High School Biology Scope and Sequence

Unit of Study 1: Matter and Energy

Standards that appear this unit: HS-LS2-3, HS-LS2-4, HS-LS2-5

HS. Matter and I	Energy in Organisms and Ecosystems			
Students who demonstrate understanding can: HS-LS2-3. Construct and revise an explanation based on evidence for the cycling of matter and flow of energy in aerobic and anaerobic conditions. [Clarification Statement: Emphasis is on conceptual understanding of the role of aerobic and anaerobic respiration in different environments.] [Assessment Boundary: Assessment does not include the specific chemical processes of either aerobic or anaerobic respiration 1				
The performance	expectations above were developed using the following eleme	ents from the NRC docum	ent A Framework	
for K-12 Science E	ducation:			
Constructing Ex Constructing expla experiences and p by multiple and inc consistent with sci • Construct and r obtained from a models, theorie theories and la did in the past • Scientific Knowl • Most scientific change based o evidence. (HS-I	Science and Engineering Practices planations and Designing Solutions mations and designing solutions in 9–12 builds on K–8 rogresses to explanations and designs that are supported dependent student-generated sources of evidence entific ideas, principles, and theories. revise an explanation based on valid and reliable evidence a variety of sources (including students' own investigations, es, simulations, peer review) and the assumption that ws that describe the natural world operate today as they and will continue to do so in the future. (HS-LS2-3) Connections to Nature of Science edge is Open to Revision in Light of New Evidence knowledge is quite durable, but is, in principle, subject to on new evidence and/or reinterpretation of existing _S2-3)	Disciplinary Core Ideas LS2.B: Cycles of Matter and Energy Transfer in Ecosystems • Photosynthesis and cellular respiration (including anaerobic processes) provide most of the energy for life processes. (HS- LS2-3)	Crosscutting Concepts Systems and System Models Energy and Matter • Energy drives the cycling of matter within and between systems. (HS- LS2-3)	
Connections to oth	her DCIs in this grade-band: HS.PS1.B (HS-LS2-3); HS.PS3	.B (HS-LS2-3); HS.PS3.I) (HS-LS2-3);	
HS.ESS2.A (HS-L	S2-3)			
Articulation across LS2-3)	: grade-bands: MS.PS1.B (HS-LS2-3); MS.PS3.D (HS-LS2-3)); MS.LS1.C (HS-LS2-3);	MS.LS2.B (HS-	
Common Core State Standards Connections:				
 CLA/LILETACY - RST.11-12.1 Cite specific textual evidence to support analysis of science and technical texts, attending to important distinctions the author makes and to any gaps or inconsistencies in the account. (HS-LS2-3) WHST.9-12.2 Write informative/explanatory texts, including the narration of historical events, scientific procedures/ experiments, or technical processes. (HS-LS2-3) 				
WHST.9-12.5	 2.5 Develop and strengthen writing as needed by planning, revising, editing, rewriting, or trying a new approach, focusing on addressing what is most significant for a specific purpose and audience. (HS-LS2-3) 			

HS. Matter and Energy in Organisms and Ecosystems

Students who demonstrate understanding can:

HS-LS2-4. Use mathematical representations to support claims for the cycling of matter and flow of energy among organisms in an ecosystem. [Clarification Statement: Emphasis is on using a mathematical model of stored energy in biomass to describe the transfer of energy from one trophic level to another and that matter and energy are conserved as matter cycles and energy flows through ecosystems. Emphasis is on atoms and molecules such as carbon, oxygen, hydrogen and nitrogen being conserved as they move through an ecosystem.] [Assessment Boundary: Assessment is limited to proportional reasoning to describe the cycling of matter and flow of energy.]

The performance expectations above were developed using the following elements from the NRC document *A Framework for K-12 Science Education*:

Science and Eng	jineering Practices	Disciplinary Core Ideas	Crosscutting Concepts	
Using Mathemat	ics and	LS2.B: Cycles of Matter and	Energy and Matter	
Computational T	hinking	Energy Transfer in Ecosystems	 Energy cannot be created or 	
Mathematical and o	computational	 Plants or algae form the lowest 	destroyed—it only moves between	
thinking in 9-12 bu	ilds on K-8	level of the food web. At each link	one place and another place,	
experiences and pr	ogresses to using	upward in a food web, only a	between objects and/or fields, or	
algebraic thinking a	and analysis, a range	small fraction of the matter	between systems.(HS-LS2-4)	
of linear and nonlir	near functions	consumed at the lower level is	, , , ,	
including trigonom	etric functions.	transferred upward, to produce		
exponentials and lo	garithms, and	growth and release energy in		
computational tool	s for statistical	cellular respiration at the higher		
analysis to analyze	represent and	level Given this inefficiency there		
model data Simple	computational	are generally fewer organisms at		
cimulations are cro	ated and used based	higher levels of a food web. Some		
on mothematical m	aleu anu useu baseu	matter reacts to release operav for		
	IUUEIS UI DASIC	life functions, some matter is		
assumptions.	al roprocentations of	stored in powly made structures		
		stored in newly made structures,		
pnenomena or o	design solutions to	and much is discarded. The		
support claims.	(HS-LS2-4)	chemical elements that make up		
		the molecules of organisms pass		
		through food webs and into and		
		out of the atmosphere and soil,		
		and they are combined and		
		recombined in different ways. At		
		each link in an ecosystem, matter		
		and energy are conserved. (HS-		
		LS2-4)		
Connections to oth	er DCIs in this grade-ba	and: HS.PS3.B (HS-LS2-4); HS.PS3.D (HS-LS2-4);	
Articulation across	grade-bands: MS.PS3.	D (HS-LS2-4); MS.LS1.C (HS-LS2-4); M	S.LS2.B (HS-LS2-4)	
Common Core Stat	te Standards Connection	าร:		
Mathematics –				
MP.2	Reason abstractly and quantitatively. (HS-LS2-4)			
MP.4	Model with mathematics. (HS-LS2-4)			
HSN-Q.A.1	Use units as a way to understand problems and to guide the solution of multi-step problems; choose			
	and interpret units consistently in formulas; choose and interpret the scale and the origin in graphs		et the scale and the origin in graphs	
	and data displays. (HS	splays. (HS-LS2-4)		
HSN-Q.A.2	Define appropriate qu	uantities for the purpose of descriptive modeling. (HS-LS2-4)		
HSN-Q.A.3	Choose a level of accu	f accuracy appropriate to limitations on measurement when reporting quantities. (HS-		
• -	LS2-4)	, , , , ,		

HS. Matter and Energy in Organis	HS. Matter and Energy in Organisms and Ecosystems			
Students who demonstrate understand	ling can:			
 HS-LS2-5. Develop a model to illustrate the role of photosynthesis and cellular respiration in the cycling of carbon among the biosphere, atmosphere, hydrosphere, and geosphere. [Clarification Statement: Examples of models could include simulations and mathematical models.] [Assessment Boundary: Assessment does not include the specific chemical steps of photosynthesis and respiration.] 				
for K-12 Science Education:	were developed using the following elements fr	om the NRC document A Framework		
Science and Engineering Practices Developing and Using Models Modeling in 9–12 builds on K–8 experiences and progresses to using, synthesizing, and developing models to predict and show relationships among variables between systems and their components in the natural and designed worlds. • Develop a model based on evidence to illustrate the relationships between systems or components of a system. (HS- LS2-5)	 Disciplinary Core Ideas LS2.B: Cycles of Matter and Energy Transfer in Ecosystems Photosynthesis and cellular respiration are important components of the carbon cycle, in which carbon is exchanged among the biosphere, atmosphere, oceans, and geosphere through chemical, physical, geological, and biological processes. (HS-LS2-5) PS3.D: Energy in Chemical Processes The main way that solar energy is captured and stored on Earth is through the complex chemical process known as photosynthesis. (secondary to HS-LS2-5) 	Crosscutting Concepts Systems and System Models • Models (e.g., physical, mathematical, computer models) can be used to simulate systems and interactions—including energy, matter, and information flows—within and between systems at different scales. (HS- LS2-5)		
Connections to other DCIs in this grade-band: HS.PS1.B (HS-LS2-5); HS.ESS2.D (HS-LS2-5)				
Articulation across grade-bands: MS.PS3.D (HS-LS2-5); MS.LS1.C (HS-LS2-5); MS.LS2.B (HS-LS2-5); MS.ESS2.A (HS- LS2-5)				
Common Core State Standards Connections: N/A				

Unit of Study 2: Organisms and Energy

Standards that appear this unit: HS-LS2-2, HS-LS2-6, HS-LS2-1

HS. Interdependent Relationships in Ecosystems

Students who demonstrate understanding can:

HS-LS2-2. Use mathematical representations to support and revise explanations based on evidence about factors affecting biodiversity and populations in ecosystems of different scales. [Clarification Statement: Examples of mathematical representations include finding the average, determining trends, and using graphical comparisons of multiple sets of data.] [Assessment Boundary: Assessment is limited to provided data.] The performance expectations above were developed using the following elements from the NRC document <i>A Framework for K-12 Science Education</i> :			
Science and Engineering Practices Using Mathematics and Computational Thinking Mathematical and computational thinking in 9- 12 builds on K-8 experiences and progresses to using algebraic thinking and analysis, a range of linear and nonlinear functions including trigonometric functions, exponentials and logarithms, and computational tools for statistical analysis to analyze, represent, and model data. Simple computational simulations are created and used based on mathematical models of basic assumptions. • Use mathematical representations of phenomena or design solutions to support and revise explanations. (HS-LS2-2)	 Disciplinary Core Ideas LS2.A: Interdependent Relationships in Ecosystems Ecosystems have carrying capacities, which are limits to the numbers of organisms and populations they can support. These limits result from such factors as the availability of living and nonliving resources and from such challenges such as predation, competition, and disease. Organisms would have the capacity to produce populations of great size were it not for the fact that environments and resources are finite. This fundamental tension affects the abundance (number of individuals) of species in any given ecosystem. (HS- LS2-2) LS2.C: Ecosystem Dynamics, Functioning, and Resilience A complex set of interactions within an ecosystem can keep its numbers and types of organisms relatively 	Crosscutting Concepts Scale, Proportion, and Quantity • Using the concept of orders of magnitude allows one to understand how a model at one scale relates to a model at another scale. (HS-LS2-2)	
<i>Connections to Nature of Science</i> Scientific Knowledge is Open to Revision in Light of New Evidence	constant over long periods of time under stable conditions. If a modest biological or physical disturbance to an ecosystem occurs, it may return to its more or less original status (i.e., the ecosystem is		

 Most scientific knowledge is quite durable, but is, in principle, subject to change based on new evidence and/or reinterpretation of existing evidence. (HS-LS2-2)

 habitat availability.
 (HS-LS2-2)

 Connections to other DCIs in this grade-band:
 HS.ESS2.E
 (HS-LS2-2);
 HS.ESS3.A
 (HS-LS2-2);
 (HS-LS2-2);
 HS.ESS3.A
 (HS-LS2-2);
 HS.ESS3.A
 (HS-LS2-2);
 (HS-LS2-2);

resilient), as opposed to becoming a very different

size of any population, however, can challenge the

ecosystem. Extreme fluctuations in conditions or the

functioning of ecosystems in terms of resources and

Articulation across grade-bands: MS.LS2.A (HS-LS2-2); MS.LS2.C (HS-LS2-2); MS.ESS3.C (HS-LS2-2)

