HIGH SCHOOL GRADUATION COMPETENCIES- CURRICULUM MAP

Biology					
Graduation Competencies	Content Standards				
	SB1	SB2	SB3	SB4	SB5
HS1	✓ (a-d)	✓ (a-e)			
HS2			✓ (a)	✓ (a-d)	
HS3		✓ (a,b)			✓ (b-e)
HS4			✓ (b-d)		

HIGH SCHOOL GRADUATION COMPETENCIES- Biology

Graduation Competency: HS1

Life Science: Structure, Function, and Information Processing

Students will apply scientific and engineering practices to understand and analyze molecular, structural, and chemical biology as they relate to biological systems and each level of organization from cells to organ systems.

Performance Indicators

A. Construct a scientific explanation based on evidence for how eukaryotic cells have evolved from prokaryotic cells using cellular structures and functions. (SB1.a)

B. Construct and use a model to demonstrate the role of the cell membrane in maintaining homeostasis both prokaryotic and eukaryotic cells. (SB1.a)

C. Infer from an experiment that enzymes are catalysts in living systems and that the rate of a reaction and function is affected by environmental factors. (SB1.b)

D. Assess how carbohydrates, lipids, proteins, and nucleic acids function at a cellular level to maintain homeostasis for the organism. (SB1.c)

E. Use the concepts related to the properties of water to explain the phenomena of how water impacts life processes. (SB1.d)

F. Appraise a model of the central dogma of biology (DNA to mRNA to Protein) and the effects of an error on any step of the process. Be sure to demonstrate the effects of changes in DNA and its effect on the protein as well as the organism. (SB2.a-b,d)

G. Create a media project to explain the relationship between mitosis and meiosis and their relationship to asexual and sexual reproduction respectively. (SB2.c,e)

H. Construct and appraise an illustration that demonstrates the application of Mendel's laws in meiosis and inheritance patterns among organisms. (SB2.c)

Performance Indicator Scoring Criteria Graduation Competency 1 Biology

Performance Indicator	Emerging	Progressing	Competent	Exemplary
A. Construct a scientific explanation based on evidence for how eukaryotic cells have evolved from prokaryotic cells using cellular structures and functions. (SB1.a)	The student can **recognize** that a cell lacking a nucleus is prokaryotic and that prokaryotic cells were the first cells on earth.	The student can **classify** a cell as prokaryotic or eukaryotic based on evidence provided and explain that eukaryotic cells have organelles and evolved from prokaryotic cells.	The student can **construct** an explanation of how eukaryotic cells evolved from prokaryotic cells and support the explanation with specific cell structures and functions.	The student can **analyze** scientific sources to **construct** an explanation of how eukaryotic cells evolved from prokaryotic cells and support the explanation with specific cell structures and functions.
B. Construct and use a model to demonstrate the role of the cell membrane in maintaining homeostasis both prokaryotic and eukaryotic cells. (SB1.a)	The student can **recognize** structural components of the cell membrane.	The student can **relate** the structure of the components to its function in the cell membrane.	The student can **construct** a model of the cell membrane and demonstrate how each of the components helps *different cell types* maintain homeostasis.	The student can **construct** a model of the cell membrane and demonstrate how each of the components helps *different cell types* maintain homeostasis. The student can **apply the concepts** of the plasma membrane to demonstrate how disruptions in the plasma membrane affect homeostasis.

