Conneaut School District – Grade 11 Biology 1 Curriculum Map

Revised August 2010 to:

- reflect standards and "big ideas" as outlined in the Pennsylvania Department of Education Standards Aligned System curriculum framework for biology

http://www.pdesas.org/module/sas/curriculumframework/

- correlate with Keystone Exam Assessment Anchors and Eligible Content

https://mail.conneautsd.org/owa/redir.aspx?C=e203649b6bcc446991d3d340afc76eda&URL=http%3a%2f%2fstatic.pdesas.org%2fContent%2fDocuments%2fKeystone_Content_Module_Standard_Blueprint_Biology_03-22_update.pdf

- include Essential Vocabulary

http://www.portal.state.pa.us/portal/server.pt?open=512&objID=4228&&PageID=440540&mode=2&subject=DA_1008467&ContentArea=DA_1007469

I. Organisms share common characteristics of life.

- ➔ suggested material: Miller Levine Biology, Chapter 1
- ➔ suggested websites:
- ➔ suggested activities:

Essential Question: *How do we know if something is alive?*

Concepts

A. Organisms are made up of simpler units called cells.

B. Organisms need light and/or chemicals to make cellular protoplasm.

C. Organisms obtain and use energy through photosynthesis or cellular respiration to carry out their life processes.

D. Organisms release waste chemicals produced by cells.

E. Organisms seek to maintain homeostasis at all biological levels of organization.

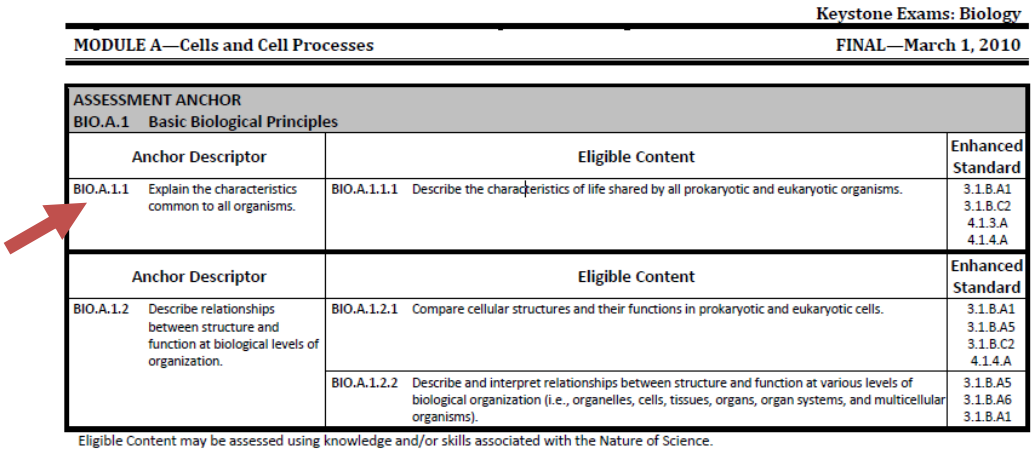
F. Organisms grow, develop and eventually die.

G. Organisms can reproduce their own kind using DNA.

H. Organisms adapt to changes in their environments.

Competencies Standards (Anchors) / Eligible Content

1) Provide examples for when it is correct to use the terms scientific principle, scientific theory, scientific law, fact, and belief.
   - S11.A.1.1.1, S11.A.1.1.2, S11.A.1.1.4
2) Pose questions and provide evidence-based explanations about understanding and observations of biological phenomena and processes.
   - S11.A.1.1.3, S11.A.1.1.5, S11.A.1.2.1, S11.A.1.3.1, S11.B.2.2.1, S11.B.2.2.2, S11.B.2.2.3
3) Select and use appropriate tools and techniques when designing and conducting experiments related to the biological sciences and then communicate an analysis of the findings using various types of media.
   - S11.A.1.1.4, S11.A.1.3.1, S11.A.2.2.1, S11.A.2.2.2, S11.A.3.1.1



Keystone Exams: Biology

MODULE A—Cells and Cell Processes — FINAL—March 1, 2010

ASSESSMENT ANCHOR
BIO.A.1 Basic Biological Principles

Anchor Descriptor	Eligible Content	Enhanced Standard
BIO.A.1.1 Explain the characteristics common to all organisms.	BIO.A.1.1.1 Describe the characteristics of life shared by all prokaryotic and eukaryotic organisms.	3.1.B.A1 3.1.B.C2 4.1.3.A 4.1.4.A

Anchor Descriptor	Eligible Content	Enhanced Standard
BIO.A.1.2 Describe relationships between structure and function at biological levels of organization.	BIO.A.1.2.1 Compare cellular structures and their functions in prokaryotic and eukaryotic cells.	3.1.B.A1 3.1.B.A5 3.1.B.C2 4.1.4.A
	BIO.A.1.2.2 Describe and interpret relationships between structure and function at various levels of biological organization (i.e., organelles, cells, tissues, organs, organ systems, and multicellular organisms).	3.1.B.A5 3.1.B.A6 3.1.B.A1

Eligible Content may be assessed using knowledge and/or skills associated with the Nature of Science.

II. Life emerges due to the chemical organization of matter into cells.

- ➔ suggested material: Miller Levine Biology, Chapter 2
- ➔ suggested websites:
- ➔ suggested activities:

Essential Question: *How does life result from chemical structure and function?*

Concepts

A. Cells function as microscopic chemical factories synthesizing and degrading biological molecules necessary for life.

B. Liquid water forms hydrogen bonds, is a solvent, and forms hydronium ions allowing a wide range of biochemical reactions to occur.

C. Biological molecules produced by a cell can be used by the cell or transported outside for use by other cells.

D. Cells are composed mostly of: C, H, N, O, P, and S.

E. Carbon rings and chains form the backbone of all biological molecules.

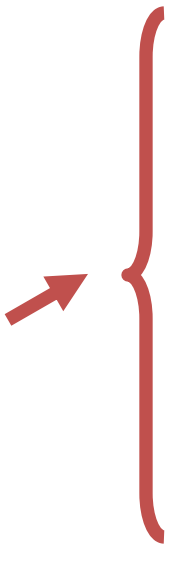
F. Many biological molecules are polymers made from monomers that contain carbon chemically bound with other elements.