Common Core State	e Standards Connections:
ELA/Literacy –	
RST.11-12.1	Cite specific textual evidence to support analysis of science and technical texts, attending to important distinctions the author makes and to any gaps or inconsistencies in the account. (HS-LS2-2)
WHST.9-12.2	Write informative/explanatory texts, including the narration of historical events, scientific procedures/ experiments, or technical processes. (<i>HS-LS2-2</i>)
Mathematics –	
MP.2	Reason abstractly and quantitatively. (HS-LS2-2)
MP.4	Model with mathematics. (HS-LS2-2)
HSN-Q.A.1	Use units as a way to understand problems and to guide the solution of multi-step problems; choose and interpret units consistently in formulas; choose and interpret the scale and the origin in graphs and data displays. (HS-LS2-2)
HSN-Q.A.2	Define appropriate quantities for the purpose of descriptive modeling. (HS-LS2-2)
HSN-Q.A.3	Choose a level of accuracy appropriate to limitations on measurement when reporting quantities. (HS-LS2-2)

HS. Interdependent Relationships in	Ecosystems				
Students who demonstrate understanding	j can:				
HS-LS2-6. Evaluate the claims, evid	ence, and reasoning that the comple	x interactions in ecosystems			
maintain relatively consi	stent numbers and types of organism	is in stable conditions, but changing			
conditions may result in	a new ecosystem. [Clarification Statem	ent: Examples of changes in ecosystem			
conditions could include mo	dest biological or physical changes, such a	s moderate hunting or a seasonal flood:			
and extreme changes, such	as volcanic eruntion or sea level rise 1				
The performance expectations above wer	e developed using the following elements	from the NRC document A Framework			
for K-12 Science Educations	e developed using the following clements	from the fifte document A Humework			
Science and Engineering Practices	Disciplinany Coro Idoas	Croccoutting Conconto			
Engaging in Argument from	LS2 CL Ecosystem Dynamics	Crosscutting Concepts			
Engaging in Argument from	LSZ.C: ECOSYSTEM Dynamics, Europian and Desiliones	- Much of colonge doals with			
Evidence	Functioning, and Resilience	 Much of science deals with 			
Engaging in argument from evidence in	 A complex set of interactions within 	constructing explanations of now			
9–12 builds from K–8 experiences and	an ecosystem can keep its numbers	things change and how they remain			
progresses to using appropriate and	and types of organisms relatively	stable. (HS-LS2-6)			
sufficient evidence and scientific	constant over long periods of time				
reasoning to defend and critique claims	under stable conditions. If a				
and explanations about the natural and	modest biological or physical				
designed world(s). Arguments may also	disturbance to an ecosystem				
come from current scientific or	occurs, it may return to its more or				
historical episodes in science.	less original status (i.e., the				
 Evaluate the claims, evidence, and 	ecosystem is resilient), as opposed				
reasoning behind currently accepted	to becoming a very different				
explanations or solutions to	ecosystem. Extreme fluctuations in				
determine the merits of arguments.	conditions or the size of any				
(HS-LS2-6)	population, however, can challenge				
	the functioning of ecosystems in				
	terms of resources and habitat				
Connections to Nature of Science	availability. (HS-LS2-6)				
Scientific Knowledge is Open to					
Revision in Light of New Evidence					
 Scientific argumentation is a mode 					
of logical discourse used to clarify					
the strength of relationships					
between ideas and evidence that					
may result in revision of an					
explanation. (HS-LS2-6)					
Connections to other DCIs in this grade-band, HS FSS2 F (HS-I S2-6)					
Articulation across grade-hands: MS LS2 & (HS-LS2-6): MS LS2 C (HS-LS2-6): MS ESS2 E (HS-LS2-6): MS ESS3 C (HS-					

Common Core Stat	te Standards Connections:
ELA/Literacy –	
RST.9-10.8	Assess the extent to which the reasoning and evidence in a text support the author's claim or a recommendation for solving a scientific or technical problem. (HS-LS2-6)
RST.11-12.1	Cite specific textual evidence to support analysis of science and technical texts, attending to important distinctions the author makes and to any gaps or inconsistencies in the account. (HS-LS2-6)
RST.11-12.7	Integrate and evaluate multiple sources of information presented in diverse formats and media (e.g., quantitative data, video, multimedia) in order to address a question or solve a problem. (HS-LS2-6)
RST.11-12.8	Evaluate the hypotheses, data, analysis, and conclusions in a science or technical text, verifying the data when possible and corroborating or challenging conclusions with other sources of information. (HS-LS2-6)
Mathematics –	
MP.2	Reason abstractly and quantitatively. (HS-LS2-6)
HSS-ID.A.1	Represent data with plots on the real number line. (HS-LS2-6)
HSS-IC.A.1	Understand statistics as a process for making inferences about population parameters based on a
	random sample from that population. (HS-LS2-6)
HSS-IC.B.6	Evaluate reports based on data. (HS-LS2-6)

HS. Interdepend	lent Relationships in	Ecosystems	
Students who dem	ionstrate understanding	j can:	
HS-LS2-1. Use m	nathematical and/or	computational representations to sup	port explanations of factors that
affect	t carrying capacity o	f ecosystems at different scales. [Clarif	fication Statement: Emphasis is on
quanti	tative analysis and con	parison of the relationships among interdep	pendent factors including boundaries,
resour	ces, climate and compo	etition. Examples of mathematical comparise	ons could include graphs, charts,
histog	rams, and population c	hanges gathered from simulations or histori	ical data sets.] [Assessment Boundary:
Assess	sment does not include	deriving mathematical equations to make c	comparisons.]
The performance e	expectations above wer	e developed using the following elements fi	rom the NRC document A Framework
for K-12 Science E	ducation:		
Science and Eng	ineering Practices	Disciplinary Core Ideas	Crosscutting Concepts
Using Mathemat	ice and	IS2 A: Interdependent	Scale, Proportion, and Quantity
Computational T	lics allu Thinking	Relationshing in Ecosystems	 The significance of a phenomenon
Mothematical and	computational	- Econystems have corrying conscition	is dependent on the scale,
Mauleniaucai anu	computational	 Ecosystems have carrying capacities, which are limits to the numbers of 	proportion, and quantity at which
uninking in 9-12 DU		which are limits to the numbers of	it occurs. (HS-LS2-1)
experiences and p	rogresses to using	organisms and populations they can	
algebraic thinking	and analysis, a range	support. These limits result from	
of linear and nonli	near functions	such factors as the availability of	
including trigonom	letric functions,	living and nonliving resources and	
exponentials and lo	ogarithms, and	from such challenges such as	
	is for statistical	predation, competition, and disease.	
analysis to analyze	e, represent, and	Organisms would have the capacity	
model data. Simple	e computational	to produce populations of great size	
simulations are cre	eated and used based	were it not for the fact that	
on mathematical n	nodels of basic	environments and resources are	
assumptions.	· - 1 1 / -	finite. This fundamental tension	
 Use mathematic 	cal and/or	affects the abundance (number of	
computational i	representations of	individuals) of species in any given	
pnenomena or	design solutions to	ecosystem. (HS-LS2-1)	
support explana	ations. (HS-LS2-1)		
Connections to oth	her DCIs in this grade-b	pand: N/A	
Articulation across	grade-bands: MS.LS2	.A (HS-LS2-1); MS.LS2.C (HS-LS2-1); MS.	ESS3.A (HS-LS2-1); MS.ESS3.C (HS-
LS2-1)			
Common Core Sta	te Standards Connectio	INS:	
ELA/Literacy -	<u></u>		
RS1.11-12.1		evidence to support analysis of science and	technical texts, attending to important
WUIGT 0 40.0	distinctions the authority	or makes and to any gaps or inconsistencies	s in the account. (HS-LS2-1)
WHS1.9-12.2	write informative/ex	Dianatory texts, including the narration of hi	istorical events, scientific procedures/
Ad-11 11	experiments, or tech	nical processes. (HS-LS2-1)	
Mathematics –			
MP.2	Reason abstractly and quantitatively. (HS-LS2-1)		
	Model with mathematics. (HS-LS2-1)		
HSN-Q.A.1	use units as a way to	understand problems and to guide the solu	ution of multi-step problems; choose
	and interpret units co	nsistently in formulas; choose and interpret	t the scale and the origin in graphs and
	data displays. (HS-LS	2-1)	
HSN-Q.A.2	Define appropriate qu	antities for the purpose of descriptive mode	eling. (HS-LS2-1)
HSN-Q.A.3	Choose a level of acc	uracy appropriate to limitations on measure	ement when reporting quantities. (HS-
	LS2-1)		

Unit of Study 3: Human Activity and Climate

Standards that appear this unit: HS-ESS3-1, HS-ESS3-6, HS-ESS3-5, HS-ESS3-4*, ETS1-3

HS. Human Sustainability				
Students who demonstrate understanding can: HS-ESS3-1. Construct an explanation based on evidence for how the availability of natural resources, occurrence of natural hazards, and changes in climate have influenced human activity. [Clarification Statement: Examples of key natural resources include access to fresh water (such as rivers, lakes, and groundwater), regions of fertile soils such as river deltas, and high concentrations of minerals and fossil fuels. Examples of natural hazards can be from interior processes (such as volcanic eruptions and earthquakes), surface processes (such as tsunamis, mass wasting and soil erosion), and severe weather (such as hurricanes, floods, and droughts). Examples of the results of changes in climate that can affect populations or drive mass migrations include changes to sea level, regional patterns of temperature and precipitation, and the types of crops and livestock that can be raised.] The performance expectations above were developed using the following elements from the NRC document A Framework				
 Science and Engineering Practices Constructing Explanations and Designing Solutions Constructing explanations and designing solutions in 9–12 builds on K–8 experiences and progresses to explanations and designs that are supported by multiple and independent student-generated sources of evidence consistent with scientific knowledge, principles, and theories. Construct an explanation based on valid and reliable evidence obtained from a variety of sources (including students' own investigations, models, theories, simulations, peer review) and the assumption that theories and laws that describe the natural world operate today as they did in the past and will continue to 		 Disciplinary Core Ideas ESS3.A: Natural Resources Resource availability has guided the development of human society. (HS-ESS3-1) ESS3.B: Natural Hazards Natural hazards and other geologic events have shaped the course of human history; [they] have significantly altered the sizes of human populations and have driven human migrations. (HS-ESS3-1) 	Crosscutting Concepts Cause and Effect • Empirical evidence is required to differentiate between cause and correlation and make claims about specific causes and effects. (HS-ESS3- 1) Connections to Engineering, Technology, and Applications of Science Influence of Engineering, Technology, and Science on Society and the Natural World • Modern civilization depends on major technological systems. (HS-ESS3-1)	
Connections to	other DCIs in this grade-l	band: N/A		
Articulation of D MS.ESS3.A (HS	Articulation of DCIs across grade-bands: MS.LS2.A (HS-ESS3-1); MS.LS4.D (HS-ESS3-1); MS.ESS2.A (HS-ESS3-1); MS.ESS3.A (HS-ESS3-1); MS.ESS3.B (HS-ESS3-1)			
<i>Common Core S</i> <i>ELA/Literacy –</i> RST.11-12.1	Common Core State Standards Connections: ELA/Literacy – RST.11-12.1 Cite specific textual evidence to support analysis of science and technical texts, attending to important distinctions the author makes and to any gaps or inconsistencies in the account. (HS-ESS3- 1)			
WHST.9-12.2	Write informative/ex experiments, or tech	Write informative/explanatory texts, including the narration of historical events, scientific procedures/ experiments, or technical processes. (HS-ESS3-1)		
MP.2 HSN-Q.A.1	Reason abstractly an Use units as a way to and interpret units co and data displays. (<i>H</i>	Reason abstractly and quantitatively. <i>(HS-ESS3-1)</i> Use units as a way to understand problems and to guide the solution of multi-step problems; choose and interpret units consistently in formulas; choose and interpret the scale and the origin in graphs and data displays. <i>(HS-ESS3-1)</i>		
11311-Q.A.Z	Denne appropriate q		. mouching. (<i>H3=L333=1)</i>	