C. Infer from an experiment that enzymes are catalysts in living systems and that the rate of a reaction and function is affected by environmental factors. (SB1.b)	The student can **define** the role of an enzyme in a biological reaction. Student can **identify** factors that affect enzymes.	The student can **interpret** the induced fit model. Student can **predict** the effect of various environmental factors (pH, temp, etc.) on enzyme function and reaction rate.	The student can **infer** from an experiment evidence enzymes are catalysts in living systems and that the rate of a reaction and function is affected by environmental factors.	The student can **design and create** an experiment showing enzymes are catalysts in living systems and that the rate of a reaction and function is affected by environmental factors. Student can **summarize** how the induced fit model for enzymes functions.
D. Assess how carbohydrates, lipids, proteins, and nucleic acids function at a cellular level to maintain homeostasis for the organism. (SB1.c)	The student can **identify** the four major organic compounds. The student can **illustrate** the structure and uses for each of the four organic compounds	The student can **construct** models of the four major organic compounds. The student can **compare** how organic compounds are used within a cell.	The student can **assess** how organic compounds function at the cellular level to maintain homeostasis for an organism.	The student can **assess** how organic compounds function at the cellular level to maintain homeostasis for an organism and **critique** how different cells use organic compounds differently.
E. Use the concepts related to the properties of water to explain the phenomena of how water impacts life processes. (SB1.d)	The student can **recognize** the properties of water and how it impacts life. Student can **label** 2 or more water molecules, their parts, charges, and bonding.	The student can **predict** how the properties of water impact life processes. Give examples of each.	The student can use the **concepts** related to the properties of water to **explain** the **phenomena** of how water impacts life processes.	The student can **apply the concepts** of the properties of water to explain the phenomena of how water impacts life processes and **prove** through experimentation the various properties of water.
F. Appraise a model of the central dogma of biology (DNA to mRNA to Protein) and the effects of an error on any step of	The student can **list** the steps of how a protein is made (central dogma of biology).	The student can **organize** the steps of how a protein is made. The student can **compare** the effects of	The student can **appraise** a model of the central dogma of biology (DNA to mRNA to Protein) and the effects of an error on any step of	The student can **apply the concepts** of the central dogma of biology to (DNA to mRNA to Protein) and the effects of an error on any step

the process. Be sure to demonstrate the effects of changes in DNA and its effect on the protein as well as the organism. (SB2.a- b, d)	The student can **identify** mutations in amino acid sequences. The student can **recognize** the effect of mutation on the protein and organism.	different types of mutations. The student can **conclude** from the evidence given the types of mutation.	the process. **Draw conclusions** demonstrating the effects of changes in DNA and its effect on the protein as well as the organism.	of the process. The student can **analyze** the effects of changes in DNA and its effect on the protein as well as the organism and **connect** it to common genetic disorders in humans.
G. Create a media project to explain the relationship between mitosis and meiosis and their relationship to asexual and sexual reproduction respectively. (SB2.c,e)	The student can **label and identify** images of mitosis and meiosis. The student can **match** the type of reproduction (asexual or sexual reproduction) to the correct cellular division process.	The student can **show** in a non-media project the relationship between mitosis and meiosis and their relationship to asexual and sexual reproduction.	The student can **create** a media project to explain the relationship between mitosis and meiosis and their relationship to asexual and sexual reproduction respectively.	The student can **create** a media project to explain the relationship between mitosis and meiosis and their relationship asexual and sexual reproduction respectively and **apply** that knowledge to natural selection and evolution.
H. Construct and appraise an illustration that demonstrates the application of Mendel's laws in meiosis and inheritance patterns among organisms. (SB2.c)	The student can **use** an illustration that demonstrates the application of Mendel's laws in meiosis and inheritance patterns among organisms.	The student can **construct** an illustration that demonstrates the application of Mendel's laws in meiosis and inheritance patterns among organisms.	The student can **construct and appraise** an illustration that demonstrates the application of Mendel's laws in meiosis and inheritance patterns among organisms.	The student can **apply the concepts** of Mendel's laws and inheritance patterns to **design** and **analyze through mathematical models** the application of Mendel's laws in meiosis and inheritance patterns among organisms.

Suggested Performance Tasks:

- Use a microscope to view a cell.
- DNA Extraction
- Osmolality lab/experiment
- Enzyme Lab
- Properties of Water Lab
- Selected Tasks from

HIGH SCHOOL GRADUATION COMPETENCIES- Biology

Graduation Competency: HS2

Life Science: Matter and Energy in Organisms and Ecosystems

Students will apply scientific and engineering practices to understand and analyze the characteristics, functions, and behavioral interactions within an ecosystem.

Performance Indicators

A. Draw conclusions from a model of an ecosystem that demonstrates the relationships among organisms, populations, communities, ecosystems, and biomes. (SB4.a)

B. Assess representations to support claims for the cycling of matter and flow of energy among organisms in an ecosystem. (SB4.b)

C. Draw conclusions with quantitative evidence for the claim that matter is cycled through an ecosystem and energy flows through an ecosystem. (SB4.b)

D. Evaluate how changes in the environment affect successional changes in ecosystems. (SB4.c)

E. Appraise data and provide evidence to demonstrate the relationship between human activities and the state of a local ecosystem. (SB4.d)