G. Carbohydrates, lipids, proteins, and nucleic acids are the chemical foundations for life.

H. Molecular structure is related to function.

Competencies Standards (Anchors) / Eligible Content

1) Provide examples for when it is correct to use the terms scientific principle, scientific theory, scientific law, fact, and belief.
   - S11.A.1.1.1, S11.A.1.1.2, S11.A.1.1.4
2) Pose questions and provide evidence-based explanations about understanding and observations of biological phenomena and processes.
   - S11.A.1.1.3, S11.A.1.1.5, S11.A.1.2.1, S11.A.1.3.1, S11.B.2.2.1, S11.B.2.2.2, S11.B.2.2.3
3) Select and use appropriate tools and techniques when designing and conducting experiments related to the biological sciences and then communicate an analysis of the findings using various types of media.
   - S11.A.1.1.4, S11.A.1.3.1, S11.A.2.2.1, S11.A.2.2.2, S11.A.3.1.1
4) Identify and describe various ways models are used to explain, interpret, and predict, biological phenomena/systems.
   - S11.A.3.2.1, S11.A.3.2.2, S11.A.3.2.3



ASSESSMENT ANCHOR
BIO.A.2 The Chemical Basis for Life

Anchor Descriptor	Eligible Content	Enhanced Standard
BIO.A.2.1 Describe how the unique properties of water support life on Earth.	BIO.A.2.1.1 Describe the unique properties of water and how these properties support life on Earth (e.g., freezing point, high specific heat, cohesion).	3.1.B.A8 3.1.B.A5 4.2.5.C
Anchor Descriptor	**Eligible Content**	**Enhanced Standard**
BIO.A.2.2 Describe and interpret relationships between structure and function at various levels of biochemical organization (i.e., atoms, molecules, and macromolecules).	BIO.A.2.2.1 Explain how carbon is uniquely suited to form biological macromolecules.	3.1.B.A7 3.2.C.A2
	BIO.A.2.2.2 Describe how biological macromolecules form from monomers.	3.1.B.A7 3.1.B.A8 3.1.B.A2 3.1.C.A2 3.1.C.A7
	BIO.A.2.2.3 Compare the structure and function of carbohydrates, lipids, proteins, and nucleic acids in organisms.	3.1.B.A7 3.1.B.A2 3.1.C.A2 3.1.C.A7
Anchor Descriptor	**Eligible Content**	**Enhanced Standard**
BIO.A.2.3 Explain how enzymes regulate biochemical reactions within a cell.	BIO.A.2.3.1 Describe the role of an enzyme as a catalyst in regulating a specific biochemical reaction.	3.1.B.A2 3.1.B.A7
	BIO.A.2.3.2 Explain how factors such as pH, temperature, and concentration levels can affect enzyme function.	3.1.B.A2 3.1.B.A7

Eligible Content may be assessed using knowledge and/or skills associated with the Nature of Science.

III. Cells have organized structures and systems necessary to support chemical reactions needed to maintain the living condition.

- ➔ suggested material: Miller Levine Biology, Chapter 7
- ➔ suggested websites:
- ➔ suggested activities:

Essential Question: *How does life result from cellular structure and function?*

Concepts

A. Cells are the basic unit of structure and function for all living things.

B. Cells occur in two basic forms: Prokaryotes (Bacteria and Archaea) and Eukaryotes (all other cells).

C. A cell's interior is separated or compartmentalized from the environment by a phospholipid bilayer plasma membrane.

D. The cytoplasm contains a collection of connected, internal membranous sacs that divide the cytoplasm into functional and structural compartments or organelles.

E. Chemical reactions and processes necessary for life are carried out in cytoplasm or organelles within a eukaryotic cell's protoplasm.

F. Structure is related to function at the cellular and organelle levels of biological organization.

G. Cells come only from the division of a pre-existing cell.

Competencies Standards (Anchors) / Eligible Content

1) Cite examples of how structure is related to function at all biological levels of organization.
   - S11.B.1.1.1, S11.B.2.2.3
2) Pose questions and provide evidence-based explanations about understanding and observations of biological phenomena and processes.
   - S11.A.1.1.3, S11.A.1.1.5, S11.A.1.2.1, S11.A.1.3.1, S11.B.2.2.1, S11.B.2.2.2, S11.B.2.2.3
3) Select and use appropriate tools and techniques when designing and conducting experiments related to the biological sciences and then communicate an analysis of the findings using various types of media.
   - S11.A.1.1.4, S11.A.1.3.1, S11.A.2.2.1, S11.A.2.2.2, S11.A.3.1.1
4) Identify and describe various ways models are used to explain, interpret, and predict, biological phenomena/systems.
   - S11.A.3.2.1, S11.A.3.2.2, S11.A.3.2.3

ASSESSMENT ANCHOR
BIO.A.4 Homeostasis and Transport

Anchor Descriptor	Eligible Content	Enhanced Standard
BIO.A.4.1 Identify and describe the cell structures involved in transport of materials into, out of, and throughout a cell.	BIO.A.4.1.1 Describe how the structure of the plasma membrane allows it to function as a regulatory structure and/or protective barrier for a cell.	3.1.B.A5 3.1.B.A2 3.1.B.A4 3.1.B.A7 3.2.C.A1 3.2.P.B6
	BIO.A.4.1.2 Compare the mechanisms that transport materials across the plasma membrane (i.e., passive transport—diffusion, osmosis, facilitated diffusion; and active transport—pumps, endocytosis, exocytosis).	3.1.B.A5 3.1.B.A2 3.1.B.A7 3.2.C.A1 3.2.P.B6
	BIO.A.4.1.3 Describe how membrane-bound cellular organelles (e.g., endoplasmic reticulum, Golgi apparatus) facilitate the transport of materials within a cell.	3.1.B.A5 3.1.B.A2
Anchor Descriptor	**Eligible Content**	**Enhanced Standard**
BIO.A.4.2 Explain mechanisms that permit organisms to maintain biological balance between their internal and external environments.	BIO.A.4.2.1 Explain how organisms maintain homeostasis (e.g., thermoregulation, water regulation, oxygen regulation).	3.1.B.A8 3.1.B.A5 4.5.4.D 4.2.4.C

Eligible Content may be assessed using knowledge and/or skills associated with the Nature of Science.

