LAB-AIDS CORRELATIONS TO DISTRICT OF COLUMBIA (DC) SCIENCE STANDARDS[1]

HIGH SCHOOL BIOLOGY

Science and Global Issues: Biology (SGI Biology) is written by the SEPUP group, at the Lawrence Hall of Science, University of California Berkeley, under the direction of Dr. Barbara Nagle, SEPUP Director. Development of *Science and Global Issues Biology* is supported by grants from the National Science Foundation

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1 http://dcps.dc.gov/downloads/TEACHING%20&%20LEARNING/Learning%20Standards%202009/DCPS-SCIENCE-BIOLOGY-STANDARDS.pdf

Science in Global Issues Biology Unit Title	Student Book Pages	Issue Focus
Sustainability	1-46	Aspects of sustainability from a personal, community and global perspective
Ecology: Living on Earth	43-154	Sustainability from an ecosystems perspective, with a focus on humans' impacts on ecosystems Making decisions regarding fisheries management
Cell Biology: World Health	155-258	Disparities between developing and developed countries in terms of diseases' impacts on life Making decisions about priorities for diseases that limit social, economic, and environmental progress
Genetics: Feeding the World	259-412	Comparison of selective breeding and genetic modification Use of genetically modified organisms, particularly in the production of agricultural crops
Evolution: Maintaining Diversity	413-512	Conserving genetic, species and ecosystem diversity Ecosystems services and intrinsic value models for conservation

Key to SEPUP Assessment System:

SEPUP materials include research-based assessment system developed by SEPUP and the Berkeley Evaluation and Assessment Research Group (BEAR) in the University of California Graduate School of Education. Forming the core of the SEPUP Assessment System are the **assessment variables** (content and process skills to be assessed), **assessment questions or tasks** used to gather evidence and **scoring guides** for interpreting students' responses (correspond to assessment variables).

The seven assessment variables are:

Designing Investigations (DI)
Organizing Data (OD)
Analyzing Data (AD)
Understanding Concepts (UC)
Evidence and Trade-offs (ET)
Communication Skills (CS)
Group Interaction (GI)

Types of assessment:

Quick Checks (✔) present opportunities for informal formative assessment and may be used prior to instruction to find out what students know or think. They may also be used to help teachers track students' knowledge of key information or progress in understanding a concept.

Some embedded questions and tasks and all item bank questions are all suitable for summative assessment. Analysis questions are included at the end of each activity.

Citations included in the correlation document are as follows:

5 AQ 1-4 means that the standard or benchmark may be assessed using Analysis Questions 1-4 for Activity 5.

5: AQ 1-4, 5 UC means that in addition to AQ1-4, AQ 5 uses the Understanding Concepts scoring guide for Activity 5.

16 Proc UC means that the procedure (Proc) of Activity 16 contains an embedded task and uses the Understanding Concepts scoring guide.

For more information on program assessment and using SEPUP rubrics, consult the Teacher's Guide, TR part IV.

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STRAND 1 Cell Biology and Bio-Chemistry		
Standard 1 Bio- Chemistry Students should appreciate that Living things are made of atoms bonded together to form molecules, some of the most important of which are large and contain carbon (i.e., "organic" compounds). In order to demonstrate this appreciation students should be able to:		
B.1.1 Describe basic atomic structure using simplified Bohr diagrams to understand the basis of chemical bonding in covalent and ionic bonds.	Not covered	
B.1.2. Describe the structure and unique properties of water and its importance to living things.	Not covered	
B.1.3. Describe the central role of carbon in the chemistry of living things because of its ability to combine in many ways with itself and other elements.	Eco 8	AQ 3 UC
B.1.4. Know that living things are made of molecules largely consisting of carbon, hydrogen, nitrogen, oxygen, phosphorus, and sulfur.	Eco 8, 9 Cell 9 Appendix F	8 AQ 3 UC 9 AQ 3, 6 UC
B.1. 5. Know that living things have many different kinds of molecules, including small ones such as water; midsize ones such as sugars, amino acids, and nucleotides; and large ones such as starches, proteins, and DNA.	Cell 9	9 AQ 3, 6 UC
Standard 2 Cells Students should know that all living things are composed of cells. In order to demonstrate this knowledge students should be able to:		
B.2.1. Describe that all organisms begin their life cycles as a single cell, and in multicellular organisms the products of mitosis of the original zygote form the embryonic body.	Cell 13 Gen 13	13 Proc GI 13 AQ 1-4
B.2.2. Compare and contrast the general anatomy and constituents of prokaryotic and eukaryotic cells and their distinguishing features: Prokaryotic cells do not have a nucleus, and eukaryotic cells do. Know that prokaryotic organisms are classified in the Eubacteria and Archaebacteria Kingdoms	Cell 3, 5, 6	3 AQ 5 UC 5 AQ 2 UC 6 AQ 1 UC