HSN-Q.A.3 Choose a level of accuracy appropriate to limitations on measurement when reporting quantities. *(HS-ESS3-1)*

HS. Human	Sustainability			
Students who	demonstrate understanding of	an:		
HS-ESS3-6.	Use a computational repr	esentation to illustrate the relationsh	nips among Earth systems and	
	how those relationships a	are being modified due to human acti	vity. [Clarification Statement:	
	Examples of Earth systems to	b be considered are the hydrosphere, atmosphere, atm	osphere, cryosphere, geosphere,	
	and/or biosphere. An examp	le of the far-reaching impacts from a huma	an activity is how an increase in	
	atmospheric carbon dioxide	results in an increase in photosynthetic bio	mass on land and an increase in	
	ocean acidification, with resu	Ilting impacts on sea organism health and	marine populations.] [Assessment	
	Boundary: Assessment does	not include running computational repres	entations but is limited to using the	
	published results of scientific	computational models]	chalono sacio innicea co doing the	
The performa	nce expectations above were	developed using the following elements fr	om the NPC document A Framework	
for K-12 Scier	nce expectations above were	developed using the following elements in	off the fille document A framework	
101 K-12 SCIEI				
Colones on	d Engineering Dynatices	Dissiplinery Core Ideas	Crossoutting Concerts	
Science an	a Engineering Practices	Disciplinary Core Ideas	Crosscutting Concepts	
Using Mathe	ematics and	ESS2.D: Weather and Climate	Systems and System Models	
Computation	nal Thinking	 Current models predict that, 	 When investigating or describing 	
Mathematical	and computational thinking	although future regional climate	a system, the boundaries and	
in 9-12 builds	on K-8 experiences and	changes will be complex and	initial conditions of the system	
progresses to	using algebraic thinking	varied, average global	need to be defined and their	
and analysis	a range of linear and	temperatures will continue to rise	inputs and outputs analyzed and	
nonlinear fund	ctions including	The outcomes predicted by global	described using models. (HS-	
trigonomotric	functions exponentials and	climate models strongly depend on	ESS3-6)	
lagarithma ar	rigonometric functions, exponentials and climate models strongly depend on			
iogariunms, ar	garithms, and computational tools for the amounts of human-generated			
statistical ana	atistical analysis to analyze, represent, greenhouse gases added to the			
and model da	d model data. Simple computational atmosphere each year and by the			
simulations ar	nulations are created and used based ways in which these gases are			
on mathemati	n mathematical models of basic absorbed by the ocean and			
assumptions.		biosphere. (secondary to HS-ESS3-		
 Use a com 	putational representation of	6)		
phenomen	a or design solutions to	ESS3.D: Global Climate Change		
describe a	nd/or support claims and/or	 Through computer simulations and 		
explanatio	ns. (HS-ESS3-6)	other studies, important discoveries		
		are still being made about how the		
		ocean, the atmosphere, and the		
	biosphere interact and are modified			
		in response to human activities		
		(HS-FSS3-6)		
Connections t	o other DCIs in this grade-ba	201 HS IS2 B (HS-FSS3-6) HS IS2 C (HS	S-ESS3-6) HS ISA D (HS-ESS3-6)	
	HS-FSS3-6)	<i>iu.</i> II3.L32.D (II3 ⁻ L333 ⁻ 0), II3.L32.C (II	טיבסטייט <i>ן, הסובסיוע (הסיבסטייס);</i>	
Articulation of	HJ-LJJJ-UJ FDCIa parada handa: M			
	LE ESS2 61 ME ESS2 D (US	3.132.0 (Π3-2333-0 <i>);</i> Μ 3.2332.Α (Π3-23 Εςς2 ε)	, M3.E332.C (N3-E333-0);	
MIS.ESSS.U (NS-ESSS-0); MIS.ESSS.U (NS-ESSS-0)				
Common Core	e State Standards Connections	<i>ii</i>		
Mathematics ·	-			
MP.2	Reason abstractly and	quantitatively. (HS-ESS3-6)		
MP.4	Model with mathematic	Model with mathematics. (HS-ESS3-6)		
HSN-Q.A.1	Use units as a way to u	nderstand problems and to guide the solu	tion of multi-step problems; choose	
-	and interpret units con	sistently in formulas; choose and interpret	the scale and the origin in graphs	
	and data displays. (HS-	ESS3-6)		
HSN-0.4.2	Define appropriate qua	ntities for the purpose of descriptive mode	ling. (HS-ESS3-6)	
	ICN O A 2 Chapped a foregraphic appropriate to limitations on measurement when repetition (IIC			
пэм-ү.А.3		acy appropriate to infitations on measure	ment when reporting quantities. (IIS-	
	ESS3-0)			

HS. Weather and	I Climate				
Students who dem	onstrate understanding can:				
HS-ESS3-5.	Analyze geoscience data and the results from global clima	ite models to make	an evidence-		
	based forecast of the current rate of global or regional cli	mate change and as	ssociated future		
	impacts to Earth systems. [Clarification Statement: Examples	s of evidence, for both	data and climate		
	model outputs, are for climate changes (such as precipitation and	temperature) and the	eir associated		
	impacts (such as on sea level, glacial ice volumes, or atmosphere	and ocean composition	on).] [Assessment		
	Boundary: Assessment is limited to one example of a climate cha	nge and its associated	d impacts.]		
The performance e K-12 Science Educ	expectations above were developed using the following elements from ation:	om the NRC document	A Framework for		
	Science and Engineering Practices	Disciplinary	Crosscutting		
Analyzing and In	ternreting Data	Core Ideas	Concents		
Analyzing data in C	–12 builds on K–8 experiences and progresses to introducing	ESS3.D: Global	Stability and		
more detailed stati	stical analysis, the comparison of data sets for consistency, and	Climate Change	Change		
the use of models	to generate and analyze data	 Though the 	 Change and 		
 Analyze data us 	sing computational models in order to make valid and reliable	magnitudes of	rates of		
scientific claims	(HS-FSS3-5)	human	change can be		
		impacts are	quantified and		
		greater than	modeled over		
	Connections to Nature of Science	they have ever	very short or		
		been, so too	very long		
Scientific Investigations Use a Variety of Methods			periods of		
 Science investion 	lations use diverse methods and do not always use the same set	abilities to	time. Some		
of procedures t	o obtain data. (HS-ESS3-5)	model, predict.	system		
 New technologi 	es advance scientific knowledge. (HS-ESS3-5)	and manage	changes are		
Scientific Knowl	edge is Based on Empirical Evidence	current and	irreversible.		
 Science knowle 	dge is based on empirical evidence. (HS-ESS3-5)	future impacts.	(HS-FSS3-5)		
 Science argume 	ents are strengthened by multiple lines of evidence supporting a	(HS-FSS3-5)	(
single explanati	on. (HS-ESS3-5)	(
Connections to oth	per DCIs in this grade-band: HS.PS3.B (HS-ESS3-5); HS.PS3.D (HS	S-ESS3-5): HS.LS1.C	(HS-ESS3-5):		
HS.ESS2.D (HS-ESS3-5)					
Articulation of DCI	Articulation of DCIs across grade-bands: MS.PS3.B (HS-ESS3-5); MS.PS3.D (HS-ESS3-5); MS.ESS2.A (HS-ESS3-5);				
MS.ESS2.D (HS-E	SS3-5); MS.ESS3.B (HS-ESS3-5); MS.ESS3.C (HS-ESS3-5); MS.E	SS3.D (HS-ESS3-5)			
Common Core Star	te Standards Connections:				
ELA/Literacy –					
RST.11-12.1	Cite specific textual evidence to support analysis of science and te	echnical texts, attendi	ng to important		
	distinctions the author makes and to any gaps or inconsistencies i	in the account. (HS-ES	SS3-5)		
RST.11-12.2	Determine the central ideas or conclusions of a text; summarize c	omplex concepts, pro	cesses, or		
-	information presented in a text by paraphrasing them in simpler b	out still accurate terms	5. (HS-ESS3-5)		
RST.11-12.7	Integrate and evaluate multiple sources of information presented	in diverse formats and	d media (e.g.,		
-	quantitative data, video, multimedia) in order to address a question	on or solve a problem	(HS-ESS3-5)		
Mathematics –	· · · · · · · · · · · · · · · · · · ·				
MP.2	Reason abstractly and quantitatively. (HS-ESS3-5)				
HSN-Q.A.1	Use units as a way to understand problems and to guide the solut	ion of multi-step prob	lems; choose and		
interpret units consistently in formulas; choose and interpret the scale and the origin in graphs and dat		graphs and data			
	displays. (HS-ESS3-5)				
HSN-Q.A.2	Define appropriate quantities for the purpose of descriptive model	ling. <i>(HS-ESS3-5)</i>			
HSN-O.A.3	Choose a level of accuracy appropriate to limitations on measurer	nent when reporting a	uantities. (HS-		
	ESS3-5)		1		

HS. Human Sustainability

Students who demonstrate understanding can:

recy by m	nples for limiting fut cling resources) to la naking large change	h as for urban development, agriculture ure impacts could range from local effor arge-scale geoengineering design solutions to the atmosphere or ocean).]	and livestock, or surface mining). ts (such as reducing, reusing, and ons (such as altering global temperatures
The performance e	xpectations above w	vere developed using the following element	ents from the NRC document A Framework
TOP K-12 Science EC	iucation:		
Science and Pract	Engineering tices	Disciplinary Core Ideas ESS3.C: Human Impacts on	Crosscutting Concepts Stability and Change
Constructing Exp	lanations and	Earth Systems	 Feedback (negative or positive) can
Designing Solution	ons	 Scientists and engineers can 	stabilize or destabilize a system. (HS-
Constructing explar	nations and	make major contributions by	ESS3-4)
designing solutions	in 9–12 builds on	developing technologies that	
K–8 experiences an	id progresses to	produce less pollution and waste	
explanations and de	esigns that are	and that preclude ecosystem	Connections to Engineering,
independent studer	ple and	ETS1 P. Designing Solutions to	recnnology,
sources of evidence	consistent with	Engineering Problems	and Applications of Science
scientific knowledge	e, principles, and	 When evaluating solutions, it is 	Influence of Engineering,
theories.	-, F - F,	important to take into account a	Technology, and Science on Society
 Design or refine a solution to a 		range of constraints, including	and the Natural World
complex real-world problem,		cost, safety, reliability, and	 Engineers continuously modify these
based on scientific knowledge,		aesthetics, and to consider social,	systems to increase benefits while
student-generated sources of		cultural, and environmental	decreasing costs and risks. (HS-ESS3-
evidence, priorit	ized criteria, and	impacts. (secondary to HS-ESS3-	4)
tradeoff conside	erations. (HS-	4)	
ESS3-4)	or DCIs in this grad		
Articulation of DCI	er DCIS III tills yrdug s across grade-band	e-Dalla: H3.L32.C (H5-E553-4); H3.L34 c: M5.L52.C (H5-E553-4); M5.E552.A	(HS-ESS3-4) (HS-ESS3-4): MS ESS3 B (HS-ESS3-4):
MS FSS3 C (HS-FS	SS3-4) MS FSS3 D	(HS-ESS3-4)	(II3-L333-4), II3.L333.B (II3-L333-4),
Common Core Stat	e Standards Connec	tions:	
ELA/Literacy –			
RST.11-12.1	Cite specific textua	Il evidence to support analysis of science	e and technical texts, attending to
	important distinction	ons the author makes and to any gaps o	r inconsistencies in the account. (HS-ESS3-
	4)	, 5 1	`
RST.11-12.8	Evaluate the hypot	heses, data, analysis, and conclusions ir	n a science or technical text, verifying the
	data when possible and corroborating or challenging conclusions with other sources of information. (HS-ESS3-4)		
Mathematics -			
MP.2	Reason abstractly a	and quantitatively. (HS-ESS3-4)	
HSN-Q.A.1	Use units as a way	to understand problems and to guide th	ne solution of multi-step problems; choose
	and interpret units	consistently in formulas; choose and int	erpret the scale and the origin in graphs
	and data displays.	(HS-ESS3-4)	modeling (UC ECC2 4)
	Define appropriate	quantities for the purpose of descriptive	e moueing. (HS-ESS3-4)
п5N-Ų.А.3	Choose a level of accuracy appropriate to limitations on measurement when reporting quantities.		
	(115-2353-4)		