IV. Structure is related to function at all biological levels of organization.

- ➔ suggested material: Miller Levine Biology, Chapter 7; Chapter 18
- ➔ suggested websites:
- ➔ suggested activities:

Essential Question: *How is structure related to function at all biological levels of organization?*

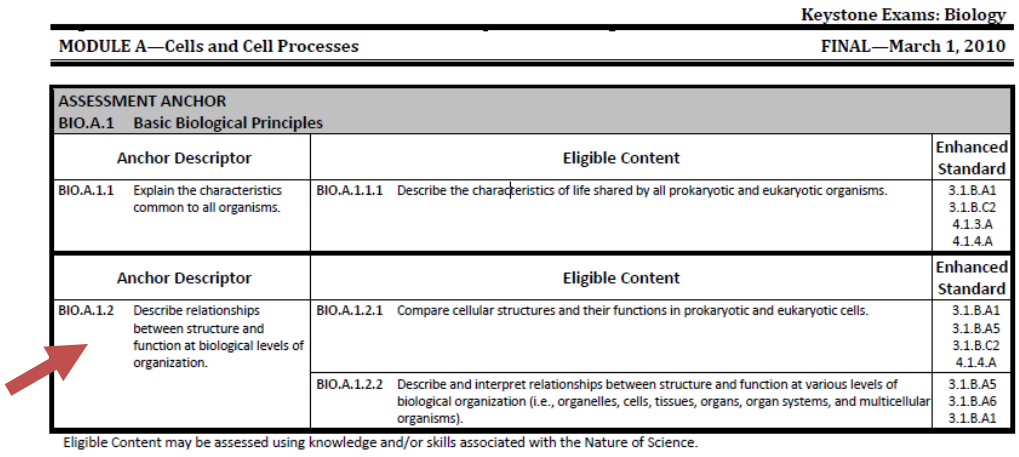
Concepts

A. Biological levels of organization from smallest to largest include: atoms, molecules, organelles, cells, tissues, organs, organ systems, multicellular organisms, populations, and communities.

B. The pattern of form following function is reflected at all biological levels of organization.

Competencies Standards (Anchors) / Eligible Content

1) Cite examples of how structure is related to function at all biological levels of organization.
   - S11.B.1.1.1, S11.B.2.2.3
2) Compare and contrast the structural and functional similarities and differences among living things.
   - S11.B.1.1.2
3) Pose questions and provide evidence-based explanations about understanding and observations of biological phenomena and processes.
   - S11.A.1.1.3, S11.A.1.1.5, S11.A.1.2.1, S11.A.1.3.1, S11.B.2.2.1, S11.B.2.2.2, S11.B.2.2.3
4) Select and use appropriate tools and techniques when designing and conducting experiments related to the biological sciences and then communicate an analysis of the findings using various types of media.
   - S11.A.1.1.4, S11.A.1.3.1, S11.A.2.2.1, S11.A.2.2.2, S11.A.3.1.1
5) Identify and describe various ways models are used to explain, interpret, and predict, biological phenomena/systems.
   - S11.A.3.2.1, S11.A.3.2.2, S11.A.3.2.3



Keystone Exams: Biology

MODULE A—Cells and Cell Processes FINAL—March 1, 2010

ASSESSMENT ANCHOR BIO.A.1 Basic Biological Principles		
Anchor Descriptor	Eligible Content	Enhanced Standard
BIO.A.1.1 Explain the characteristics common to all organisms.	BIO.A.1.1.1 Describe the characteristics of life shared by all prokaryotic and eukaryotic organisms.	3.1.B.A1 3.1.B.C2 4.1.3.A 4.1.4.A
Anchor Descriptor	Eligible Content	Enhanced Standard
BIO.A.1.2 Describe relationships between structure and function at biological levels of organization.	BIO.A.1.2.1 Compare cellular structures and their functions in prokaryotic and eukaryotic cells.	3.1.B.A1 3.1.B.A5 3.1.B.C2 4.1.4.A
	BIO.A.1.2.2 Describe and interpret relationships between structure and function at various levels of biological organization (i.e., organelles, cells, tissues, organs, organ systems, and multicellular organisms).	3.1.B.A5 3.1.B.A6 3.1.B.A1

Eligible Content may be assessed using knowledge and/or skills associated with the Nature of Science.

V. Through a variety of mechanisms organisms seek to maintain a biological balance between their internal and external environments.

- ➔ suggested material: Miller Levine Biology, Chapter 7, Chapter 18
- ➔ suggested websites:
- ➔ suggested activities:

Essential Question: *How do organisms maintain a biological balance between their internal and external environments?*

Concepts

A. Homeostasis dynamically returns biological changes (body temperature, osmolarity, blood pressure, pH, blood glucose, etc.) to balance by modifying chemical reactions, adjusting energy transformations, and responding to environmental changes.

B. Molecules, ions and water move in and out of the cell through a variety of mechanisms.

C. Passive transport depends on the diffusion of substances with a concentration gradient moving across a membrane from an area of higher concentration to an area of lesser concentration without energy.

D. Both passive and facilitated diffusion move materials along a concentration gradient without energy.

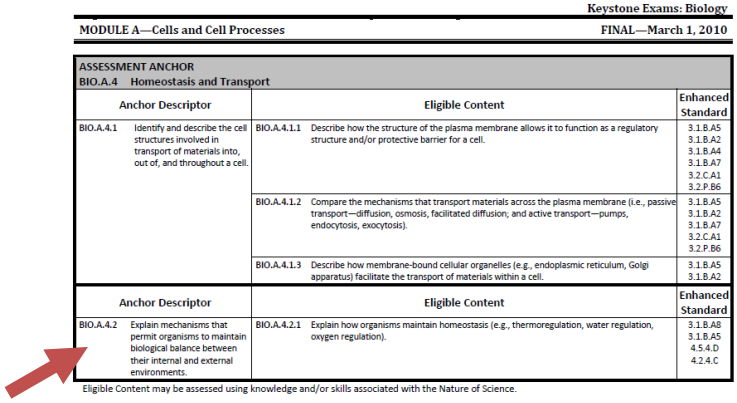
E. Osmosis is the diffusion of water from an area of lower solute concentration (more aqueous solution) across a membrane to an area higher solute concentration (less aqueous solution).