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and that organisms in the other four kingdoms have eukaryotic cells.		
B.2.3. Demonstrate and explain that cell membranes act as highly selective permeable barriers to penetration of substances by diffusion or active transport.	Cell 7, 8, 9	7 AQ 5-6 8 AQ 1&2 UC 9 AQ 3, 5, 6 UC
B.2.4. Explain that some structures in the eukaryotic cell, such as mitochondria, and in plants, such as chloroplasts, have apparently evolved by endosymbiosis (one organism living inside another, to the advantage of both) with early prokaryotes.	Cell 6	AQ 1 UC
B.2.5. Describe that all growth and development of organisms is a consequence of an increase in cell number, size, and/or products.	Cell 3	AQ 5 UC
B.2.6. Explain why communication and/or interaction are required between cells to coordinate their diverse activities.	Cell 6	AQ 1 UC
Standard 3 Reactions of Life Students should know that all the fundamental life processes of a cell are either chemical reactions or molecular interactions. In order to demonstrate this knowledge students should be able to:		
B.3.1. Observe and explain the role of enzymatic catalysis in biochemical processes.	Cell 11	AQ 4 AD
B.3. 2. Understand the function of cellular organelles and how the organelles work together in cellular activities (e.g., enzyme secretion from the pancreas).	Cell 6, 10 Gen 17	6 AQ 1 UC 10 AQ 3 UC 17 Proc GI
B.3. 3. Demonstrate that most cells function best within a narrow range of temperature and pH; extreme changes usually harm cells by modifying the structure of their macromolecules and, therefore, some of their functions.	Cell 4, 6	4 AQ 2 UC 6 AQ 4 UC
B.3. 4. Explain that complex interactions among the different kinds of molecules in the cell cause distinct cycles of activities, such as growth and division.	Cell 10, 13	10 AQ 3 UC. Proc CS 13 Proc GI
B.3. 5. Explain how cell activity in a multicellular plant or animal can be affected by molecules from other parts of the	Cell 6	AQ 4 UC

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organism.		
B.3.6. Explain the photosynthesis process: Plants make simple sugars and other molecules in their leaves, and chlorophyll found in the leaves can make the food and nutrients that the plant can use from carbon dioxide, water, nutrients, and energy from sunlight.	Eco 9 Cell 12	9 AQ 3, 6 UC 12 AQ 8 UC
B.3. 7. Recognize and describe that cellular respiration is important for the production of adenosine triphosphate (ATP), which is the basic energy source for cell metabolism.	Cell 12	AQ 8 UC
Standard 4 Biological Structure and Organization Student should have a clear understanding of the relationships between Biological Structure, Organization and how this impacts functionality. Specifically students should be able to:		
B.4.1. Explain the hierarchical organization of living things from least complex to most complex (subatomic, atomic, molecular, cellular, tissue, organs, organ system, organism, population, community, ecosystem, and biosphere).	Eco 7 Appendix G	7 AQ 2, 3, 4 UC
B.4.2. Observe and describe that within the cell are specialized parts for the transport of materials, energy capture and release, waste disposal, and motion of the whole cell or of its parts.	Cell 6	AQ 4 UC
B.4.3. Describe the organelles that plant and animal cells have in common (e.g., ribosomes, golgi bodies, endoplasmic reticulum) and some that differ (e.g., only plant cells have chloroplasts and cell walls).	Cell 6, 13	6 AQ 4 UC 13 Proc GI
B.4.4. Describe that the work of the cell is carried out by structures made up of many different types of large (macro) molecules that it assembles, such as proteins, carbohydrates, lipids, and nucleic acids.	Cell 10	AQ 3 UC
B.4.5. Explain that a complex network of proteins provides organization and shape to cells.	Cell 10	AQ 3 UC
Standard 5 Chemical Change Students should understand how Chemical Change impacts life. Specifically students should be able to:		

