C. Evolution--3 weeks (8%)
   1. Origin of life
   2. Evidence for evolution
   3. Natural selection
   4. Hardy-Weinberg principle, factors influencing allelic frequencies
   5. Speciation: isolating mechanisms, allopatry, sympatry, adaptive radiation
   6. Patterns of evolution, gradualism, punctuated equilibrium

III. Organisms and populations (20 weeks)
   A. Principles of taxonomy and systematics, five kingdom system--1 week (1%)
   B. Survey of monera, protista, and fungi--1 week (2%)
   C. Plants--8 weeks (15%)
      1. Diversity; classification, phylogeny, adaptations to land; alternation of generations in moss, fern, pine, and flowering plants
      2. Structure and physiology of vascular plants
      3. Seed formation, germination, growth in seed plants
      4. Hormonal regulation of plant growth
      5. Plant response to stimuli: tropisms, photo-periodicity
   D. Animals--8 weeks (23%)
      1. Diversity; classification, phylogeny, survey of acoelomate, pseudocoelomate, protostome, and deuterostome phyla
      2. Structure and function of tissues, organs, and systems (emphasis on vertebrates), homeostasis, immune response
      3. Gametogenesis, fertilization, embryogeny development
      4. Behavior
   E. Ecology--2 weeks (9%) Off-site Field Program
      1. Population dynamics, biotic potential, limiting factors
      2. Ecosystem and community dynamics: energy flow, productivity, species interactions, succession, biomes
      3. Biogeochemical cycles
      4. Anthropogenic environmental issues

SAMPLE INSTRUCTIONAL STRATEGIES:

1. Small group activities
2. Cooperative learning
3. Problem solving activities
4. Individual explorations
5. Process writing
6. Lecture and discussion
7. Journal entries
8. Audio visual presentations
9. Off site investigations
10. Laboratory exercises
11. Technology assisted learning

12. Computer simulations
13. Independent reading
14. Research activities
15. Participation in online classroom

MATERIALS:
1. Text: Biology, Campbell and Reece, 7th edition, Prentice Hall, 2002
2. IBM (or compatible) computers, appropriate software, and laboratory interfaces
3. Laboratory materials and equipment necessary for the performance of the 12 required laboratory exercises
4. Appropriate laboratory instrumentation, including oil immersion microscopes, sterilization equipment, incubation and refrigeration resources and chromatographic systemics
5. Audio visual equipment and resources
6. Supplemental materials and texts

METHODS OF ASSISTANCE AND ENRICHMENT:
1. Modified vocabulary
2. Appropriate level textbooks
3. Opportunities for retesting
4. Tutorial opportunities
5. Pretest/test previews
6. Extra credit opportunities
7. Study guides/worksheets
8. Collaborative assessment opportunities
9. Alternative modes of assessment

PORTFOLIO DEVELOPMENT:
In order to document achievement and show evidence of improvement in science, students may include selections from the following in their portfolio:
1. Lab reports
2. Scientific writing
3. Projects/presentations
4. Tests/quizzes
5. Demonstrations of scientific method
6. Drawings/models
7. Graphic organizers
8. Collections
9. Evidence of extended learning
10. Science awards

METHODS OF EVALUATION:
1. Essay writing evaluation using Advanced Placement scoring rubric
2. Written tests and quizzes
3. Oral examinations

4. Laboratory reports
5. Notebook evaluations
6. Research reports

INTEGRATED ACTIVITIES:

1. Conceptual frameworks involving major biology themes
   -development of nine core themes utilized in the course through
      a) vocabulary definition and use
      b) class discussions delineating themes
      c) use of technology to illustrate themes (labs and equipment)

2. Communication
   -text reading and discussion
   -other resource readings
   -oral and written responses
   -listening and understanding messages
   -writing for a variety of purposes

3. Thinking/Problem Solving
   -making associations of key concepts and drawing conclusions
   -interpreting data and inferring meaning

4. Application of Knowledge
   -acquire the knowledge base for participation in the A.P. exam
   -computer aided research (areas of genetics)
   -acquire skill to use laboratory instrumentation

5. Interpersonal Skills
   -enrichment participation in A.P. based extra-curricular projects through volunteerism
   -remediation
   -conferencing