HS. Engineering I	HS. Engineering Design			
Students who demo	onstrate understanding car	1:		
HS-ETS1-3. Eva	luate a solution to a co	mplex real-world problem based or	n prioritized criteria and trade-	
offs	s that account for a ran	ge of constraints, including cost, sa	fety, reliability, and aesthetics,	
asv	well as possible social, o	cultural, and environmental impact	S.	
The performance ex	xpectations above were de	veloped using the following elements fr	om the NRC document A Framework	
for K-12 Science Ed	lucation:			
Science and En	gineering Practices	Disciplinary Core Ideas	Crosscutting Concepts	
Constructing Exp	lanations and	ETS1.B: Developing Possible	Connections to Engineering,	
Designing Solution	ons	Solutions	Technology,	
Constructing explan	nations and designing	 When evaluating solutions, it is 	and Applications of Science	
solutions in 9–12 bi	uilds on K–8 experiences	important to take into account a		
and progresses to e	explanations and designs	range of constraints, including	Influence of Science,	
that are supported	by multiple and	cost, safety, reliability, and	Engineering, and Technology	
independent studer	it-generated sources of	aesthetics, and to consider social,	on Society and the Natural	
evidence consistent	with scientific ideas,	cultural, and environmental	world	
principies and theor	ies.	Impacts. (HS-ETST-3)	 New technologies can have deep impacts on society and the 	
 Evaluate a soluti world problem 	non to a complex real-		any ironmont including come	
knowledge stud	ent-generated sources		that were not anticipated	
of evidence price	oritized criteria and		Analysis of costs and benefits is	
tradeoff conside	rations. (HS-FTS1-3)		a critical aspect of decisions	
			about technology. (HS-ETS1-3)	
Connections to HS-	ETS1.A: Defining and Delii	miting Engineering Problems include:		
Physical Scien	ce: HS-PS2-3, HS-PS3-3			
Connections to HS-	ETS1.B: Designing Solution	ns to Engineering Problems include:		
Earth and Spa	ce Science: HS-ESS3-2, H	HS-ESS3-4, Life Science: HS-LS2-7, HS	S-LS4-6	
Connections to HS-	ETS1.C: Optimizing the De	sign Solution include:		
Physical Scien	ce: HS-PS1-6, HS-PS2-3			
Articulation of DCIs	across grade-bands: MS	.ETS1.A (HS-ETS1-3); MS.ETS1.B (HS	-ETS1-3)	
Common Core State	e Standards Connections:			
ELA/Literacy –				
RST.11-12.7	Integrate and evaluate m	ultiple sources of information presented	I in diverse formats and media (e.g.,	
DCT 11 12 0	quantitative data, video,	multimedia) in order to address a quest	ion or solve a problem. (HS-EISI-3)	
K31.11-12.8	Evaluate the hypotheses,	uala, analysis, and conclusions in a scie	with other sources of information	
RST 11-12 9	Synthesize information fr	om a range of sources (e.g. texts evo	riments simulations) into a coherent	
	understanding of a proce	ss, phenomenon, or concent, resolving	conflicting information when possible	
	(HS-ETS1-3)		termeting internation when possibler	
Mathematics –	/			
MP.2	Reason abstractly and ou	antitatively. (HS-ETS1-3)		
MP.4	Model with mathematics.	(HS-ETS1-3)		

Unit of Study 4: Human Activity and Biodiversity

Standards that appear this unit: HS-ESS3-3, HS-LS2-7*, HS-LS4-6*, ETS1-1, ETS1-2, ETS1-3, ETS1-4

HS. Human Sustainability					
Students who demonstrate understand	ling can:				
HS-ESS3-3. Create a computation	al simulation to illus	trate the relationships among management of			
natural resources, the	sustainability of hu	man populations, and biodiversity. [Clarification			
Statement: Examples of	factors that affect the	management of natural resources include costs of resource			
extraction and waste mai	nagement, per-capita d	consumption, and the development of new technologies.			
Examples of factors that	affect human sustainal	hility include agricultural efficiency, levels of conservation.			
and urban planning 1 [As	sessment Boundary: 4	Assessment for computational simulations is limited to using			
provided multi-parameter	r programs or construc	ting simplified spreadsheet calculations 1			
The performance expectations above w	vore developed using t	the following elements from the NPC document A Framework			
for K 12 Science Education	vere developed using t	The following elements from the fixe document A framework			
TOT K-12 SCIENCE EUUCALION.					
Science and Engineering	Disciplinary Core	Crosscutting Concepts			
Practices	Ideas	Stability and Change			
Using Mathematics and	ESS3.C: Human	Change and rates of change can be quantified and			
Computational Thinking	Impacts on Earth	modeled over very short or very long periods of time.			
Mathematical and computational	Systems	Some system changes are irreversible. (HS-ESS3-3)			
thinking in 9-12 builds on K-8	 The 				
experiences and progresses to using	sustainability of				
algebraic thinking and analysis a	human societies	Connections to Engineering, Technology,			
range of linear and nonlinear	and the	and Applications of Science			
functions including trigonometric	biodiversity that				
functions including trigonometric	supports them	Influence of Engineering, Technology, and Science			
incuons, exponentials and requires on Society and the Natural World					
logarithms, and computational tools	or statistical analysis to analyze responsible Modern civilization depends on major technological				
for statistical analysis to analyze,	management of	systems. (HS-ESS3-3)			
represent, and model data. Simple	natural	 New technologies can have deep impacts on society 			
computational simulations are	resources (HS-	and the environment including some that were not			
created and used based on	FCC3-3)	anticipated (HS_FSS3_3)			
mathematical models of basic					
assumptions.					
Create a computational model or					
simulation of a phenomenon, Connections to Nature of Science					
designed device, process, or		Colonas is a Useran Fadaaaa			
system. (HS-ESS3-3)		Science is a Human Endeavor			
		 Scientific knowledge is a result of numan endeavors, 			
		Imagination, and creativity. (HS-ESS3-3)			
Connections to other DCIs in this grade-band: HS.PS1.B (HS-ESS3-3); HS.LS2.A (HS-ESS3-3); HS.LS2.B (HS-ESS3-3);					
HS.LS2.C (HS-ESS3-3); HS.LS4.D (HS-ESS3-3); HS.ESS2.A (HS-ESS3-3); HS.ESS2.E (HS-ESS3-3)					
Articulation of DCIs across grade-bands: MS.PS1.B (HS-ESS3-3); MS.LS2.A (HS-ESS3-3); MS.LS2.B (HS-ESS3-3);					
MS.LS2.C (HS-ESS3-3); MS.LS4.C (HS-ESS3-3); MS.LS4.D (HS-ESS3-3); MS.ESS2.A (HS-ESS3-3); MS.ESS3.A (HS-					
ESS3-3); MS.ESS3.C (HS-ESS3-3)					
Common Core State Standards Connections:					
Mathematics –					
MP.2 Reason abstractly	MP.2 Reason abstractly and quantitatively. (HS-ESS3-3)				
IP.4 Model with mathematics. (HS-ESS3-3)					

HS. Interdependent Relationships in	1 Ecosystems			
Students who demonstrate understandin	g can:			
HS-LS2-7. Design, evaluate, and ref	ine a solution for reducing the impacts	of human activities on the		
environment and biodive	rsity. * [Clarification Statement: Example	s of human activities can include		
urbanization, building dams,	and dissemination of invasive species.]			
The performance expectations above we	re developed using the following elements f	rom the NRC document A Framework		
for K-12 Science Education:				
Science and Engineering Practices	Disciplinary Core Ideas	Crosscutting Concepts		
Constructing Explanations and	LS2.C: Ecosystem Dynamics,	Stability and Change		
Designing Solutions	Functioning, and Resilience	 Much of science deals with 		
Constructing explanations and	 Moreover, anthropogenic changes 	constructing explanations of how		
designing solutions in 9–12 builds on	(induced by human activity) in the	things change and how they		
K–8 experiences and progresses to	environment—including habitat	remain stable. (HS-LS2-7)		
explanations and designs that are	destruction, pollution, introduction of			
supported by multiple and independent	invasive species, overexploitation,			
student-generated sources of evidence	and climate change—can disrupt an			
consistent with scientific ideas,	ecosystem and threaten the survival			
principles, and theories.	of some species. (HS-LS2-7)			
 Design, evaluate, and refine a 	LS4.D: Biodiversity and Humans			
solution to a complex real-world	 Biodiversity is increased by the 			
problem, based on scientific	formation of new species (speciation)			
knowledge, student-generated	and decreased by the loss of species			
sources of evidence, prioritized	(extinction). <i>(secondary to HS-LS2-7)</i>			
criteria, and tradeoff considerations.	riteria, and tradeoff considerations. Humans depend on the living world 			
(HS-LS2-7)	for the resources and other benefits			
	provided by biodiversity. But human			
activity is also having adverse				
Impacts on biodiversity through				
overpopulation, overexploitation,				
habitat destruction, pollution,				
	introduction of invasive species, and			
	climate change. Thus sustaining			
	biodiversity so that ecosystem			
	functioning and productivity are			
	and enhancing life on Earth			
	Sustaining highly are the also aids			
	bumphity by procerving landscapes			
	of recreational or inspirational value			
	(secondary to HS-1S2-7)			
	FTS1 B: Developing Possible			
	Solutions			
	 When evaluating solutions, it is 			
	important to take into account a			
	range of constraints, including cost			
	safety, reliability, and aesthetics, and			
	to consider social, cultural, and			
	environmental impacts (secondary			
	to HS-I S2-7)			
Connections to other DCIs in this grade-band: HS.ESS2.D (HS-I S2-7): HS ESS2 F (HS-I S2-7): HS ESS3 A (HS-I S2-7):				
HS-ESS3-C (HS-I S2-7)		$(10 \ 102 \ 7), 101 \ 100 \ 102 \ 7),$		
Articulation across grade-bands: MS-LS2	2.C (HS-152-7): MS.ESS3.C (HS-152-7): M	S.ESS3.D (HS-I S2-7)		

Common Core Stat	e Standards Connections:
ELA/Literacy –	
RST.9-10.8	Assess the extent to which the reasoning and evidence in a text support the author's claim or a recommendation for solving a scientific or technical problem. (HS-LS2-7)
RST.11-12.7	Integrate and evaluate multiple sources of information presented in diverse formats and media (e.g., quantitative data, video, multimedia) in order to address a question or solve a problem. (HS-LS2-7)
RST.11-12.8	Evaluate the hypotheses, data, analysis, and conclusions in a science or technical text, verifying the data when possible and corroborating or challenging conclusions with other sources of information. (HS-LS2-7)
WHST.9-12.7	Conduct short as well as more sustained research projects to answer a question (including a self- generated question) or solve a problem; narrow or broaden the inquiry when appropriate; synthesize multiple sources on the subject, demonstrating understanding of the subject under investigation. (HS- LS2-7)
Mathematics –	
MP.2	Reason abstractly and quantitatively. (HS-LS2-7)
HSN-Q.A.1	Use units as a way to understand problems and to guide the solution of multi-step problems; choose and interpret units consistently in formulas; choose and interpret the scale and the origin in graphs and

HS. Interdependent Relationships in Ecosystems

Students who demonstrate understanding can:

HS-LS4-6. Create or revise a simulation to test a solution to mitigate adverse impacts of human activity on biodiversity. * [Clarification Statement: Emphasis is on designing solutions for a proposed problem related to threatened or endangered species, or to genetic variation of organisms for multiple species.]

