Virginia Science

Biology

The student will demonstrate an understanding of scientific and engineering practices by: BIO.1

a asking questions and defining problems BIO.1.A

i. ask questions that arise from careful observation of phenomena and/or organisms, from examining models and theories, and/or to seek additional information BIO.1.A.I

ii. determine which questions can be investigated within the scope of the school laboratory or field to determine relationships between independent and dependent variables BIO.1.A.II

iii. generate hypotheses based on research and scientific principles BIO.1.A.III

iv. make hypotheses that specify what happens to a dependent variable when an independent variable is manipulated BIO.1.A.IV

b planning and carrying out investigations BIO.1.B

i. individually and collaboratively plan and conduct observational and experimental investigations BIO.1.B.I

ii. plan and conduct investigations or test design solutions in a safe and ethical manner including considerations of environmental, social, and personal effects BIO.1.B.II

iii. determine appropriate sample size and techniques BIO.1.B.III

iv. select and use appropriate tools and technology to collect, record, analyze, and evaluate data BIO.1.B.IV

c interpreting, analyzing, and evaluating data BIO.1.C

i. construct and interpret data tables showing independent and dependent variables, repeated trials, and means BIO.1.C.I

ii. construct, analyze, and interpret graphical displays of data BIO.1.C.II

iii. use data in building and revising models, supporting an explanation for phenomena, or testing solutions to problems BIO.1.C.III

iv. analyze data using tools, technologies, and/or models to make valid and reliable scientific claims or determine an optimal design solution BIO.1.C.IV

d constructing and critiquing conclusions and explanations BIO.1.D

i. make quantitative and/or qualitative claims regarding the relationship between dependent and independent variables BIO.1.D.I

ii. construct and revise explanations based on valid and reliable evidence obtained from a variety of sources including students' own investigations, models, theories, simulations, and peer review BIO.1.D.II

iii. apply scientific ideas, principles, and/or evidence to provide an explanation of phenomena and design solutions BIO.1.D.III

iv. compare and evaluate competing arguments or design solutions in light of currently accepted explanations and new scientific evidence BIO.1.D.IV

v. construct arguments or counterarguments based on data and evidence BIO.1.D.V

vi. differentiate between a scientific hypothesis and theory BIO.1.D.VI

e developing and using models BIO.1.E

i. evaluate the merits and limitations of models BIO.1.E.I

ii. develop, revise, and/or use models based on evidence to illustrate or predict relationships BIO.1.E.II

iii. develop and/or use models to generate data to support explanations, predict phenomena, analyze systems, and/or solve problems BIO.1.E.III

f obtaining, evaluating, and communicating information BIO.1.F

i. compare, integrate, and evaluate sources of information presented in different media or formats to address a scientific question or solve a problem BIO.1.F.I

ii. gather, read, and evaluate scientific and/or technical information from multiple authoritative sources, assessing the evidence and credibility of each source BIO.1.F.II

iii. communicate scientific and/or technical information about phenomena in multiple formats BIO.1.F.III

The student will investigate and understand that chemical and biochemical processes are essential for life. Key ideas include: BIO.2

A water chemistry has an influence on life processes; BIO.2.A

b macromolecules have roles in maintaining life processes; BIO.2.B

C enzymes have a role in biochemical processes; BIO.2.C

d protein synthesis is the process of forming proteins which influences inheritance and evolution; and BIO.2.D

e the processes of photosynthesis and respiration include the capture, storage, transformation, and flow of energy. BIO.2.E

The student will investigate and

a the cell theory is supported by evidence; BIO.3.A

understand that cells have structure and function. Key ideas include: BIO.3	b structures in unicellular and multicellular organisms work interdependently to carry out life processes; BIO.3.B
	C cell structures and processes are involved in cell growth and division; BIO.3.C
	d the structure and function of the cell membrane support cell transport; and BIO.3.D
	e specialization leads to the development of different types of cells. BIO.3.E
The student will investigate and understand that bacteria and viruses have an effect on living systems. Key ideas include: BIO.4	a viruses depend on a host for metabolic processes; BIO.4.A
	b the modes of reproduction/replication can be compared; BIO.4.B
	c the structures and functions can be compared; BIO.4.C
	d bacteria and viruses have a role in other organisms and the environment; and BIO.4.D
	e the germ theory of infectious disease is supported by evidence. BIO.4.E
The student will investigate and understand that there are common mechanisms for inheritance. Key ideas include: BIO.	a DNA has structure and is the foundation for protein synthesis; BIO.5.A
	b the structural model of DNA has developed over time; BIO.5.B
	c the variety of traits in an organism are the result of the expression of various combinations of alleles; BIO.5.C
	d meiosis has a role in genetic variation between generations; and BIO.5.D
	e synthetic biology has biological and ethical implications. BIO.5.E
The student will investigate and understand that modern classification systems can be used as organizational tools for scientists in the study of organisms. Key ideas include: BIO.6	A organisms have structural and biochemical similarities and differences; BIO.6.A
	b fossil record interpretation can be used to classify organisms; BIO.6.B
	c developmental stages in different organisms can be used to classify organisms; BIO.6.C
	Dad Archaea, Bacteria, and Eukarya are domains based on characteristics of organisms; BIO.6.D
	e the functions and processes of protists, fungi, plants, and animals allow for comparisons and differentiation within the Eukarya kingdoms; and BIO.6.E
	f systems of classification are adaptable to new scientific discoveries. BIO.6.F
The student will investigate and	A evidence is found in fossil records and through DNA analysis; BIO.7.A

understand that populations change through time. Key ideas include: BIO.7	b genetic variation, reproductive strategies, and environmental pressures affect the survival of populations; BIO.7.B
	c natural selection is a mechanism that leads to adaptations and may lead to the emergence of new species; and BIO.7.C
	d biological evolution has scientific evidence and explanations. BIO.7.D
The student will investigate and understand that there are dynamic equilibria within populations, communities, and ecosystems. Key ideas include: BIO.8	a interactions within and among populations include carrying capacities, limiting factors, and growth curves; BIO.8.A
	b nutrients cycle with energy flow through ecosystems; BIO.8.B
	c ecosystems have succession patterns; and BIO.8.C
	d natural events and human activities influence local and global ecosystems and may affect the flora and fauna of Virginia. BIO.8.D