Keystone Exams: Biology

Assessment Anchors and Eligible Content

Pennsylvania Department of Education

www.education.state.pa.us

2014

General Introduction to the Keystone Exam Assessment Anchors

Introduction

Since the introduction of the Keystone Exams, the Pennsylvania Department of Education (PDE) has been working to create a set of tools designed to help educators improve instructional practices and better understand the Keystone Exams. The Assessment Anchors, as defined by the Eligible Content, are one of the many tools the Department believes will better align curriculum, instruction, and assessment practices throughout the commonwealth. Without this alignment, it will not be possible to significantly improve student achievement across the Commonwealth.

How were Keystone Exam Assessment Anchors developed?

Prior to the development of the Assessment Anchors, multiple groups of PA educators convened to create a set of standards for each of the Keystone Exams. Enhanced standards, derived from a review of existing standards, focused on what students need to know and be able to do in order to be college and career ready.

Additionally, the Assessment Anchors and Eligible Content statements were created by other groups of educators charged with the task of clarifying the standards assessed on the Keystone Exams. The Assessment Anchors, as defined by the Eligible Content, have been designed to hold together or *anchor* the state assessment system and curriculum/instructional practices in schools.

Assessment Anchors, as defined by the Eligible Content, were created with the following design parameters:

- **Clear:** The Assessment Anchors are easy to read and are user friendly; they clearly detail which standards are assessed on the Keystone Exams.
- **Focused:** The Assessment Anchors identify a core set of standards that could be reasonably assessed on a large-scale assessment, which will keep educators from having to guess which standards are critical.
- **Rigorous:** The Assessment Anchors support the rigor of the state standards by assessing higher-order and reasoning skills.
- **Manageable:** The Assessment Anchors define the standards in a way that can be easily incorporated into a course to prepare students for success.

How can teachers, administrators, schools, and districts use these Assessment Anchors?

The Assessment Anchors, as defined by the Eligible Content, can help focus teaching and learning because they are clear, manageable, and closely aligned with the Keystone Exams. Teachers and administrators will be better informed about which standards will be assessed. The Assessment Anchors and Eligible Content should be used along with the Standards and the Curriculum Framework of the Standards Aligned System (SAS) to build curriculum, design lessons, and support student achievement.

The Assessment Anchors and Eligible Content are designed to enable educators to determine when they feel students are prepared to be successful in the Keystone Exams. An evaluation of current course offerings, through the lens of what is assessed on those particular Keystone Exams may provide an opportunity for an alignment to ensure student preparedness.

How are the Assessment Anchors organized?

The Assessment Anchors, as defined by the Eligible Content, are organized into cohesive blueprints, each structured with a common labeling system that can be read like an outline. This framework is organized first by module, then by Assessment Anchor, followed by Anchor Descriptor, and then finally, at the greatest level of detail, by an Eligible Content statement. The common format of this outline is followed across the Keystone Exams.

Here is a description of each level in the labeling system for the Keystone Exams:

- **Module:** The Assessment Anchors are organized into two thematic modules for each of the Keystone Exams. The module title appears at the top of each page. The module level is important because the Keystone Exams are built using a module format, with each of the Keystone Exams divided into two equally-sized test modules. Each module is made up of two or more Assessment Anchors.
- **Assessment Anchor:** The Assessment Anchor appears in the shaded bar across the top of each Assessment Anchor table. The Assessment Anchors represent categories of subject matter that anchor the content of the Keystone Exams. Each Assessment Anchor is part of a module and has one or more Anchor Descriptors unified under it.
- **Anchor Descriptor:** Below each Assessment Anchor is a specific Anchor Descriptor. The Anchor Descriptor level provides further details that delineate the scope of content covered by the Assessment Anchor. Each Anchor Descriptor is part of an Assessment Anchor and has one or more Eligible Content unified under it.
- **Eligible Content:** The column to the right of the Anchor Descriptor contains the Eligible Content statements. The Eligible Content is the most specific description of the content that is assessed on the Keystone Exams. This level is considered the assessment limit and helps educators identify the range of the content covered on the Keystone Exams.
- **Enhanced Standard:** In the column to the right of each Eligible Content statement is a code representing one or more Enhanced Standards that correlate to the Eligible Content statement. Some Eligible Content statements include annotations that indicate certain clarifications about the scope of an eligible content.
    - "e.g." ("for example") —sample approach, but not a limit to the eligible content.
    - "i.e." ("that is") —specific limit to the eligible content.

Standards Aligned System — http://www.pdesas.org/ **Pennsylvania Department of Education** — www.education.state.pa.us

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.

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.

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.

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.

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.

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.

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.

ASSESSMENT ANCHOR
BIO.B.4 Ecology

Anchor Descriptor		Eligible Content		Enhanced Standard			
BIO.B.4.1	Describe ecological levels of organization in the biosphere.	**BIO.B.4.1.1**	Describe the levels of ecological organization (i.e., organism, population, community, ecosystem, biome, and biosphere).	4.1.4.A 4.1.7.A	4.1.10.A 4.1.7.C	4.4.6.A	4.5.3.D
		BIO.B.4.1.2	Describe characteristic biotic and abiotic components of aquatic and terrestrial ecosystems.	4.1.7.A 4.1.3.A	4.1.4.B 4.2.10.A	4.1.4.C 4.4.5.C	4.4.3.C

Anchor Descriptor		Eligible Content		Enhanced Standard			
BIO.B.4.2	Describe interactions and relationships in an ecosystem.	**BIO.B.4.2.1**	Describe how energy flows through an ecosystem (e.g., food chains, food webs, energy pyramids).	4.1.4.C 4.1.7.C	4.1.10.C 4.1.12.C	4.1.3.C 4.1.5.C	4.1.5.A
		BIO.B.4.2.2	Describe biotic interactions in an ecosystem (e.g., competition, predation, symbiosis).	4.1.7.A	4.1.10.A	4.5.3.D	4.5.6.D
		BIO.B.4.2.3	Describe how matter recycles through an ecosystem (i.e., water cycle, carbon cycle, oxygen cycle, and nitrogen cycle).	4.1.4.B 4.1.7.B 4.2.5.A	4.2.7.A 4.3.12.A 4.4.3.C	4.5.4.C 4.5.8.C	4.3.4.D 3.1.B.A2
		BIO.B.4.2.4	Describe how ecosystems change in response to natural and human disturbances (e.g., climate changes, introduction of nonnative species, pollution, fires).	4.1.10.A 4.1.10.B 4.1.12.A 4.1.4.A 4.1.12.C 4.1.4.E	4.1.7.E 4.1.10.E 4.5.10.D 4.2.8.A 4.2.10.A 4.2.12.A	4.2.10.B 4.2.12.B 4.2.10.C 4.2.12.C 4.3.12.A	4.3.10.B 4.5.10.B 4.5.12.B 4.5.4.C 4.5.7.C
		BIO.B.4.2.5	Describe the effects of limiting factors on population dynamics and potential species extinction.	4.1.4.A 4.1.10.A 4.1.12.A 4.1.7.E 4.1.10.E 4.1.4.E	4.2.10.C 4.5.3.D 4.5.5.D 4.5.6.D 4.5.10.D	4.2.10.A 4.2.7.A 4.2.8.A 4.2.10.B 4.4.6.A	4.4.6.B 4.4.3.C 4.4.5.C 4.5.7.B 4.5.7.C

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