F. Active transport moves atoms, ions and small molecule mostly against a concentration gradient and requires an expenditure of energy.

G. Active transport of larger substances and subcellular structures occurs through endocytosis and exocytosis.

Competencies Standards (Anchors) / Eligible Content

1) Provide examples for when it is correct to use the terms scientific principle, scientific theory, scientific law, fact, and belief.
    - S11.A.1.1.1, S11.A.1.1.2, S11.A.1.1.4
2) Pose questions and provide evidence-based explanations about understanding and observations of biological phenomena and processes.
    - S11.A.1.1.3, S11.A.1.1.5, S11.A.1.2.1, S11.A.1.3.1, S11.B.2.2.1, S11.B.2.2.2, S11.B.2.2.3
3) Select and use appropriate tools and techniques when designing and conducting experiments related to the biological sciences and then communicate an analysis of the findings using various types of media.
    - S11.A.1.1.4, S11.A.1.3.1, S11.A.2.2.1, S11.A.2.2.2, S11.A.3.1.1
4) Identify and describe various ways models are used to explain, interpret, and predict, biological phenomena/systems.
    - S11.A.3.2.1, S11.A.3.2.2, S11.A.3.2.3



ASSESSMENT ANCHOR BIO.A.4 Homeostasis and Transport			
Anchor Descriptor		**Eligible Content**	**Enhanced Standard**
BIO.A.4.1	Identify and describe the cell structures involved in transport of materials into, out of, and throughout a cell.	BIO.A.4.1.1 Describe how the structure of the plasma membrane allows it to function as a regulatory structure and/or protective barrier for a cell.	3.1.B.A5 3.1.B.A2 3.1.B.A4 3.1.B.A7 3.2.C.A1 3.2.P.B6
		BIO.A.4.1.2 Compare the mechanisms that transport materials across the plasma membrane (i.e., passive transport—diffusion, osmosis, facilitated diffusion; and active transport—pumps, endocytosis, exocytosis).	3.1.B.A5 3.1.B.A2 3.1.B.A7 3.2.C.A1 3.2.P.B6
		BIO.A.4.1.3 Describe how membrane-bound cellular organelles (e.g., endoplasmic reticulum, Golgi apparatus) facilitate the transport of materials within a cell.	3.1.B.A5 3.1.B.A2
Anchor Descriptor		**Eligible Content**	**Enhanced Standard**
BIO.A.4.2	Explain mechanisms that permit organisms to maintain biological balance between their internal and external environments.	BIO.A.4.2.1 Explain how organisms maintain homeostasis (e.g., thermoregulation, water regulation, oxygen regulation).	3.1.B.A8 3.1.B.A5 4.5.4.D 4.2.4.C

Eligible Content may be assessed using knowledge and/or skills associated with the Nature of Science.

VI. Organisms obtain and use energy to carry out their life processes.

- ➔ suggested material: Miller Levine Biology, Chapters 8 & 9
- ➔ suggested websites:
- ➔ suggested activities:

Essential Question: *How do different organisms obtain and use energy to survive in their environment?*

Concepts

A. Forms of energy are required to maintain life.

B. The energy flow of biochemical reactions is governed by the physical laws of thermodynamics.

C. Most biochemical reactions require an input of energy.

D. Photosynthesis is the process that transforms light energy into potential chemical energy.

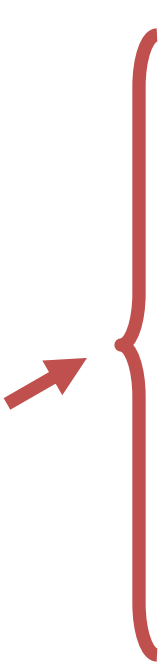
E. Cellular respiration is the process by which potential chemical energy in the bonds of glucose is transformed into potential chemical energy in the bonds of ATP.

F. ATP molecules store usable chemical energy to drive life processes through coupled reactions.

G. Glycolysis is the foundation of both aerobic and anaerobic respiration. Glycolysis, through anaerobic respiration, is the main energy source in many prokaryotes.

Competencies Standards (Anchors) / Eligible Content

1) Describe the flow of energy through living systems.
   - S11.A.1.3.2, S11.C.2.1.2
2) Pose questions and provide evidence-based explanations about understanding and observations of biological phenomena and processes.
   - S11.A.1.1.3, S11.A.1.1.5, S11.A.1.2.1, S11.A.1.3.1, S11.B.2.2.1, S11.B.2.2.2, S11.B.2.2.3
3) Select and use appropriate tools and techniques when designing and conducting experiments related to the biological sciences and then communicate an analysis of the findings using various types of media.
   - S11.A.1.1.4, S11.A.1.3.1, S11.A.2.2.1, S11.A.2.2.2, S11.A.3.1.1
4) Identify and describe various ways models are used to explain, interpret, and predict, biological phenomena/systems.
   - S11.A.3.2.1, S11.A.3.2.2, S11.A.3.2.3



ASSESSMENT ANCHOR BIO.A.3 Bioenergetics		
Anchor Descriptor	**Eligible Content**	**Enhanced Standard**
BIO.A.3.1 Identify and describe the cell structures involved in processing energy.	BIO.A.3.1.1 Describe the fundamental roles of plastids (e.g., chloroplasts) and mitochondria in energy transformations.	3.1.B.A2 3.1.B.A5 3.1.C.A1
Anchor Descriptor	**Eligible Content**	**Enhanced Standard**
BIO.A.3.2 Identify and describe how organisms obtain and transform energy for their life processes.	BIO.A.3.2.1 Compare the basic transformation of energy during photosynthesis and cellular respiration.	3.1.B.A2 3.1.B.A5 3.1.C.A1 4.1.10.C
	BIO.A.3.2.2 Describe the role of ATP in biochemical reactions.	3.1.B.A2 3.1.C.A1 3.1.C.A2

Eligible Content may be assessed using knowledge and/or skills associated with the Nature of Science.

VII. New cells arise from the division of pre-existing cells.

- ➔ suggested material: Miller Levine Biology, Chapter 10
- ➔ suggested websites:
- ➔ suggested activities:

Essential Question: *How do cells grow and reproduce?*

Concepts

A. Cells grow when they can take in more nutrients through their plasma membranes than they can metabolize in their interior. Cells may divide when their metabolism exceeds nutrient absorption.