The performance expectations above were developed using the following elements from the NRC document *A Framework for K-12 Science Education*:

Science and Engineering Practices

Using Mathematics and

Computational Thinking Mathematical and computational thinking in 9-12 builds on K-8 experiences and progresses to using algebraic thinking and analysis, a range of linear and nonlinear functions including trigonometric functions, exponentials and logarithms, and computational tools for statistical analysis to analyze, represent, and model data. Simple computational simulations are created and used based on mathematical models of basic assumptions.

 Create or revise a simulation of a phenomenon, designed device, process, or system. (HS-LS4-6)

Disciplinary Core Ideas LS4.C: Adaptation

 Changes in the physical environment, whether naturally occurring or human induced, have thus contributed to the expansion of some species, the emergence of new distinct species as populations diverge under different conditions, and the decline–and sometimes the extinction–of some species. (HS-LS4-6)

LS4.D: Biodiversity and Humans

 Humans depend on the living world for the resources and other benefits provided by biodiversity. But human activity is also having adverse impacts on biodiversity through overpopulation, overexploitation, habitat destruction, pollution, introduction of invasive species, and climate change. Thus sustaining biodiversity so that ecosystem functioning and productivity are maintained is essential to supporting and enhancing life on Earth. Sustaining biodiversity also aids humanity by preserving landscapes of recreational or inspirational value. (HS-LS4-6)

ETS1.B: Developing Possible Solutions

- When evaluating solutions, it is important to take into account a range of constraints, including cost, safety, reliability, and aesthetics, and to consider social, cultural, and environmental impacts. (secondary to HS-LS4-6)
- Both physical models and computers can be used in various ways to aid in the engineering design process.
 Computers are useful for a variety of purposes, such as running simulations to test different ways of solving a problem or to see which one is most efficient or economical; and in making a persuasive presentation to a client about how a given design will meet his or her needs. (secondary to HS-LS4-6)

Crosscutting Concepts

Cause and Effect

 Empirical evidence is required to differentiate between cause and correlation and make claims about specific causes and effects. (HS-LS4-6)

Connections to other DCIs in this grade-band: HS.ESS2.D (HS-LS4-6); HS.ESS2.E (HS-LS4-6); HS.ESS3.A (HS-LS4-6);			
HS.ESS3.C (HS-LS	64-6); HS.ESS3.D (HS-LS4-6)		
Articulation across	grade-bands: MS.LS2.C (HS-LS4-6), MS.ESS3.C (HS-LS4-6)		
Common Core Stat	e Standards Connections:		
ELA/Literacy –			
WHST.9-12.5	Develop and strengthen writing as needed by planning, revising, editing, rewriting, or trying a new approach, focusing on addressing what is most significant for a specific purpose and audience. (HS-LS4-6)		
WHST.9-12.7	Conduct short as well as more sustained research projects to answer a question (including a self- generated question) or solve a problem: parrow or broaden the inquiry when appropriate: synthesize		

HS. Engineering	Design		
Students who demo	onstrate understandi	ng can:	
HS-ETS1-1. Ana	lyze a major globa	I challenge to specify qualitative and o	quantitative criteria and
The performance of	straints for solution	ns that account for societal needs and	wants.
for K-12 Science E		ere developed using the following elements	G from the NRC document A Framework
TOF R-12 Science Lu			
Science and Engi	neering Practices	Disciplinary Core Ideas	Crosscutting Concepts
 Asking Questions ar Problems Asking questions ar problems in 9–12 b experiences and pri formulating, refinin empirically testable design problems us simulations. Analyze complex problems by spe constraints for s solutions. (HS-E 	s and Defining builds on K–8 ogresses to g, and evaluating e questions and sing models and x real-world ecifying criteria and successful TTS1-1)	 ETS1.A: Defining and Delimiting Engineering Problems Criteria and constraints also include satisfying any requirements set by society, such as taking issues of risk mitigation into account, and they should be quantified to the extent possible and stated in such a way that one can tell if a given design meets them. (HS-ETS1-1) Humanity faces major global challenges today, such as the need for supplies of clean water and food or for energy sources that minimize pollution, which can be addressed through engineering. These global challenges also may have manifestations in local communities. (HS-ETS1-1) 	Connections to Engineering, Technology, and Applications of Science Influence of Science, Engineering, and Technology on Society and the Natural World • New technologies can have deep impacts on society and the environment, including some that were not anticipated. Analysis of costs and benefits is a critical aspect of decisions about technology. (HS-ETS1-1)
Connections to HS	ETS1 A: Dofining an	d Delimiting Engineering Problems include:	
Physical Scien	re: HS-PS2-3 HS-P	S Deminiung Engineering Problems Include.	
Connections to HS-	FTS1.B: Desianina S	olutions to Fnaineerina Problems include:	
Earth and Spa	ice Science: HS-ESS	3-2, HS-ESS3-4, Life Science: HS-LS2-7,	HS-LS4-6
Connections to HS-	ETS1.C: Optimizing t	he Design Solution include:	
Physical Scien	nce: HS-PS1-6, HS-PS	52-3	
Articulation of DCIs	s across grade-bands	: MS.ETS1.A (HS-ETS1-1)	
Common Core Stat	e Standards Connect	ions:	
ELA/Literacy –			
RST.11-12.7	Integrate and evalu	ate multiple sources of information present	ted in diverse formats and media (e.g.,
DCT 11 12 0	quantitative data, v	ideo, multimedia) in order to address a que	estion or solve a problem. (HS-ETS1-1)
K31.11-12.8	data when possible	and corroborating or challenging conclusions in a s	science of lectifical lext, verifying the
	(HS-FTS1-1)		
RST.11-12.9	Synthesize informat	ion from a range of sources (e.g., texts, e	(periments, simulations) into a coherent
	understanding of a process, phenomenon, or concept, resolving conflicting information when possible. (HS-ETS1-1)		
Mathematics –			
MP.2	Reason abstractly a	nd quantitatively. (HS-ETS1-1)	
MP.4	Model with mathem	natics. (HS-ETS1-1)	

HS. Engineering Design					
Students who demonstrate understanding	g can:				
HS-ETS1-2. Design a solution to a	complex real-world problem by breal	king it down into smaller, more			
manageable problems	that can be solved through engineer	ing.			
The performance expectations above we	re developed using the following elements	from the NRC document A Framework			
for K-12 Science Education:					
Science and Engineering Practices	Disciplinary Core Ideas	Crosscutting Concepts			
Constructing Explanations and	ETS1.C: Optimizing the Design	N/A			
Designing Solutions	Solution				
Constructing explanations and	 Criteria may need to be broken 				
designing solutions in 9–12 builds on	down into simpler ones that can be				
K–8 experiences and progresses to	approached systematically, and				
explanations and designs that are	decisions about the priority of				
supported by multiple and independent	offs) may be peeded (HS-ETS1-2)				
consistent with scientific ideas					
principles and theories					
 Design a solution to a complex real- 					
world problem, based on scientific					
knowledge, student-generated					
sources of evidence, prioritized					
criteria, and tradeoff considerations.					
(HS-ETS1-2)					
Connections to HS-ETS1.A: Defining and	Delimiting Engineering Problems include:				
Physical Science: HS-PS2-3, HS-PS	53-3				
Connections to HS-ETS1.B: Designing Solutions to Engineering Problems include:					
Earth and Space Science: HS-ESS3-2, HS-ESS3-4, Life Science: HS-LS2-7, HS-LS4-6					
Deviced Science, US DS1.6, US DS2.2					
Articulation of DCIs across grade-bands: MS FTS1 & (HS-FTS1-2): MS FTS1 B (HS-FTS1-2): MS FTS1 C (HS-FTS1-2)					
Common Core State Standards Connections:					
Mathematics –					
MP.4 Model with mathema	atics. (HS-ETS1-2)				

HS. Engineering Design			
Students who demo	onstrate understanding car	1:	
HS-ETS1-3. Eva	luate a solution to a co	mplex real-world problem based or	n prioritized criteria and trade-
offs	s that account for a ran	ge of constraints, including cost, sa	fety, reliability, and aesthetics,
asv	well as possible social,	cultural, and environmental impact	S.
The performance ex	xpectations above were de	veloped using the following elements fr	om the NRC document A Framework
for K-12 Science Ed	lucation:		
Science and En	gineering Practices	Disciplinary Core Ideas	Crosscutting Concepts
Constructing Exp	lanations and	ETS1.B: Developing Possible	Connections to Engineering,
Designing Solution	ons	Solutions	Technology,
constructing explan		 When evaluating solutions, it is important to take into account a 	and Applications of Science
and progresses to c	unus on K-o experiences	range of constraints, including	Influence of Science
that are supported	by multiple and	cost safety reliability and	Engineering and Technology
independent studer	nt-generated sources of	aesthetics and to consider social	on Society and the Natural
evidence consistent	with scientific ideas.	cultural, and environmental	World
principles and theor	ries.	impacts. (HS-ETS1-3)	 New technologies can have deep
 Evaluate a soluti 	ion to a complex real-		impacts on society and the
world problem, I	based on scientific		environment, including some
knowledge, stud	ent-generated sources		that were not anticipated.
of evidence, pric	pritized criteria, and		Analysis of costs and benefits is
tradeoff conside	rations. (HS-ETS1-3)		a critical aspect of decisions
			about technology. (HS-ETS1-3)
Connections to HS-	ETS1.A: Defining and Deli	miting Engineering Problems include:	
Physical Scien	ce: HS-PS2-3, HS-PS3-3		
Connections to HS-	ETST.B: Designing Solution	ns to Engineering Problems Include:	
Connections to HS-	ETS1 C. Ontimizing the De	is clution include: h5-L52-7, h5	-L34-0
Physical Scien	re HS-PS1-6 HS-PS2-3	sign solution include.	
Articulation of DCIs	across grade-bands: MS	.ETS1.A (HS-FTS1-3): MS.ETS1.B (HS	-FTS1-3)
Common Core State	e Standards Connections:		
ELA/Literacy -			
RST.11-12.7	Integrate and evaluate m	ultiple sources of information presented	in diverse formats and media (e.g.,
	quantitative data, video,	multimedia) in order to address a quest	ion or solve a problem. (HS-ETS1-3)
RST.11-12.8	Evaluate the hypotheses,	data, analysis, and conclusions in a scie	ence or technical text, verifying the
	data when possible and c	corroborating or challenging conclusions	with other sources of information.
	(HS-ETS1-3)		
RST.11-12.9	Synthesize information fr	om a range of sources (e.g., texts, expe	riments, simulations) into a coherent
	understanding of a process, phenomenon, or concept, resolving conflicting information when possible.		
	(HS-E151-3)		
Mathematics –	D		
MP.2	Reason abstractly and qu	antitatively. (HS-ETS1-3)	
MP.4	Model with mathematics.	(HS-E1S1-3)	

