AP BIOLOGY STUDENT ESSAY QUESTION
OBJECTIVES

This is a list of questions that cover topics that have been on previous AP Biology Free Response Questions from the last several years.

BASIC CHEMISTRY
1. How do the unique chemical and physical properties of water make life on earth possible?

THE CHEMISTRY OF ORGANIC MOLECULES
2. What is the role of carbon in the molecular diversity of life?
3. How do cells synthesize and break down macromolecules?
4. How do structures of biologically important molecules (carbohydrates, lipids, proteins, nucleic acids) account for their functions?

CELL STRUCTURE AND FUNCTION
5. What are the similarities and differences between prokaryotic and eukaryotic cells?
6. What are the evolutionary relationships between prokaryotic and eukaryotic cells?

MEMBRANE STRUCTURE AND FUNCTION
7. What is the current model of the molecular architecture of membranes?
8. How do variations in this structure account for the functional differences among membranes?
9. How does the structural organization of membranes provide for transport and recognition?
10. What are various mechanisms by which substances cross membranes?
11. How does compartmentalization organize a cell’s functions?
12. How are the structures of the various subcellar organelles related to their functions?
13. How do organelles function together in cellular processes?
14. What factors limit cell size?

METABOLISM: ENERGY AND ENZYMES
15. How do the laws of thermodynamics relate to the biochemical processes that provide energy to living systems?
16. How do enzymes regulate the rate of chemical change?
17. How does the specificity of an enzyme depend on its structure?
18. How is the activity of an enzyme regulated?
19. What is the role of ATP in coupling the cells’ anabolic and catabolic processes?
20. How does chemiosmosis function in bioenergetics?

PHOTOSYNTHESIS
21. How does photosynthesis convert light energy into chemical energy?
22. How are the chemical products of the light trapping reactions coupled to the synthesis of carbohydrates?
23. What kind of photosynthesis adaptations have evolved in response to different environmental conditions?
CELLULAR RESPIRATION
24. How are organic molecules broken down by catabolic pathways?
25. What is the role oxygen in energy-yielding pathways?
26. How do cells generate ATP in the absence of oxygen?
27. What interaction exists between photosynthesis and cellular respiration?

CELLULAR REPRODUCTION AND CELL CYCLE
28. How does the cell cycle assure genetic continuity?
29. How does mitosis allow for the even distribution of genetic information to new cells?
30. What are the mechanisms of cytokinesis?
31. How can aberrations in the cell cycle lead to tumor formation?

MEIOSIS AND SEXUAL REPRODUCTION
32. What features of meiosis are important in sexual reproduction?
33. Why is meiosis important in heredity?
34. How is meiosis related to gametogenesis?
35. What are the similarities and differences between gametogenesis in animals and gametogenesis in plants?

MENDELIAN PATTERNS OF INHERITANCE
36. How did Mendel’s work lay the foundation of modern genetics?
37. What are the principal patterns of inheritance?

CHROMOSOMES AND GENES
38. How is genetic information organized in the eukaryotic chromosome?
39. How does this organization contribute to both continuity of and variability in the genetic information?

HUMAN GENETICS
40. Distinguish between the inheritance of a sex-linked trait, monohybrid trait and that of a dihybrid trait.
41. List and describe the 3 types of inheritance patterns exhibiting autosomal dominant, autosomal recessive and sex-linked categories.

DNA STRUCTURE AND FUNCTION
42. How do the structures of nucleic acids relate to their functions of information storage and protein synthesis?
43. What are the similarities and differences between prokaryotic and eukaryotic genomes?

GENE ACTIVITY: HOW GENES WORK
44. Describe how protein synthesis controls many functions within the cell.

GENOME ORGANIZATION AND REGULATION OF GENE ACTIVITY
45. What are some mechanisms by which gene expression is regulated in prokaryotes and eukaryotes?
46. In what way can genetic information be altered?
47. What are some effects of carcinogens?
BIOTECHNOLOGY
48. What are some current recombinant technologies?
49. What are some practical applications of nucleic acid technology?
50. What legal and ethical problems may arise from these applications?

DARWIN AND EVOLUTION?
51. What is the role of natural selection in the process of evolution?
52. How are heredity and natural selection involved in the process of evolution?
53. What different patterns of evolution have been identified and what mechanisms are responsible for each of these patterns?
54. What types of evidence support an evolutionary view of life?

PROCESS OF EVOLUTION
55. Describe how the Hardy Weinberg Law relates to speciation.
56. What factors work against the Hardy Weinberg Law?
57. Distinguish between macroevolution and microevolution.

ORIGIN AND HISTORY OF LIFE
58. What are the current biological models for the origins of biological macromolecules?
59. What are the current models for the origins of prokaryotic and eukaryotic cells?

BEHAVIOR AND ECOLOGY
60. Distinguish between innate and learned patterns of behavior.

ECOLOGY OF POPULATIONS
61. What models are useful in describing the growth of a population?

COMMUNITY ECOLOGY
62. How is population size regulated by abiotic and biotic factors?
63. How is the energy flow through an ecosystem related to trophic structure (trophic levels)?
64. How do organisms affect the cycling of elements and water through the biosphere?
65. How do biotic and abiotic factors affect community structure and ecosystem function?
66. How do elements (e.g. carbon, nitrogen, phosphorus, sulfur, oxygen) cycle through ecosystems?

ECOSYSTEMS AND HUMAN INTERFERENCES
67. In what ways are humans affecting biogeochemical cycles?

THE BIOSPHERE
68. Describe 3 biomes and the types of factors that limit distribution of organisms in each.
CONVERSATION BIOLOGY
69. Discuss the various causes of extinction of organisms.
70. What are some conversation techniques used to preserve populations?

CLASSIFICATION OF LIVING THINGS
71. What is some evidence that organisms are related to each other?
72. How do scientists study evolutionary relationships among organisms?
73. How is this information used in classification of organisms?

VIRUSES< BACTERIA< AND ARCHAEA
74. What is the structure of viruses?
75. What are the major steps in viral reproduction?
76. How do viruses transfer genetic material between cells?

PROTISTS AND FUNGI
77. What are representative organisms from the Monera, Fungi, and Protista?

PLANTS AND ANIMALS
78. What are representative members of the major animal phyla and plant divisions?
79. What are the distinguishing characteristics of each group (kingdoms and the major phyla and divisions of animals and plants)?

PLANTS
80. What is the adaptive significance of alternation of generations in the major groups of plants?

ANIMAL ORGANIZATION AND HOMEOSTASIS
81. How does the organization of cells, tissues, and organs determine structure and function in plant animal systems?
82. How are structure and function related in the various organ systems?

ANIMAL STRUCTURE AND FUNCTION
83. How do the organ systems of animals interact?
84. What adaptive features have contributed to the success of various plants and animals on land?
85. What are the responses of plants and animals to environmental cues, and how do hormones mediate them?