B. All cells go through a cell cycle.

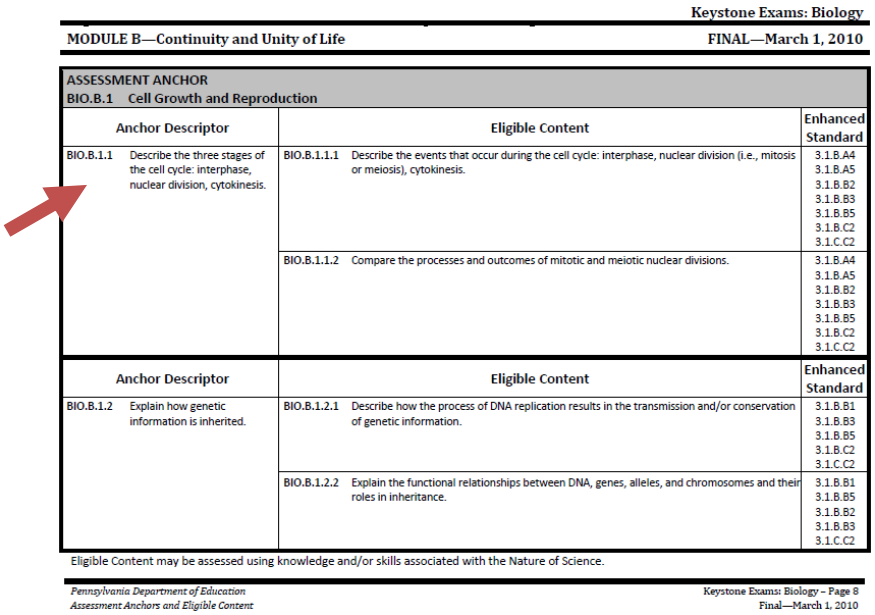
C. Prokaryotic cells divide via binary fission.

D. Eukaryotic cells first divide their nucleus and then divide their cytoplasm to make new cells.

E. Cell differentiation occurs many times during development of a multicellular organisms giving rise to a diversity of cell types.

Competencies Standards (Anchors) / Eligible Content

1) Describe the role of DNA in protein synthesis, reproduction and evolution.
   - S11.A.3.1.1, S11.B.1.1.3, S11.B.2.1.1, S11.B.2.1.2, S11.B.2.1.3, S11.B.2.1.4, S11.B.2.2.1, S11.B.2.2.2, S11.B.2.2.3
2) Provide examples for when it is correct to use the terms scientific principle, scientific theory, scientific law, fact, and belief.
   - S11.A.1.1.1, S11.A.1.1.2, S11.A.1.1.4
3) Pose questions and provide evidence-based explanations about understanding and observations of biological phenomena and processes.
   - S11.A.1.1.3, S11.A.1.1.5, S11.A.1.2.1, S11.A.1.3.1, S11.B.2.2.1, S11.B.2.2.2, S11.B.2.2.3
4) Select and use appropriate tools and techniques when designing and conducting experiments related to the biological sciences and then communicate an analysis of the findings using various types of media.
   - S11.A.1.1.4, S11.A.1.3.1, S11.A.2.2.1, S11.A.2.2.2, S11.A.3.1.1
5) Identify and describe various ways models are used to explain, interpret, and predict, biological phenomena/systems.
   - S11.A.3.2.1, S11.A.3.2.2, S11.A.3.2.3



Keystone Exams: Biology

MODULE B—Continuity and Unity of Life — FINAL—March 1, 2010

ASSESSMENT ANCHOR
BIO.B.1 Cell Growth and Reproduction

Anchor Descriptor	Eligible Content	Enhanced Standard
BIO.B.1.1 Describe the three stages of the cell cycle: interphase, nuclear division, cytokinesis.	BIO.B.1.1.1 Describe the events that occur during the cell cycle: interphase, nuclear division (i.e., mitosis or meiosis), cytokinesis.	3.1.B.A4 3.1.B.A5 3.1.B.B2 3.1.B.B3 3.1.B.B5 3.1.B.C2 3.1.C.C2
	BIO.B.1.1.2 Compare the processes and outcomes of mitotic and meiotic nuclear divisions.	3.1.B.A4 3.1.B.A5 3.1.B.B2 3.1.B.B3 3.1.B.B5 3.1.B.C2 3.1.C.C2

Anchor Descriptor	Eligible Content	Enhanced Standard
BIO.B.1.2 Explain how genetic information is inherited.	BIO.B.1.2.1 Describe how the process of DNA replication results in the transmission and/or conservation of genetic information.	3.1.B.B1 3.1.B.B3 3.1.B.B5 3.1.B.C2 3.1.C.C2
	BIO.B.1.2.2 Explain the functional relationships between DNA, genes, alleles, and chromosomes and their roles in inheritance.	3.1.B.B1 3.1.B.B5 3.1.B.B2 3.1.B.B3 3.1.C.C2

Eligible Content may be assessed using knowledge and/or skills associated with the Nature of Science.

Pennsylvania Department of Education
Assessment Anchors and Eligible Content

Keystone Exams: Biology – Page 8
Final—March 1, 2010

VIII. Eukaryotic cells can differentiate and organize making it possible for multicellularity.

- ➔ suggested material: Miller Levine Biology, Chapter 10
- ➔ suggested websites:
- ➔ suggested activities:

Essential Question: *What are the advantages of multicellularity?*

Concepts

A. A multicellular organization enables life functions such as movement, digestion, internal circulation of nutrients, excretion of waste and reproduction to be subdivided among specialized groups of cells.

B. The simplest level of multicellular organization is a tissue.

C. Different types of cells and tissues combine to form distinct structures known as organs which perform specific functions.

D. Organs work together as a system to perform common functions.

E. Organ systems function to meet an organism's needs.

F. Cells that have differentiated to perform specialized functions rely on the collective function of other specialized cells within a multicellular organism to maintain their living condition.