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B.5.1. Explain how layers of energy-rich organic material, mostly of plant origin, have been gradually turned into great coal beds and oil pools by the pressure of the overlying Earth and its internal heat.	Not covered	
STRAND 2 Genetics and Evolution		
Standard 6 Theories of Inheritance Students should be refining their understanding of Theories of Inheritance. Specifically students should be able to:		
B.6. 1. Research and explain the genetic basis for Gregor Mendel's laws of segregation and independent assortment	Gen 5	AQ 3-4
B.6.2. Investigate and describe how a biological classification system that implies degrees of kinship between organisms or species can be deduced from the similarity of their nucleotide (DNA) or amino acids (protein) sequences. Know that such systems often match the completely independent classification systems based on anatomical similarities.	Gen 11	AQ 2-3
B.6.3. Explain how the actions of genes, patterns of inheritance, and the reproduction of cells and organisms account for the continuity of life.	Gen 5, 11	5 AQ 3-4 11 AQ 2-3
B.6.4. Investigate and explain how molecular evidence reinforces and confirms the fossil, anatomical, behavioral, and embryological evidence for evolution, and provides additional detail about the sequence in which various lines of descent branched off from one another.	Evo 5, 6	5 AQ 4-5 6 AQ 2-3
B.6.5. Explain Gregor Mendel's identification of what we now call "genes," how they are sorted in reproduction, and how this led to an understanding of the mechanism of heredity. Understand how the integration of his concept of heredity and the concept of natural selection has led to the modern model of speciation and evolution.	Gen 5 Evo 10, 11, 13	5 AQ 3-4 10 AQ 2, 3 UC 11 AQ 1-4 13 AQ 4-5

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Standard 7 Genetics Students should know that Genes are a set of instructions encoded in the DNA sequence of each organism [responsible for inheritance] and be able to apply this knowledge to problems of inheritance. Specifically students should be able to:		
B.7.1. Describe how the discovery of the structure of DNA by James D. Watson and Francis Crick made it possible to interpret the genetic code on the basis of a nucleotide sequence. Know the important contribution of Rosalind Franklin's data to this discovery (i.e., the careful X-ray crystallography on DNA that provided Watson and Crick the clue they needed to build the correct structure).	Gen 10	AQ 1-4
B.7.2. Explain how hereditary information is passed from parents to offspring in the form of "genes," which are long stretches of DNA consisting of sequences of nucleotides. Explain that in eukaryotes, the genes are contained in chromosomes, which are bodies made up of DNA and various proteins.	Gen 10, 12	10 AQ 1-4 12 AQ 1 UC
B.7.3. Know every species has its own characteristic DNA sequence.	Gen 10, 11	10 AQ 1-4 11 AQ 1-3
B.7.4. Explain how biological evolution is also supported by the discovery that the genetic code found in DNA is the same for almost all organisms.	Gen 10, 11 Evo 13	10 AQ 1-4 11 AQ 1-3 13 AQ 1-4
B.7.5. Differentiate between the functions of mitosis and meiosis. Mitosis is a process by which a cell divides into each of two daughter cells, each of which has the same number of chromosomes as the original cell. Meiosis is a process of cell division in organisms that reproduce sexually, during which the nucleus divides eventually into four nuclei, each of which contains half the usual number of chromosomes.	Cell 13 Gen 13	13 Proc GI 13 AQ 1-4
B.7.6. Explain how zygotes are produced in the fertilization process.	Gen 13	AQ 1-4