HS. Engineering Design				
Students who demonstrate understanding can				
HS-ETS1-4. Use a computer simulation	to model the impact of proposed solution	ons to a complex real-world		
problem with numerous cri	teria and constraints on interactions wi	thin and between systems		
relevant to the problem.				
The performance expectations above were dev	veloped using the following elements from th	e NRC document A Framework		
for K-12 Science Education:				
Science and Engineering Practices	Disciplinary Core Ideas	Crosscutting Concepts		
Using Mathematics and Computational	ETS1.B: Developing Possible	Systems and System		
Thinking	Solutions	Models		
Mathematical and computational thinking in	 Both physical models and computers 	 Models (e.g., physical, 		
9-12 builds on K-8 experiences and	can be used in various ways to aid in	mathematical, computer		
progresses to using algebraic thinking and	the engineering design process.	models) can be used to		
analysis, a range of linear and nonlinear	Computers are useful for a variety of	simulate systems and		
functions including trigonometric functions,	purposes, such as running simulations	interactions—including		
exponentials and logarithms, and	to test different ways of solving a	energy, matter, and		
computational tools for statistical analysis to	officient or economical, and in making	information flows— within		
computational simulations are created and	a porculative presentation to a client	and between systems at		
used based on mathematical models of basic	a persuasive presentation to a cheft	different scales. (HS-ETS1-		
assumptions	his or her needs (HS-FTS1-4)	4)		
 Use mathematical models and/or 				
computer simulations to predict the				
effects of a design solution on systems				
and/or the interactions between systems.				
(HS-ETS1-4)				
Connections to HS-ETS1.A: Defining and Delin	niting Engineering Problems include:			
Physical Science: HS-PS2-3, HS-PS3-3				
Connections to HS-ETS1.B: Designing Solutions to Engineering Problems include:				
Connections to HS-ETS1 C: Ontimizing the Design Solution include:				
Physical Science: HS-PS1-6, HS-PS2-3				
Articulation of DCIs across grade-bands' MS.FTS1.A (HS-FTS1-4)' MS.FTS1.B (HS-FTS1-4)' MS FTS1 C (HS-FTS1-4)				
Common Core State Standards Connections:				
Mathematics –				
MP.2 Reason abstractly and quantitatively. (HS-ETS1-4)				
MP.4 Model with mathematics.	(HS-ETS1-4)			

Unit of Study 5: Cell Structure

Standards that appear this unit: HS-LS1-1, HS-LS1-2, HS-LS1-3, HS-LS1-4

HS. Structure an	d Function			
Students who de	monstrate understanding can:			
HS-LS1-1. Cons	struct an explanation based on ev	idence for how the structure of DN	IA determines the	
struc	cture of proteins which carry out t	the essential functions of life throu	igh systems of	
spec	ialized cells. [Assessment Boundary	: Assessment does not include identifi	cation of specific cell or	
tissue	e types, whole body systems, specific	protein structures and functions, or the	e biochemistry of protein	
Synth	lesis.]	in a the fallowing along out from the NI	C de sussent A Europeaner	
for K-12 Science E	ducation:	ing the following elements from the NF		
Science a	nd Engineering Practices	Disciplinary Core Ideas	Crosscutting Concepts	
Constructing Exp	planations and Designing	IS1 A: Structure and Eunction	Structure and	
Solutions	5 5	Systems of specialized cells	Function	
Constructing expla	nations and designing solutions in	within organisms help them	 Investigating or 	
9–12 builds on K–8	B experiences and progresses to	perform the essential functions	designing new	
explanations and d	esigns that are supported by	of life. (HS-LS1-1)	systems or structures	
multiple and indep	endent student-generated sources	All cells contain genetic	requires a detailed	
of evidence consist	ent with scientific ideas, principles,	information in the form of DNA	examination of the	
and theories.	monation bacad on valid and	molecules. Genes are regions in	properties of different	
	e obtained from a variety of sources	the DNA that contain the	structures of different	
(including stude	(including students' own investigations models			
theories, simula	tions, peer review) and the	formation of proteins, which	connections of	
assumption that	t theories and laws that describe the	carry out most of the work of	components to reveal	
natural world or	perate today as they did in the past	Disciplinary Core Idea is also	its function and/or	
and will continu	e to do so in the future. (HS-LS1-1)	addressed by HS-I S3-1	solve a problem. (HS-	
			LS1-1)	
Connections to oth	er DCIs in this grade-band: HS.LS3.	A (HS-LS1-1)		
Articulation across	grade-bands: MS.LS1.A (HS-LS1-1);	: MS.LS3.A (HS-LS1-1); MS.LS3.B (H	S-LS1-1)	
Common Core Stat	te Standards Connections:			
ELA/Literacy –				
RST.11-12.1	Cite specific textual evidence to supp	port analysis of science and technical te	exts, attending to	
	important distinctions the author ma	akes and to any gaps or inconsistencies	in the account. (HS-LS1-	
WHET 0 12 2	1) Write informative (evolutionate in texts	including the paration of historical as	onto aciontific procedures/	
WU21.3-17.5	while informative/explanatory texts,		ents, scientific procedures/	
WHST.9-12.9	Draw evidence from informational te	exts to support analysis, reflection, and	research. (HS-LS1-1)	

HS. Structure and Function				
Students who demonstrate understanding can: HS-LS1-2. Develop and use a model to illustrate the hierarchical organization of interacting systems that provide specific functions within multicellular organisms. [Clarification Statement: Emphasis is on functions at the organism system level such as nutrient uptake, water delivery, and organism movement in response to neural stimuli. An example of an interacting system could be an artery depending on the proper function of elastic tissue and smooth muscle to regulate and deliver the proper amount of blood within the circulatory system.] [Assessment Boundary: Assessment does not include interactions and functions at the molecular or chemical reaction level.]				
for K-12 Science Education:	sing the following elements from	the NRC document A Framework		
Science and Engineering Practices Developing and Using Models Modeling in 9–12 builds on K-8 experiences and progresses to using, synthesizing, and developing models to predict and show relationships among variables between systems and their components in the natural and designed world. Disciplinary Core Ideas Systems and System Models • Multicellular organisms have a hierarchical structural organization, in ulter actionships between systems or between components of a system. (HS-LS1-2) • Multicellular organization, in which any one system is made up of numerous parts and is itself a component of the next • Models (e.g., physical, mathematical, computer models) can be used to simulate systems and interactions—including energy, matter, and information flows—within and between systems at different				
Connections to other DCIs in this grade-band: N/A				
Articulation across grade-bands: MS.LS1.A (HS-LS1-2) Common Core State Standards Connections: ELA/Literacy – SL.11-12.5 Make strategic use of digital media (e.g., textual, graphical, audio, visual, and interactive elements) in presentations to enhance understanding of findings, reasoning, and evidence and to add interest. (HS-LS1-2)				

HS. Structure an	d Function		
Students who de	monstrate understanding can:		
HS-LS1-3. Pla	an and conduct an investigation to prov	vide evidence that feedback mechan	isms maintain
ho	meostasis. [Clarification Statement: Exar	nples of investigations could include hear	t rate response to
exe	ercise, stomate response to moisture and te	mperature, and root development in resp	onse to water
lev	els.] Assessment Boundary: Assessment d	loes not include the cellular processes inv	olved in the
fee	dback mechanism.]		
The performance e	expectations above were developed using th	e following elements from the NRC docur	ment A Framework
for K-12 Science Ed	ducation:	5	
Science	e and Engineering Practices	Disciplinary Core Ideas	Crosscutting
Planning and Ca	rrying Out Investigations	LS1 Au Structure and Eurotion	Concepts
Planning and carry	ing out in 9-12 builds on K-8 experiences	All colle contain genetic	Stability and
and progresses to	include investigations that provide	All cells contain genetic information in the form of DNA	Change
evidence for and te	est conceptual, mathematical, physical,	Information in the form of DNA	 Feedback
and empirical mode	els.	the DNA that centrin the	(negative or
 Plan and conduct 	ct an investigation individually and	instructions that contain the	positive) can
collaboratively t	o produce data to serve as the basis for	Instructions that code for the	stabilize or
evidence, and in	the design: decide on types, how much	formation of proteins, which carry	destabilize a
and accuracy of	data needed to produce reliable	out most of the work of cells. (HS-	system (HS-
measurements	and consider limitations on the precision	LS1-1) (Note: This Disciplinary	1 \$1-3)
of the data (e.g	number of trials cost risk time) and	Core Idea is also addressed by	201 5)
refine the desig	n accordingly (HS-LS1-3)	HS-LS3-1.)	
Tenne the desig		 Feedback mechanisms maintain a 	
		living system's internal conditions	
Conne	ctions to Nature of Science	within certain limits and mediate	
conne	clions to Nature of Science	behaviors, allowing it to remain alive	
Scientific Investi	idations like a Variety of Methods	and functional even as external	
Scientific inquin	v is characterized by a common set of	conditions change within some	
- Scientific Inquiry	de logical thinking procision open	range. Feedback mechanisms can	
mindodnoss ob	iostivity, skoptisism, replicability of	encourage (through positive	
regulte and her	beet and othical reporting of findings (HC	feedback) or discourage (negative	
LC1 2)	lest and ethical reporting of findings. (HS-	feedback) what is going on inside the	
LSI-3)		living system. (HS-LS1-3)	
Connections to oth	er DCIs in this grade-band: N/A		
Articulation across	grade-bands: MS.LS1.A (HS-LS1-3)		
Common Core Stat	te Standards Connections:		
ELA/Literacv –			
WHST.9-12.7	Conduct short as well as more sustained r	research projects to answer a question (ir	ncluding a self-
	generated question) or solve a problem: r	arrow or broaden the inquiry when appro	opriate: synthesize
	multiple sources on the subject. demonstr	ating understanding of the subject under	investigation. (HS-
	LS1-3)		
WHST.11-12.8	Gather relevant information from multiple	authoritative print and digital sources, us	sing advanced
	searches effectively: assess the strengths	and limitations of each source in terms of	f the specific task
	purpose, and audience: integrate informat	tion into the text selectively to maintain t	he flow of ideas.
	avoiding plagiarism and overreliance on a	ny one source and following a standard fo	ormat for citation
	(HS-LS1-3)		

HS. Inheritance	and Variation of Tr	aits		
Students who den	nonstrate understandir	ng can:		
HS-LS1-4. Use	a model to illustrat	e the role of cellular division (mitosis) and differentiation in producing	
and	maintaining comple	ex organisms. [Assessment Boundary: /	Assessment does not include specific	
gene	e control mechanisms	or rote memorization of the steps of mitos	is.]	
The performance	expectations above we	ere developed using the following element	s from the NRC document A Framework	
for K-12 Science E	Education:			
Science an	d Engineering	Disciplinary Core Ideas	Crosscutting Concepts	
Pra	ctices	LS1.B: Growth and Development	Systems and System Models	
Developing and	Using Models	of Organisms	 Models (e.g., physical, 	
Modeling in 9–12	builds on K–8	 In multicellular organisms individual 	mathematical, computer models)	
experiences and p	progresses to using,	cells grow and then divide via a	can be used to simulate systems	
synthesizing, and	developing models	process called mitosis, thereby	and interactions—including energy,	
to predict and sho	w relationships	allowing the organism to grow. The	matter, and information flows—	
among variables b	between systems	organism begins as a single cell	within and between systems at	
and their compone	ents in the natural	(fertilized egg) that divides	different scales. (HS-LS1-4)	
and designed wor	lds.	successively to produce many cells,		
Use a model bag	ased on evidence to	with each parent cell passing		
illustrate the re	elationships between	identical genetic material (two		
systems or between components		variants of each chromosome pair)		
or a system. (H5-L31-4)		division and differentiation produce		
		and maintain a complex organism		
		composed of systems of tissues and		
		organs that work together to meet		
		the needs of the whole organism.		
		(HS-LS1-4)		
Connections to ot	her DCIs in this arade	-band: N/A		
Articulation across	s grade-bands: MS.LS	51.A (HS-LS1-4); MS.LS1.B (HS-LS1-4); N	MS.LS3.A (HS-LS1-4)	
Common Core Sta	te Standards Connect	ions:		
ELA/Literacy –				
SL.11-12.5	Make strategic use of digital media (e.g., textual, graphical, audio, visual, and interactive elements) in			
	presentations to enhance understanding of findings, reasoning, and evidence and to add interest. (HS-			
	LS1-4)	,		
Mathematics –				
MP.4	Model with mathem	atics. (HS-LS1-4)		
HSF-IF.C.7	Graph functions exp	Graph functions expressed symbolically and show key features of the graph, by hand in simple cases		
_	and using technolog	gy for more complicated cases. (HS-LS1-4))	
HSF-BF.A.1	Write a function that	at describes a relationship between two qu	antities. (HS-LS1-4)	

Unit of Study 6: DNA and Inheritance

Standards that appear this unit: HS-LS3-1, HS-LS3-2, HS-LS3-3

HS. Inheritance and Variation of Traits

Students who demonstrate understanding can:

HS-LS3-1. Ask questions to clarify relationships about the role of DNA and chromosomes in coding the instructions for characteristic traits passed from parents to offspring. [Assessment Boundary: Assessment does not include the phases of meiosis or the biochemical mechanism of specific steps in the process.]