Competencies Standards (Anchors) / Eligible Content

1) Compare and contrast the structural and functional similarities and differences among living things.
    - S11.B.1.1.2
2) Pose questions and provide evidence-based explanations about understanding and observations of biological phenomena and processes.
    - S11.A.1.1.3, S11.A.1.1.5, S11.A.1.2.1, S11.A.1.3.1, S11.B.2.2.1, S11.B.2.2.2, S11.B.2.2.3

IX. Hereditary information in genes is inherited and expressed.

- ➔ suggested material: Miller Levine Biology, Chapters 11, 14 ★ (& 15)
- ➔ suggested websites:
- ➔ suggested activities:

Essential Question: *How is the hereditary information in genes inherited and expressed?*

Concepts

A. Sexually reproducing organisms produce gametes which transport hereditary information from one generation of organisms into another generation.

B. Meiosis involves a two-step nuclear division reducing the number of chromosomes in half – producing gametes.

C. One or more pairs of genes on one or more chromosomes code for the expression of inherited traits.

D. Two or more versions of a gene (alleles) contribute to the expression of inherited traits.

E. During the process of meiosis genetic recombinations may occur contributing to genetic variability within a population.

F. Patterns of inheritance reflecting how genes interact and express themselves (including dominant, recessive, codominance, incomplete dominance, sex-linked, sex-influenced, multiple alleles) can be predicted, observed and described.

G. The Punnett square is a tool that can be used to predict the probability of an offspring's genotype and phenotype.

Competencies Standards (Anchors) / Eligible Content

1) Describe the role of DNA in protein synthesis, reproduction and evolution.
   - S11.A.3.1.1, S11.B.1.1.3, S11.B.2.1.1, S11.B.2.1.2, S11.B.2.1.3, S11.B.2.1.4, S11.B.2.2.1, S11.B.2.2.2, S11.B.2.2.3
2) Provide examples for when it is correct to use the terms scientific principle, scientific theory, scientific law, fact, and belief.
   - S11.A.1.1.1, S11.A.1.1.2, S11.A.1.1.4
3) Pose questions and provide evidence-based explanations about understanding and observations of biological phenomena and processes.
   - S11.A.1.1.3, S11.A.1.1.5, S11.A.1.2.1, S11.A.1.3.1, S11.B.2.2.1, S11.B.2.2.2, S11.B.2.2.3
4) Select and use appropriate tools and techniques when designing and conducting experiments related to the biological sciences and then communicate an analysis of the findings using various types of media.
   - S11.A.1.1.4, S11.A.1.3.1, S11.A.2.2.1, S11.A.2.2.2, S11.A.3.1.1

ASSESSMENT ANCHOR BIO.B.2 Genetics			
Anchor Descriptor		**Eligible Content**	**Enhanced Standard**
BIO.B.2.1 Compare Mendelian and non-Mendelian patterns of inheritance.	BIO.B.2.1.1	Describe and/or predict observed patterns of inheritance (i.e., dominant, recessive, co-dominance, incomplete dominance, sex-linked, polygenic, and multiple alleles).	3.1.B.B5
	BIO.B.2.1.2	Describe processes that can alter composition or number of chromosomes (i.e., crossing-over, nondisjunction, duplication, translocation, deletion, insertion, and inversion).	3.1.B.B1 3.1.B.B2 3.1.B.B3 3.1.C.C2
Anchor Descriptor		**Eligible Content**	**Enhanced Standard**
BIO.B.2.2 Explain the process of protein synthesis (i.e., transcription, translation, and protein modification).	BIO.B.2.2.1	Describe how the processes of transcription and translation are similar in all organisms.	3.1.B.B1 3.1.B.B3 3.1.B.B5 3.1.C.B3 3.1.C.C2
	BIO.B.2.2.2	Describe the role of ribosomes, endoplasmic reticulum, Golgi apparatus, and the nucleus in the production of specific types of proteins.	3.1.B.A5 3.1.B.B3 3.1.B.B5 3.1.C.B3
Anchor Descriptor		**Eligible Content**	**Enhanced Standard**
BIO.B.2.3 Explain how genetic information is expressed.	BIO.B.2.3.1	Describe how genetic mutations alter the DNA sequence and may or may not affect phenotype (e.g., silent, nonsense, frame-shift).	3.1.B.B1 3.1.B.B3 3.1.B.C2 3.1.C.B3 3.1.C.C2

Eligible Content may be assessed using knowledge and/or skills associated with the Nature of Science.

Anchor Descriptor		**Eligible Content**	**Enhanced Standard**
BIO.B.2.4 Apply scientific thinking, processes, tools, and technologies in the study of genetics.	BIO.B.2.4.1	Explain how genetic engineering has impacted the fields of medicine, forensics, and agriculture (e.g., selective breeding, gene splicing, cloning, genetically modified organisms, gene therapy).	3.1.B.B4 4.4.7.A 4.4.10.A 4.4.12.A 4.4.7.B 4.4.10.B 4.4.12.B

Eligible Content may be assessed using knowledge and/or skills associated with the Nature of Science.

X. DNA segments contain information for the production of proteins necessary for growth and function of cells.

- ➔ suggested material: Miller Levine Biology, Chapters 12 & 13
- ➔ suggested websites:
- ➔ suggested activities:

Essential Question: *Why is DNA called the "blueprint of life"?*

Concepts

A. The basic molecular and the associated genetic code structure of DNA are universal, revolutionizing our understanding of disease, heredity and evolution.

B. DNA contains the complete set of instructions, the genetic code, for building and running an organism.

C. RNA is necessary for protein synthesis from DNA.

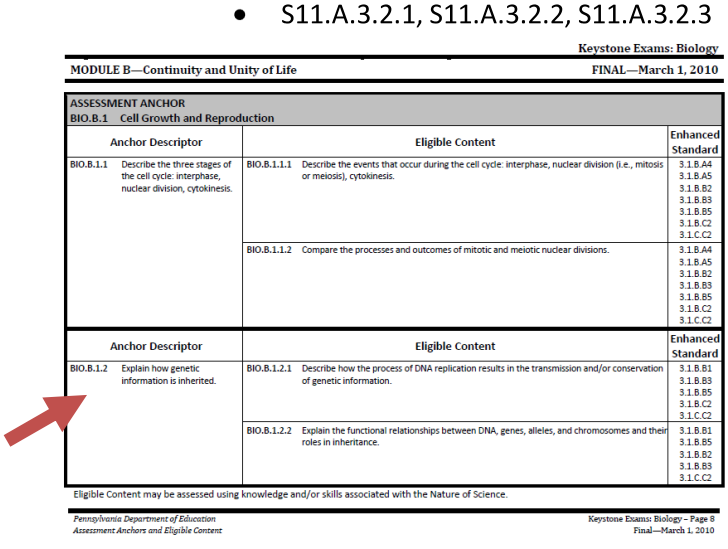
D. Many synthesized polypeptides require additional processing to acquire their active, three-dimensional structures.