F. Compare and contrast the role of photosynthesis and cellular respiration in the cycling of carbon among the biosphere, atmosphere, hydrosphere, and geosphere. (SB4.d)

Performance Indicator Scoring Criteria Graduation Competency 2 Biology

Performance Indicator	Emerging	Progressing	Competent	Exemplary
A. Draw conclusions from a model of an ecosystem that demonstrates the relationships among organisms, populations, communities, ecosystems, and biomes. (SB4.a),	The student can **list** and **define** parts of an ecosystem to demonstrate the relationships among organisms, populations, communities, ecosystems, and biomes.	The student can **interpret** a model of an ecosystem demonstrating the relationships among; organisms, populations, communities, ecosystems, and biomes.	The student can **draw conclusions** from a model of an ecosystem that demonstrates the relationships among organisms, populations, communities, ecosystems, and biomes.	The student can **demonstrates** the relationships among organisms, populations, communities, and apply the concepts to a local ecosystem.
B. Assess representations to support claims for the cycling of matter and flow of energy among organisms in an ecosystem. (SB4.b)	The student can **arrange** and **identify** representations of the cycling of matter and flow of energy among organisms in an ecosystem.	The student can **organize** and **construct** representations of the cycling of matter and flow of energy among organisms in an ecosystem.	The student can **assess** representations to support claims for the cycling of matter and flow of energy among organisms in an ecosystem.	The student can use **mathematical representations** to support claims for the cycling of matter and flow of energy among organisms in an ecosystem. (SB4.b)
C. Draw conclusions with quantitative evidence for the claim that matter is cycled through an ecosystem and energy flows through an ecosystem. (SB4.b)	The student can **use** quantitative evidence to show matter is cycled through an ecosystem and that energy flows through an ecosystem.	The student can **Interpret**, using quantitative evidence, the claim that matter is cycled through an ecosystem and that energy flows through an ecosystem.	The student can **draw conclusions** with quantitative evidence for the claim that matter is cycled through an ecosystem and energy flows through an ecosystem.	The student can **apply** and **connect** quantitative evidence to the claim that matter is cycled through an ecosystem and energy flows through an ecosystem.
D. Evaluate how changes in the environment affect successional changes in ecosystems. (SB4.c)	The student can **identify** how changes in the environment affect succession. The student can **recognize** types of successional changes in ecosystems.	The student can **interpret** how changes in the environment affect environmental conditions and successional changes in ecosystems.	The student can **evaluate** how changes in the environment affect environmental conditions and successional changes in ecosystems.	The student can **critique** information showing how changes in the environment affect environmental conditions and successional changes in ecosystems.
E. Appraise data and provide evidence to demonstrate the relationship between human activities and the state of a local ecosystem. (SB4.d)	The student can list human activities that affect the ecosystem. The student can **recognize** the effect of humans on local ecosystems.	The student can **interpret** evidence to demonstrate the relationship between human activities and the state of a local ecosystem.	The student can **appraise** data and provide evidence to demonstrate the relationship between human activities and the state of a local ecosystem.	The student can **synthesize and analyze** data to provide evidence demonstrating the relationship between human activities and the state of a local ecosystem.

Performance Indicator	Emerging	Progressing	Competent	Exemplary
F. Compare and contrast the role of photosynthesis and cellular respiration in the cycling of carbon among the biosphere, atmosphere, hydrosphere, and geosphere. (SB3.a)	The student can **identify** the role of photosynthesis and cellular respiration. The student can **identify** how photosynthesis and cellular respiration are part of the carbon cycle.	The student can **distinguish** the role of photosynthesis and cellular respiration in the cycling of carbon among the biosphere, atmosphere, hydrosphere, and geosphere.	The student can **compare** and contrast the role of photosynthesis and cellular respiration in the cycling of carbon among the biosphere, atmosphere, hydrosphere, and geosphere.	The student can **Develop** a model **applying the concepts** of photosynthesis and cellular respiration in the cycling of carbon among the biosphere, atmosphere, hydrosphere, and geosphere.

Suggested Performance Tasks

- Selected Tasks from https://www.georgiastandards.org/Frameworks/Pages/BrowseFrameworks/Science9-12.aspx
- Selected Tasks from https://phet.colorado.edu/en/simulations/category/biology

HIGH SCHOOL GRADUATION COMPETENCIES- Biology

Graduation Competency: HS3

Life Science: Growth, Development, and Reproduction of Organisms, Natural Selection, and Adaptations

Students will apply scientific and engineering practices to understand and analyze the relationship between genetics, adaptation, and biodiversity.