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Standard 8 Structure and Function of Genes Students should know that Genes specify the sequence of amino acids in proteins characteristic of that organism and how this impacts their functionality. Specifically students should be able to:		
B.8.1. Explain the flow of information is usually from DNA to RNA, and then to protein.	Gen 16	Proc UC
B.8.2. Explain how the genetic information in DNA molecules provides the basic form of instructions for assembling protein molecules and that this mechanism is the same for all life forms.	Gen 16	Proc UC
B.8.3. Understand and explain that specialization of cells is almost always due to different patterns of gene expression, rather than differences in the genes themselves.	Gen 17	AQ 1-7
Standard 9 Biodiversity Students should understand Biodiversity as the result of genetic changes. Specifically students should be able to:		
B.9.1. Understand and describe how inserting, deleting, or substituting short stretches of DNA alters a gene. Recognize that changes (mutations) in the DNA sequence in or near a specific gene may (or may not) affect the sequence of amino acids in the encoded protein or the expression of the gene.	Gen 12	AQ 1 UC
B.9.2. Explain the mechanisms of genetic mutations and chromosomal recombinations, and when and how they are passed on to offspring.	Gen 12, 13	12 AQ 1 UC 13 AQ 1-3
B.9.3. Explain how the sorting and recombination of genes in sexual reproduction result in a vast variety of potential allele combinations in the offspring of any two parents.	Gen 13	AQ 1-3
B.9.4. Explain that genetic variation can occur from such processes as crossing over,	Gen 13, 14	13 AQ 1-3 14 AQ 1 UC

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jumping genes, and deletion and duplication of genes.		
Standard 10 Evolution Students should be cognizant of the Theory of Evolution. Specifically students should be able to:		
B.10.1. Describe how life on Earth is thought to have begun as one or a few simple one-celled organisms about 3.5 billion years ago, and that during the first 2 billion years, only single-cell microorganisms existed. Know that, once cells with nuclei developed about a billion years ago, increasingly complex multicellular organisms could evolve.	Evo 3	AQ 1 UC, CS
B.10.2. Explain that prior to the theory first offered by Charles Darwin and Alfred Wallace, the universal belief was that all known species had been created de novo at about the same time and had remained unchanged.	Evo 4	AQ 1-4
B.10.3. Research and explain that Darwin argued that only biologically inherited characteristics could be passed on to offspring, and that some of these characteristics would be different from the average and advantageous in surviving and reproducing; over generations, accumulation of these inherited advantages would lead to a new species.	Evo 4	AQ 1-4
B.10.4. Explain that evolution builds on what already exists, so the more variety there is, the more there can be in the future.	Evo 11, 12	11 AQ 1-4 12 AQ 1-4
Standard 11 Environment al Impact on Evolution Students should appreciate Evolution as the result of genetic changes that occur in constantly changing environments. Specifically students should be able to:		
B.11.1. Explain how a large diversity of species increases the chance that at least some living things will survive in the face of large or even catastrophic changes in the environment.	Evo 1, 13	1 AQ 5-6 13 AQ 4-5
B.11.2. Research and explain how natural selection provides a mechanism for evolution and leads to organisms that are	Evo 12	12 AQ 1-4

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optimally suited for survival in particular environments.		
B.11.3. Explain that biological diversity, episodic speciation, and mass extinction are depicted in the fossil record, comparative anatomy, and other evidence.	Evo 3, 6	3 AQ 1 UC 6 AQ 1-3
STRAND 3 Multicellular Organisms: Plants and Animals		
Standard 12 The Plant Kingdom Students should be aware of the unique Biology of The Plant Kingdom. Specifically students should be able to:		
B.12. 1. Describe the structure and function of roots, leaves, flowers, and stems of plants.	Not covered	
B.12.2. Know that about 250,000 species of flowering plants have been identified.	Not covered	
B.12.3. Explain that during the process of photosynthesis, plants release oxygen into the air.	Evo 9 Cell 12	9 AQ 1 ET 12 AQ 1 UC
B.12.4. Recognize that plants have a greater problem with "unpredictable environments" because they cannot seek shelter as many animals can.	Not covered	
Standard 13 Plant and Animal Interactions Students should develop an understanding of Plant and animal interactions and be aware that Plants are essential to animal life on Earth. Specifically students should be able to:		
B.13.1. Identify the roles of plants in the ecosystem: Plants make food and oxygen, provide habitats for animals, make and preserve soil, and provide thousands of useful products for people (e.g., energy, medicines, paper, resins).	Eco 6, 9	6 Proc GI 9 Proc GI
B.13.2. Describe that plants have broad patterns of behavior that have evolved to ensure reproductive success, including co-evolution with animals that distribute a plant's pollen and seeds.	Not covered	
Standard 14 Mammals Students should understand how biological Systems function in the mammalian Body. Specifically students should be able to:		