The performance expectations above were developed using the following elements from the NRC document *A Framework for K-12 Science Education*:

Science and Engineering	Disciplinary Core Ideas	Crosscutting Concepts	
Practices	LS1.A: Structure and Function	Cause and Effect	
 Asking Questions and Defining Problems Asking questions and defining problems in 9-12 builds on K-8 experiences and progresses to formulating, refining, and evalua empirically testable questions and design problems using models ar simulations. Ask questions that arise from examining models or a theory clarify relationships. (HS-LS3- 	 All cells contain genetic information in the form of DNA molecules. Genes are regions in the DNA that contain the instructions that code for the formation of proteins. <i>(secondary to HS-LS3-1) (Note: This Disciplinary Core Idea is also addressed by HS-LS1-1.)</i> LS3.A: Inheritance of Traits Each chromosome consists of a single very long DNA molecule, and each gene on the chromosome is a particular segment of that DNA. The instructions for forming species' characteristics are carried in DNA. All cells in an organism have the same genetic content, but the genes used (expressed) by the cell may be regulated in different ways. Not all DNA codes for a protein; some segments of DNA are involved in regulatory or structural functions, and some have no as-yet known function. (HS-LS3-1) 	 Empirical evidence is required to differentiate between cause and correlation and make claims about specific causes and effects. (HS- LS3-1) 	
Connections to other DCIs in this	grade-band: N/A		
Articulation across grade-bands:	MS.LS3.A (HS-LS3-1); MS.LS3.B (HS-LS3-1)		
Common Core State Standards C	Common Core State Standards Connections:		
ELA/Literacy –			
RST.11-12.1 Cite specific	Cite specific textual evidence to support analysis of science and technical texts, attending to important		
distinctions t	ne author makes and to any gaps or inconsistenc	les in the account. (HS-LS3-1)	
understandir (HS-I,S3-1)	understanding of a process, phenomenon, or concept, resolving conflicting information when possible. <i>(HS-LS3-1)</i>		

HS. Inheritance and Variation of	Traits		
Students who demonstrate understan	ding can:		
HS-LS3-2. Make and defend a cla	im based on evidence that inheritable ge	enetic variations may result from:	
(1) new genetic comb	nations through meiosis, (2) viable erro	rs occurring during replication,	
and/or (3) mutations	caused by environmental factors. [Clarified	cation Statement: Emphasis is on using	
data to support argumen	s for the way variation occurs.] [Assessment	Boundary: Assessment does not	
include the phases of me	osis or the biochemical mechanism of specific	steps in the process.]	
The performance expectations above	were developed using the following elements	from the NRC document A Framework	
for K-12 Science Education:			
Science and Engineering	Disciplinary Core Ideas	Crosscutting Concepts	
Practices	LS3.B: Variation of Traits	Cause and Effect	
Engaging in Argument from	 In sexual reproduction, chromosomes 	 Empirical evidence is required to 	
Evidence	can sometimes swap sections during	differentiate between cause and	
Engaging in argument from evidence	the process of meiosis (cell division),	correlation and make claims about	
in 9-12 builds on K-8 experiences and	thereby creating new genetic	specific causes and effects (HS-	
progresses to using appropriate and	combinations and thus more genetic		
sufficient evidence and scientific	variation. Although DNA replication is	L35 2)	
reasoning to defend and critique	tightly regulated and remarkably		
claims and explanations about the	accurate, errors do occur and result in		
natural and designed world(s).	mutations, which are also a source of		
Arguments may also come from	genetic variation. Environmental		
current scientific or historical	factors can also cause mutations in		
episodes in science.	genes, and viable mutations are		
 Make and defend a claim based 	inherited. (HS-LS3-2)		
on evidence about the natural	 Environmental factors also affect 		
world that reflects scientific	expression of traits, and hence affect		
knowledge, and student-	the probability of occurrences of traits		
generated evidence. (HS-LS3-2)	in a population. Thus the variation		
с. — то у	and distribution of traits observed		
	depends on both genetic and		
	environmental factors. (HS-LS3-2)		
Connections to other DCIs in this grad	e-band: N/A		
Articulation across grade-bands: MS.I	S3.A (HS-LS3-2); MS.LS3.B (HS-LS3-2)		
Common Core State Standards Connections:			
ELA/Literacy –			
RST.11-12.1 Cite specific textu	al evidence to support analysis of science and	I technical texts, attending to important	
distinctions the a	distinctions the author makes and to any gaps or inconsistencies in the account. (HS-LS3-2)		
WHST.9-12.1 Write arguments	Write arguments focused on <i>discipline-specific content</i> . (HS-LS3-2)		
Mathematics –			
MP.2 Reason abstractly	and quantitatively. (HS-LS3-2)		

HS. Inheritance and Variation of T	raits			
Students who demonstrate understand	ing can:			
HS-LS3-3. Apply concepts of sta	tistics and probability to explain the	e variation and distribution of		
expressed traits in a	population. [Clarification Statement: E	Emphasis is on the use of mathematics to		
describe the probability	of traits as it relates to genetic and envir	onmental factors in the expression of		
traits.] [Assessment Bou	ndary: Assessment does not include Ha	rdy-Weinberg calculations.]		
The performance expectations above w	vere developed using the following eleme	ents from the NRC document A Framework		
for K-12 Science Education:				
Science and Engineering	Disciplinary Core Ideas	Crosscutting Concepts		
Practices	LS3.B: Variation of Traits	Scale, Proportion, and Quantity		
Analyzing and Interpreting Data	 Environmental factors also affect 	 Algebraic thinking is used to examine 		
Analyzing data in 9-12 builds on K-8	expression of traits, and hence	scientific data and predict the effect of		
experiences and progresses to	affect the probability of	a change in one variable on another		
introducing more detailed statistical	occurrences of traits in a	(e.g., linear growth vs. exponential		
analysis, the comparison of data sets	population. Thus the variation	growth). (HS-LS3-3)		
for consistency, and the use of	and distribution of traits observed			
models to generate and analyze depends on both genetic and				
data.	environmental factors. (HS-LS3-3)	Connections to Nature of Science		
 Apply concepts of statistics and 				
probability (including determining		Science is a Human Endeavor		
function fits to data, slope,		 Technological advances have 		
intercept, and correlation		influenced the progress of science and		
coefficient for linear fits) to		science has influenced advances in		
scientific and engineering		technology. (HS-LS3-3)		
questions and problems, using		 Science and engineering are 		
digital tools when feasible. (HS-		influenced by society and society is		
LS3-3)		influenced by science and		
engineering. (HS-LS3-3)				
Connections to other DCIs in this grade-band: HS.LS2.A (HS-LS3-3); HS.LS2.C (HS-LS3-3); HS.LS4.B (HS-LS3-3);				
HS.LS4.C (HS-LS3-3)				
Articulation across grade-bands: MS.LS2.A (HS-LS3-3);; MS.LS3.B (HS-LS3-3); MS.LS4.C (HS-LS3-3)				
Common Core State Standards Connections:				
Mathematics –				
MP.2 Reason abstractly and quantitatively. (HS-LS3-3)				

Unit of Study 7: Natural Selection

Standards that appear this unit: HS-LS4-4, HS-LS4-3, HS-LS4-5, HS-LS2-8

HS. Natural Selection	and Evolution		
Students who demonstrate understanding can: HS-LS4-4. Construct an explanation based on evidence for how natural selection leads to adaptation of populations. [Clarification Statement: Emphasis is on using data to provide evidence for how specific biotic and abiotic differences in ecosystems (such as ranges of seasonal temperature, long-term climate change, acidity, light, geographic barriers, or evolution of other organisms) contribute to a change in gene frequency over time, leading to adaptation of populations.]			
The performance expect for K-12 Science Educat	tations above we <i>tion</i> :	re developed using the following elements	from the NRC document A Framework
 for K-12 Science Educations Science and Engineering Practices Constructing Explanations and Designing Solutions Constructing explanations and designing solutions in 9–12 builds on K-8 experiences and progresses to explanations and designs that are supported by multiple and independent student-generated sources of evidence consistent with scientific ideas, principles, and theories. Construct an explanation based on valid and reliable evidence obtained from a variety of sources (including students' own investigations, models, theories, simulations, peer review) and the assumption that theories and laws that describe the natural world operate today as they did in the past and will continue to 		Disciplinary Core Ideas LS4.C: Adaptation • Natural selection leads to adaptation, that is, to a population dominated by organisms that are anatomically, behaviorally, and physiologically well suited to survive and reproduce in a specific environment. That is, the differential survival and reproduction of organisms in a population that have an advantageous heritable trait leads to an increase in the proportion of individuals in future generations that have the trait and to a decrease in the proportion of individuals that do not. (HS-LS4-4)	Crosscutting Concepts Cause and Effect • Empirical evidence is required to differentiate between cause and correlation and make claims about specific causes and effects. (HS- LS4-4)
Connections to other De	CIs in this grade-	band: HS.LS2.A (HS-LS4-4); HS.LS2.D ((HS-LS4-4)
Articulation across grade-bands: MS.LS4.B (HS-LS4-4); MS.LS4.C (HS-LS4-4) Common Core State Standards Connections: ELA/Literacy –			
RST.11-12.1 Cite dist WHST.9-12.2 Wri exp	Cite specific textual evidence to support analysis of science and technical texts, attending to important distinctions the author makes and to any gaps or inconsistencies in the account. (HS-LS4-4) Write informative/explanatory texts, including the narration of historical events, scientific procedures/ experiments, or technical processes. (HS-LS4-4)		
WHST.9-12.9 Dra Mathematics – MP.2 Rea	Draw evidence from informational texts to support analysis, reflection, and research. (HS-LS4-4) Reason abstractly and quantitatively. (HS-LS4-4)		