Performance Indicators

A. Determine the frequency of the inheritance of a specific genetic disorder and demonstrate the role of DNA and RNA in the inheritance of this trait as well as show a possible inheritance pattern of the trait in three generations of a family. (SB2.a.b.)

B. Research the inheritance of a genetic disorder that has remained prevalent in the human population and demonstrate how the disorder remains in the population through natural selection. (SB5. d)

C. Apply the concepts of statistics and probability to explain the variation and distribution of an expressed phenotype in a population. (SB5.b and d)

D. Draw conclusions on how populations change due to evolutionary pressures such as genetic drift, gene flow, natural selection, and mutations. (SB5. e)

E. Explain the phenomena of antibiotic or pesticide resistance over time as it relates to a chosen species. (SB5. e)

F. Assess and critique fossil and biochemical evidence used to support evolutionary relationships among organisms. (SB5.c)

G. Make and defend a claim based on evidence that inheritable genetic variations are a result from: 1) new genetic combinations through meiosis, 2) viable errors occurring during replication, and/or 3) mutations caused by environmental factors. (SB2)

Performance Indicator Scoring Criteria Graduation Competency 3 Biology

Performance Indicator	Emerging	Progressing	Competent	Exemplary
A. Draw conclusions from a model of an ecosystem that demonstrates the relationships among organisms, populations, demonstrate the role of DNA and RNA in the inheritance of this trait as well as show a possible inheritance pattern of the trait in three generations of a family. (SB2.a.b.)	The student can **list** and **define** parts of an ecosystem to demonstrate the relationships among organisms, populations, communities, ecosystems, medicine, and agriculture	The student can **interpret** a model of an ecosystem demonstrating the relationships among; organisms, populations, communities, ecosystems, agriculture.	The student can **draw conclusions** from a model of an ecosystem that demonstrates the relationships among organisms, populations,	The student can **demonstrates** the relationships among organisms, populations, communities, and apply the concepts to a local agriculture and **perform a task** using DNA technology.
B. I can develop a logical argument explaining how an inherited genetic disorder remains prevalent in the human population through natural selection.	The student can **identify** that genetic disorders sometimes remain prevalent in human populations.	The student can **summarize** ways that the inheritance of a genetic disorder could be favored by natural selection and therefore remain prevalent in a human population.	The student can **develop a logical argument** explaining how an inherited genetic disorder remains prevalent in the human population through natural selection.	The student can **research** the inheritance of a genetic disorder that has remained prevalent in the human population and **analyze** how the disorder remains in the population through natural selection.
C. I can compare types of selection and construct an explanation about the distribution of an expressed phenotype based on selection pressure.	The student can **recognize** that natural selection acts on phenotypes.	The student can **predict** how the distribution of phenotypes in a population would change due to selection pressure.	The student can **compare** types of selection and **construct** an explanation about the distribution of an expressed phenotype based on selection pressure.	The student can **apply the concepts** of statistics and probability to explain the variation and distribution of an expressed phenotype in a population.
D. Draw conclusions on how populations change due to evolutionary pressures such as genetic drift, gene flow, natural selection, and mutations. (SB5. e)	The student can **identify** mechanisms of evolution, and **define** genetic drift gene flow, natural selection, and mutations.	The student can **relate** how populations change due to evolutionary pressures such as genetic drift, gene flow, natural selection, and mutations.	The student can **draw conclusions** on how populations change due to of evolutionary pressures such as genetic drift, gene flow, natural selection, and mutations.	The student can **analyze** how populations change due to evolutionary pressures such as genetic drift, gene flow, natural selection, and mutations