E. Which genes are expressed at a given time is determined by the integration of internal and environmental signals received by a cell.

F. Enzymes are special proteins designed to catalyze most biochemical reactions that otherwise would not occur.

Competencies Standards (Anchors) / Eligible Content

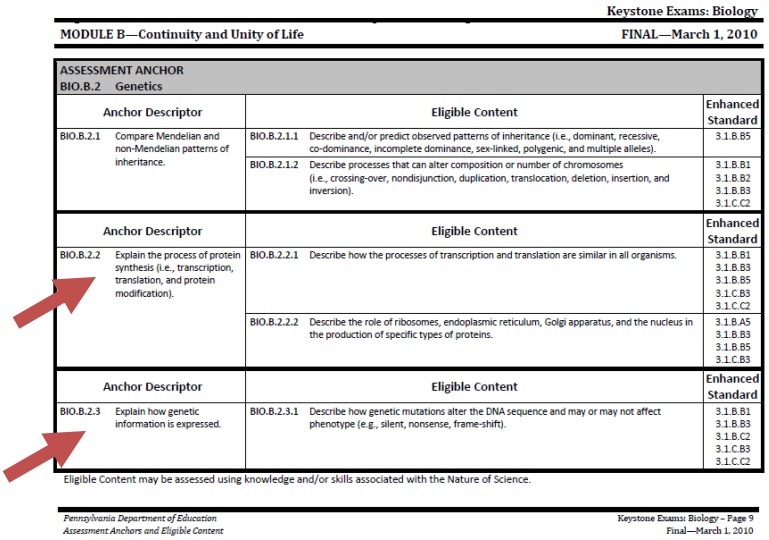
1) Describe the role of DNA in protein synthesis, reproduction and evolution.
   - S11.A.3.1.1, S11.B.1.1.3, S11.B.2.1.1, S11.B.2.1.2, S11.B.2.1.3, S11.B.2.1.4, S11.B.2.2.1, S11.B.2.2.2, S11.B.2.2.3
2) Provide examples for when it is correct to use the terms scientific principle, scientific theory, scientific law, fact, and belief.
   - S11.A.1.1.1, S11.A.1.1.2, S11.A.1.1.4
3) Pose questions and provide evidence-based explanations about understanding and observations of biological phenomena and processes.
   - S11.A.1.1.3, S11.A.1.1.5, S11.A.1.2.1, S11.A.1.3.1, S11.B.2.2.1, S11.B.2.2.2, S11.B.2.2.3
4) Select and use appropriate tools and techniques when designing and conducting experiments related to the biological sciences and then communicate an analysis of the findings using various types of media.
   - S11.A.1.1.4, S11.A.1.3.1, S11.A.2.2.1, S11.A.2.2.2, S11.A.3.1.1
5) Identify and describe various ways models are used to explain, interpret, and predict, biological phenomena/systems.
   - S11.A.3.2.1, S11.A.3.2.2, S11.A.3.2.3



ASSESSMENT ANCHOR
BIO.B.1 Cell Growth and Reproduction

Anchor Descriptor	Eligible Content	Enhanced Standard
BIO.B.1.1 Describe the three stages of the cell cycle: interphase, nuclear division, cytokinesis.	BIO.B.1.1.1 Describe the events that occur during the cell cycle: interphase, nuclear division (i.e., mitosis or meiosis), cytokinesis.	3.1.B.A4 3.1.B.A5 3.1.B.B2 3.1.B.B3 3.1.B.B5 3.1.B.C2 3.1.C.C2
	BIO.B.1.1.2 Compare the processes and outcomes of mitotic and meiotic nuclear divisions.	3.1.B.A4 3.1.B.A5 3.1.B.B2 3.1.B.B3 3.1.B.B5 3.1.B.C2 3.1.C.C2
Anchor Descriptor	**Eligible Content**	**Enhanced Standard**
BIO.B.1.2 Explain how genetic information is inherited.	BIO.B.1.2.1 Describe how the process of DNA replication results in the transmission and/or conservation of genetic information.	3.1.B.B1 3.1.B.B3 3.1.B.B5 3.1.B.C2 3.1.C.C2
	BIO.B.1.2.2 Explain the functional relationships between DNA, genes, alleles, and chromosomes and their roles in inheritance.	3.1.B.B1 3.1.B.B5 3.1.B.B2 3.1.B.B3 3.1.C.C2

Eligible Content may be assessed using knowledge and/or skills associated with the Nature of Science.



ASSESSMENT ANCHOR
BIO.B.2 Genetics

Anchor Descriptor	Eligible Content	Enhanced Standard
BIO.B.2.1 Compare Mendelian and non-Mendelian patterns of inheritance.	BIO.B.2.1.1 Describe and/or predict observed patterns of inheritance (i.e., dominant, recessive, co-dominance, incomplete dominance, sex-linked, polygenic, and multiple alleles).	3.1.B.B5
	BIO.B.2.1.2 Describe processes that can alter composition or number of chromosomes (i.e., crossing-over, nondisjunction, duplication, translocation, deletion, insertion, and inversion).	3.1.B.B1 3.1.B.B2 3.1.B.B3 3.1.C.C2
Anchor Descriptor	**Eligible Content**	**Enhanced Standard**
BIO.B.2.2 Explain the process of protein synthesis (i.e., transcription, translation, and protein modification).	BIO.B.2.2.1 Describe how the processes of transcription and translation are similar in all organisms.	3.1.B.B1 3.1.B.B3 3.1.B.B5 3.1.C.B3 3.1.C.C2
	BIO.B.2.2.2 Describe the role of ribosomes, endoplasmic reticulum, Golgi apparatus, and the nucleus in the production of specific types of proteins.	3.1.B.A5 3.1.B.B3 3.1.B.B5 3.1.C.B3
Anchor Descriptor	**Eligible Content**	**Enhanced Standard**
BIO.B.2.3 Explain how genetic information is expressed.	BIO.B.2.3.1 Describe how genetic mutations alter the DNA sequence and may or may not affect phenotype (e.g., silent, nonsense, frame-shift).	3.1.B.B1 3.1.B.B3 3.1.B.C2 3.1.C.B3 3.1.C.C2

Eligible Content may be assessed using knowledge and/or skills associated with the Nature of Science.