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B.14. 1. Explain the major systems of the mammalian body (digestive, respiratory, reproductive, circulatory, excretory, nervous, endocrine, integumentary, immune, skeletal, and muscular) and how they interact with each other.	Not covered	
Standard 15 Homeostasis Students should be introduced to Homeostasis using Homeostasis in the Mammalian Body. This can be understood as a result of the coordinated structures and functions of organ systems, the internal environment of the mammalian body remains relatively stable (homeostatic), despite changes in the outside environment. Specifically students should be able to:		
B.15.1. Analyze the complementary activity of major body systems, such as how the respiratory and circulatory systems provide cells with oxygen and nutrients, and remove toxic waste products such as carbon dioxide.	Not covered	
B.15.2. Explain how the nervous system mediates communication between different parts of the body and the environment.	Not covered	
B.15.3. Describe that the nervous and endocrine systems maintain overall regulation of optimal conditions within the body by chemical communication.	Not covered	
B.15.4. Investigate and cite specific examples of how the mammalian immune system is designed to protect against microscopic organisms and foreign (or nonself) substances from outside the body and against some aberrant (e.g., cancer) cells that arise within.	Cell 3.1, 8.1, 13.1 Case studies – tuberculosis, HIV/AIDS, cancer	3 AQ 5 UC 8 AQ 1, 2 AD 13 Proc GI
STRAND 4 Ecosystems		
Standard 16 Classification of Systems Students should understand Classification in systems. Specifically students should be able to:		
B.16.1. Using ecological studies, explain distinct relationships and differences between urban environments and other environmental systems	Eco 1, 4	1 Proc GI 4 AQ 4 ET

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Standard 17 Dynamics of Ecosystems Students should understand Ecosystems as dynamic systems. Specifically students should be able to:		
B.17. 1. Illustrate and describe the cycles of biotic and abiotic factors (matter, nutrients, energy) in an ecosystem.	Eco 7, 8	7 AQ 2, 3, 4 UC 8 AQ 3 UC
B.17. 2. Describe how factors in an ecosystem, such as the availability of energy, water, oxygen, and minerals, and the ability to recycle the residue of dead organic materials, cause fluctuations in population sizes.	Eco 14, 15	14 AQ 7-9 15 Proc OD
B.17. 3. Explore and explain how changes in population size have an impact on the ecological balance of a community and how to analyze the effects.	Eco 14, 15	14 AQ 7-9 15 Proc OD
B.17. 4. Describe how the physical or chemical environment may influence the rate, extent, and nature of the way organisms develop within ecosystems.	Eco 5, 17	5 AQ 6 ET 17 AQ 1, 2 UC
Standard 18 Stability of Dynamic Systems Students should understand Stability in ecosystems as a specific example of stability in Systems of dynamic equilibrium. Specifically students should be able to:		
B.18. 1. Describe how ecosystems can be reasonably stable over hundreds or thousands of years.	Eco 16, 17	16 AQ 5 AD, AQ 1 UC 17 AQ 1, 2 UC
B.18. 2. Explain that ecosystems tend to have cyclic fluctuations around a state of rough equilibrium, and change results from shifts in climate, natural causes, human activity, or when a new species or non-native species appears.	Eco 16, 17	16 AQ 5 AD, AQ 1 UC 17 AQ 1, 2 UC
Standard 19 Pollution Students should understand the effects of Pollution and other Environmental challenges and their longer term consequences. Specifically students should be able to:		
B.19.1. Investigate and describe how point and nonpoint source pollution can affect the health of a bay's watershed and wetlands.	Eco 1, Case study 1: Crab Jubilee	Proc GI
B.19.2. Assess the method for monitoring and safeguarding water quality, including	Eco 1, also local standard	Proc GI

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local waterways such as the Anacostia and Potomac rivers, and know that macroinvertebrates can be early warning signs of decreasing water quality.		