Performance Indicator	Emerging	Progressing	Competent	Exemplary
E. Explain the phenomena of antibiotic or pesticide resistance over time as it relates to a chosen species. (SB5. e)	The student can **recognize** that populations become resistant to chemicals or antibiotics over time.	The student can **summarize** antibiotic or pesticide resistance over time as it relates to a chosen species.	The student can **explain the phenomena** of antibiotic or pesticide resistance over time as it relates to a chosen species.	The student can **demonstrate** how the population of a chosen species may become resistant to chemicals or antibiotics over time.
F. Assess and critique fossil and biochemical evidence used to support evolutionary relationships among organisms. (SB5.c)	The student can **define** what a fossil is and **recognize** that fossil evidence is used to support evolution.	The student can **define** fossil and biochemical evidence and **interpret** data used to support evolutionary relationships among organisms.	The student can **assess and critique** fossil and biochemical evidence used to support evolutionary relationships among organisms.	The student can research the Georgia fossil record to identify fossils endemic to GA and **synthesize an argument using this evidence** to show the biochemical relationship to species that are related to the fossil(s) chosen.
G. Make and defend a claim based on evidence that heritable genetic variations may result from: 1) new genetic combinations through meiosis, 2) viable errors occurring during replication, and/or 3) mutations caused by environmental factors.	The student can **identify** that heritable genetic variations result from meiosis, replication errors, and environmental mutagens.	The student can **interpret** a claim based on evidence that heritable genetic variations may result from: 1) new genetic combinations through meiosis, 2) viable errors occurring during replication, and/or 3) mutations caused by environmental factors.	The student can **cite evidence** that supports heritable genetic variations may result from: 1) new genetic combinations through meiosis, 2) viable errors occurring during replication, and/or 3) mutations caused by environmental factors.	The student can **make and defend** a claim based on evidence that heritable genetic variations may result from: 1) new genetic combinations through meiosis, 2) viable errors occurring during replication, and/or 3) mutations caused by environmental factors.

Suggested Performance Tasks

- Selected Tasks from https://www.georgiastandards.org/Frameworks/Pages/BrowseFrameworks/Science9-12.aspx
- Selected Tasks from https://phet.colorado.edu/en/simulations/category/biology

HIGH SCHOOL GRADUATION COMPETENCIES- Biology

Graduation Competency: HS4

Life Science: Classification and the Diversity of Organisms

Students will apply scientific and engineering practices to understand and analyze the structural similarities of organisms and how they can be compared scientifically.

Performance Indicators

A. Construct an argument comparing how structure and function vary among the six kingdoms. (archaebacteria, eubacteria, protists, fungi, plants, and animals). (SB3.b)

B. Construct a phylogenetic tree for a group of fictitious organisms to demonstrate the evolutionary basis of modern classification systems. (SB3.c)

C. Develop an argument using scientific evidence to explain if viruses are living or nonliving organisms. (SB3.d)

Performance Indicator Scoring Criteria Graduation Competency 4 Biology

Performance Indicator	Emerging	Progressing	Competent	Exemplary
A. Construct an argument comparing how structure and function vary among the six kingdoms. (archaebacteria, eubacteria, protists, fungi, plants, and animals). (SB3.b)	The student can **identify** structures and functions unique to the six kingdoms. (archaebacteria, eubacteria, protists, fungi, plants, and animals).	The student can **compare** how structures and function vary among the six kingdoms. (archaebacteria, eubacteria, protists, fungi, plants, and animals).	The student can **construct an argument comparing** how structure and function vary among the six kingdoms. (archaebacteria, eubacteria, protists, fungi, plants, and animals).	The student can **construct** and **critique** how structure and function vary among the six kingdoms and the evolutionary role it plays in classification. (archaebacteria, eubacteria, protists, fungi, plants, and animals).

B. Construct and revise a phylogenetic tree for a group of fictitious organisms to demonstrate the evolutionary basis of modern classification systems. (SB3.c)	The student can **use** a phylogenetic tree that demonstrates evolutionary relationships.	The student can **interpret** and **modify** a phylogenetic tree for a group of organisms to demonstrate evolutionary relationships.	The student can **construct** and **revise** a phylogenetic tree for a group of fictitious organisms to demonstrate the evolutionary basis of modern classification systems.	The student can **analyze** two versions of phylogenetic tree for a group of organisms to demonstrate the evolutionary basis for modern classification systems.
C. Develop an argument using scientific evidence to explain if viruses are living or nonliving organisms. (SB3.d)	The student can **state** why viruses are nonliving organisms.	The student can **categorize** viruses as living or nonliving organisms based on scientific evidence.	The student can **develop an argument** using scientific evidence to explain if viruses are living or nonliving organisms.	The student can **critique** evidence that supports whether viruses are living or nonliving organisms.

Suggested Performance Tasks

- Selected Tasks from https://www.georgiastandards.org/Frameworks/Pages/BrowseFrameworks/Science9-12.aspx
- Selected Tasks from https://phet.colorado.edu/en/simulations/category/biology