XI. Evolution is the result of many random processes selecting for the survival and reproduction of a population.

- ➔ suggested material: Miller Levine Biology, Chapter 16
- ➔ suggested websites:
- ➔ suggested activities:

Essential Question: *How do we scientifically explain the evidence and mechanisms for biological evolution?*

Concepts

A. Mutations alter a gene's genetic information, resulting in a change in the protein that is made, or how or when a cell makes that protein. Most mutations are evolutionary neutral.

B. Evolution occurs when the gene frequency of alleles in a population shifts to confer survival and reproductive success.

C. The differential reproductive success of populations of organisms with advantageous traits is known as natural selection.

D. Speciation occurs when one population is isolated from another population. The isolation can be geological, reproductive, or filling different ecological niches to reduce competition. With isolation comes changing environmental factors exerting selective pressure on mutations and adaptations.

E. Common anatomical and/or genetic structures and behaviors demonstrate that species have evolved from common ancestors.

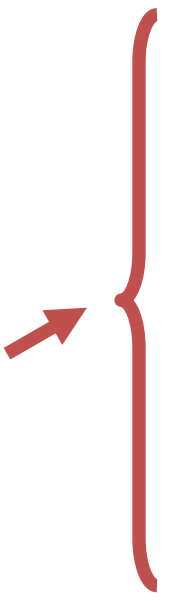
F. The fossil record documents patterns of mass and background extinctions and the appearance of new species.

G. There are similarities and differences between fossils and living organisms.

H. Selective breeding and biotechnology contribute to the deliberate changing of the genetic makeup of a population.

Competencies Standards (Anchors) / Eligible Content

1) Describe the role of DNA in protein synthesis, reproduction and evolution.
   - S11.A.3.1.1, S11.B.1.1.3, S11.B.2.1.1, S11.B.2.1.2, S11.B.2.1.3, S11.B.2.1.4, S11.B.2.2.1, S11.B.2.2.2, S11.B.2.2.3
2) Provide examples for when it is correct to use the terms scientific principle, scientific theory, scientific law, fact, and belief.
   - S11.A.1.1.1, S11.A.1.1.2, S11.A.1.1.4
3) Pose questions and provide evidence-based explanations about understanding and observations of biological phenomena and processes.
   - S11.A.1.1.3, S11.A.1.1.5, S11.A.1.2.1, S11.A.1.3.1, S11.B.2.2.1, S11.B.2.2.2, S11.B.2.2.3
4) Select and use appropriate tools and techniques when designing and conducting experiments related to the biological sciences and then communicate an analysis of the findings using various types of media.
   - S11.A.1.1.4, S11.A.1.3.1, S11.A.2.2.1, S11.A.2.2.2, S11.A.3.1.1
5) Identify and describe various ways models are used to explain, interpret, and predict, biological phenomena/systems.
   - S11.A.3.2.1, S11.A.3.2.2, S11.A.3.2.3



ASSESSMENT ANCHOR BIO.B.3 Theory of Evolution			
Anchor Descriptor		**Eligible Content**	**Enhanced Standard**
BIO.B.3.1 Explain the mechanisms of evolution.	BIO.B.3.1.1	Explain how natural selection can impact allele frequencies of a population.	3.1.B.C1
	BIO.B.3.1.2	Describe the factors that can contribute to the development of new species (e.g., isolating mechanisms, genetic drift, founder effect, migration).	3.1.B.C1 3.1.B.C2
	BIO.B.3.1.3	Explain how genetic mutations may result in genotypic and phenotypic variations within a population.	3.1.B.C2 3.1.B.B1
Anchor Descriptor		**Eligible Content**	**Enhanced Standard**
BIO.B.3.2 Analyze the sources of evidence for biological evolution.	BIO.B.3.2.1	Interpret evidence supporting the theory of evolution (i.e., fossil, anatomical, physiological, embryological, biochemical, and universal genetic code).	3.1.B.C3 3.1.B.C1 3.1.B.B3
Anchor Descriptor		**Eligible Content**	**Enhanced Standard**
BIO.B.3.3 Apply scientific thinking, processes, tools, and technologies in the study of the theory of evolution.	BIO.B.3.3.1	Distinguish between the scientific terms: hypothesis, inference, law, theory, principle, fact, and observation.	3.1.B.A9

Eligible Content may be assessed using knowledge and/or skills associated with the Nature of Science.

Key Vocabulary: atom, molecule, organelle, cell, tissue, organ, organ system, organism, species, population, community, ecosystem, prokaryotic, eukaryotic, unicellular, multicellular, autotrophic, heterotrophic, food chain, food web, sexual reproduction, asexual reproduction, carbohydrate, protein, lipid, nucleic acid, enzyme, adenosine triphosphate (ATP), homeostasis, photosynthesis, cellular respiration, glycolysis, metabolism, deoxyribonucleic acid (DNA), ribonucleic acid (RNA), natural selection, microevolution, macroevolution, cytoplasm, protoplasm, microscopic, macroscopic, phospholipid bilayer, passive transport, active transport, osmosis, diffusion, concentration gradient, endocytosis, exocytosis, solute, solvent, replication, transcription, translation, monomer, polymer, heredity, gene, genome, allele, chromosome, chromatid, centromere, homologous, heterozygous, homozygous, dominant, recessive, codominance, incomplete dominance, sex-linkage, sex-influenced traits, multiple alleles, genotype, phenotype, Punnett square, mitosis, meiosis, somatic cell, sex cell, gamete, genetic recombination, mutation, speciation, adaptation, cell cycle, biotechnology, inquiry, equilibrium, organic, inorganic

References:

- PA Academic Standards for Science:

http://www.pdesas.org/main/fileview/Academic_Standards_for_Science_and_Technology_and_Engineering_Education_(Secondary).pdf

- PA Assessment Anchors and Eligible Content for Science

http://www.pdesas.org/main/fileview/Science_Grade_11_Assessment_Anchors_and_Eligible_Content.pdf