HS. Natural Sele	ction and Evo	lution		
Students who dem	onstrate unders	standing can:		
HS-LS4-3. App	ly concepts o	f statistics and probability to support explanations that organi	sms with an	
adv	antageous he	ritable trait tend to increase in proportion to organisms lackin	g this trait.	
[Cla	rification Staten	nent: Emphasis is on analyzing shifts in numerical distribution of traits	and using these	
shift	s as evidence t	o support explanations.] [Assessment Boundary: Assessment is limited	to basic	
stat	stical and grapi	nical analysis. Assessment does not include allele frequency calculation	S.]	
The performance e	expectations abo	ove were developed using the following elements from the NRC docum	ent A Framework	
for K-12 Science Ed	ducation:			
Science and Er	ngineering	Disciplinary Core Ideas	Crosscutting	
Practic	es	LS4.B: Natural Selection	Concepts	
 Practices Analyzing and Interpreting Data Analyzing data in 9–12 builds on K–8 experiences and progresses to introducing more detailed statistical analysis, the comparison of data sets for consistency, and the use of models to generate and analyze data. Apply concepts of statistics and probability (including determining function fits to data, slope, intercept, and correlation coefficient for linear fits) to scientific and engineering questions and 		 Natural selection occurs only if there is both (1) variation in the genetic information between organisms in a population and (2) variation in the expression of that genetic information—that is, trait variation—that leads to differences in performance among individuals. (HS-LS4-3) The traits that positively affect survival are more likely to be reproduced, and thus are more common in the population. (HS-LS4-3) LS4.C: Adaptation Natural selection leads to adaptation, that is, to a population dominated by organisms that are anatomically, behaviorally, and physiologically well suited to survive and reproduce in a specific environment. That is, the differential survival and reproduction of organisms in a population that have an advantageous heritable trait leads to an increase in the proportion of individuals in future generations that have the trait and to a decrease in the proportion of individuals that do not. (HS-LS4-3) Adaptation also means that the distribution of traits in a population can change when conditions change. (HS-LS4-3) 	 Patterns Different patterns may be observed at each of the scales at which a system is studied and can provide evidence for causality in explanations of phenomena. (HS-LS4-3) 	
Connections to oth	no-Lot-3) Per DCIs in this	arade-band: HSIS2 & (HS-154-3): HSIS2 D (HS-154-3): HSIS2 B	(HS-I S4-3)	
Articulation across	arade-hands	MS.I S2.A (HS-I S4-3); MS.I S3.B (HS-I S4-3); MS I S4 R (HS-I S4-3);	MS_I_S4_C (HS-	
LS4-3)	grade Darius.	(13 L J T J), (13 L J T J), (13 L J J T J), (13 L J T J)		
Common Core Stat	e Standards Co	nnections:		
FLA/Literacy –				
RST.11-12.1	Cite specific to	extual evidence to support analysis of science and technical texts, atter	nding to important	
	distinctions the author makes and to any gaps or inconsistencies in the account (HS-1S4-3)			
WHST.9-12.2	Write informa	tive/explanatory texts, including the narration of historical events, scien	ntific procedures/	
	experiments, or technical processes. (HS-1S4-3)			
WHST.9-12.9	Draw evidence from informational texts to support analysis, reflection, and research, (HS-I S4-3)			
Mathematics –			/	
MP.2	Reason abstra	actly and quantitatively. (HS-LS4-3)		

HS. Natural Selection and Evolution			
Students who dem	nonstrate understandi	ng can:	
HS-LS4-5. Eva	luate the evidence	supporting claims that changes in en	vironmental conditions may result
in:	(1) increases in th	e number of individuals of some speci	es, (2) the emergence of new
spe	cies over time, and	(3) the extinction of other species.	Clarification Statement: Emphasis is on
dete	ermining cause and el	fect relationships for how changes to the e	environment such as deforestation,
fish	ing, application of fer	tilizers, drought, flood, and the rate of cha	nge of the environment affect
dist	ribution or disappeara	ance of traits in species.]	-
The performance e	expectations above w	ere developed using the following elements	s from the NRC document A Framework
for K-12 Science E	ducation:		
Science and	Engineering	Disciplinary Core Ideas	Crosscutting Concepts
Prac	ctices	LS4.C: Adaptation	Cause and Effect
Engaging in Arg	ument from	 Changes in the physical 	 Empirical evidence is required to
Evidence		environment, whether naturally	differentiate between cause and
Engaging in argum	nent from evidence	occurring or human induced, have	correlation and make claims about
in 9-12 builds on k	K-8 experiences and	thus contributed to the expansion of	specific causes and effects. (HS-
progresses to usin	g appropriate and	some species, the emergence of	LS4-5)
sufficient evidence	and scientific	new distinct species as populations	
reasoning to defer	nd and critique	diverge under different conditions,	
claims and explana	ations about the	and the decline-and sometimes the	
natural and design	ned world(s).	extinction-of some species. (HS-	
Arguments may al	so come from	LS4-5)	
current or historica	al episodes in	 Species become extinct because 	
science.		they can no longer survive and	
 Evaluate the ev 	vidence behind	reproduce in their altered	
currently accep	ted explanations or	environment. If members cannot	
solutions to det	termine the merits	adjust to change that is too fast or	
of arguments. ((HS-LS4-5)	drastic, the opportunity for the	
		species' evolution is lost. (HS-LS4-5)	
Connections to oth	her DCIs in this grade	-band: HS.LS2.A (HS-LS4-5); HS.LS2.D	(HS-LS4-5); HS.LS3.B (HS-LS4-5);
HS.ESS2.E (HS-LS	S4-5); HS.ESS3.A (H	S-LS4-5)	
Articulation across	grade-bands: MS.LS	52.A (HS-LS4-5); MS.LS2.C (HS-LS4-5); N	IS.LS4.C (HS-LS4-5); MS.ESS3.C (HS-
LS4-5)			
Common Core Sta	te Standards Connect	ions:	
ELA/Literacy –			
RST.11-12.8	Evaluate the hypoth	neses, data, analysis, and conclusions in a	science or technical text, verifying the
	data when possible and corroborating or challenging conclusions with other sources of information.		
	(HS-LS4-5)		
WHST.9-12.9	Draw evidence from informational texts to support analysis, reflection, and research. (HS-LS4-5)		
Mathematics –			
MP.2	Reason abstractly and quantitatively. (HS-LS4-5)		
	,		

HS. Interdepend	ent Relationships in	Ecosystems	
Students who dem	onstrate understanding	j can:	
HS-LS2-8. Evalu	uate the evidence fo	r the role of group behavior on indivi	dual and species' chances to
survi	ive and reproduce.	Clarification Statement: Emphasis is on: ((1) distinguishing between group and
indivi	dual behavior, (2) iden	tifying evidence supporting the outcomes	of group behavior, and (3) developing
logica	al and reasonable argur	ments based on evidence. Examples of gro	oup behaviors could include flocking,
schoo	ling, herding, and coo	perative behaviors such as hunting, migrat	ting, and swarming.]
The performance e	expectations above wer	e developed using the following elements	from the NRC document A Framework
for K-12 Science E	ducation:		
Science and End	ineering Practices	Disciplinary Core Ideas	Crosscutting Concepts
Engaging in Argu	ument from	LS2.D: Social Interactions and	Cause and Effect
Evidence		Group Behavior	- Empirical avidance is required to
Engaging in argum	ent from evidence in	 Group behavior has evolved 	 Empirical evidence is required to differentiate between cause and
9–12 builds from K	-8 experiences and	because membership can increase	differentiale between cause and
progresses to using	appropriate and	the chances of survival for	correlation and make claims about
sufficient evidence	and scientific	individuals and their genetic	specific causes and effects. (HS-
reasoning to defen	d and critique claims	relatives. (HS-I S2-8)	LS2-8)
and explanations a	bout the natural and		
designed world(s).	Arguments may also		
come from current	scientific or historical		
episodes in science			
 Evaluate the evaluate the evalu	idence behind		
currently accent	ted explanations or		
solutions to det	ermine the merits of		
arguments (HS	(-1 S2-8)		
argumento. (115	152 0)		
Connections to Nature of Science			
connections to	Mature of Science		
Scientific Knowledge is Open to			
Revision in Light	of New Evidence		
 Scientific around 	entation is a mode		
of logical disco	irse used to clarify		
the strength of	relationships		
between ideas	and evidence that		
may result in re	vision of an		
explanation (H	S-LS2-8)		
Connections to oth	er DCIs in this grade-h	and: N/A	
Articulation across	arade-bands: MS.I.S1	L.B (HS-1 S2-8)	
Common Core Stat	te Standards Connectio	ns:	
ELA/Literacv –			
RST.9-10.8	Assess the extent to	which the reasoning and evidence in a tex	t support the author's claim or a
	recommendation for	solving a scientific or technical problem.	HS-LS2-8)
RST.11-12.1	Cite specific textual e	vidence to support analysis of science and	l technical texts, attending to important
	distinctions the author	or makes and to any gaps or inconsistencie	es in the account. (HS-LS2-8)
RST.11-12.7	Integrate and evaluation	te multiple sources of information present	ed in diverse formats and media (e.g.,
	quantitative data, video, multimedia) in order to address a question or solve a problem. (HS-I S2-8)		
RST.11-12.8	Evaluate the hypothe	ses, data, analysis, and conclusions in a s	cience or technical text. verifying the
	data when possible a	nd corroborating or challenging conclusion	is with other sources of information
	(HS-LS2-8)		

Unit of Study 8: Evolution

Standards that appear this unit: HS-LS4-1, HS-LS4-2

HS. Natural Selection and Evolution				
 Students who demonstrate understanding can: HS-LS4-1. Communicate scientific information that common ancestry and biological evolution are supported by multiple lines of empirical evidence. [Clarification Statement: Emphasis is on a conceptual understanding of the role each line of evidence has relating to common ancestry and biological evolution. Examples of evidence could include similarities in DNA sequences, anatomical structures, and order of appearance of structures in 				
The performance	expectations above were developed using t	he following elements from the	e NRC document A Framework for K-	
12 Science Educa	tion:			
Scienc Obtaining, Eval	e and Engineering Practices Jating, and Communicating	Disciplinary Core Ideas	Crosscutting Concepts Patterns	
Science and Engineering Practices Obtaining, Evaluating, and Communicating Information Obtaining, evaluating, and communicating information in 9–12 builds on K–8 experiences and progresses to evaluating the validity and reliability of the claims, methods, and designs. • Communicate scientific information (e.g., about phenomena and/or the process of development and the design and performance of a proposed process or system) in multiple formats (including orally, graphically, textually, and mathematically). (HS-LS4-1) Connections to Nature of Science Science Models, Laws, Mechanisms, and Theories Explain Natural Phenomena • A scientific theory is a substantiated explanation of some aspect of the natural world, based on a body of facts that have been repeatedly confirmed through observation and experiment and the science community validates each theory before it is accepted. If new evidence is discovered that the theory does not accommodate, the		Common Ancestry and Diversity • Genetic information provides evidence of evolution. DNA sequences vary among species, but there are many overlaps; in fact, the ongoing branching that produces multiple lines of descent can be inferred by comparing the DNA sequences of different organisms. Such information is also derivable from the similarities and differences in amino acid sequences and from anatomical and embryological evidence. (HS-LS4-1)	 Different patterns may be observed at each of the scales at which a system is studied and can provide evidence for causality in explanations of phenomena. (HS-LS4-1) Connections to Nature of Science Scientific Knowledge Assumes an Order and Consistency in Natural Systems Scientific knowledge is based on the assumption that natural laws operate today as they did in the past and they will continue to do so in the future. (HS-LS4-1) 	
Connections to ot 2),(HS-LS4-3),(HS HS.ESS1.C (HS-L	<i>her DCIs in this grade-band:</i> HS.LS2.A (H9 5-LS4-4),(HS-LS4-5); HS.LS3.A (HS-LS4-1); .S4-1); HS.ESS2.E (HS-LS4-2),(HS-LS4-5);	S-LS4-2),(HS-LS4-3),(HS-LS4-4; ; HS.LS3.B (HS-LS4-1),(HS-LS HS.ESS3.A (HS-LS4-2),(HS-L	4),(HS-LS4-5); HS.LS2.D (HS-LS4- 54-2) (HS-LS4-3),(HS-LS4-5); _S4-5)	
Articulation acros	s grade-bands: MS.LS3.A (HS-LS4-1); MS.	LS3.B (HS-LS4-1); MS.LS4.A	(HS-LS4-1); MS.ESS1.C (HS-LS4-1)	
Common Core Sta	te Standards Connections:			
ELA/Literacy –		e an a busia a f a a t		
KST.11-12.1	Cite specific textual evidence to support distinctions the author makes and to an	: analysis of science and techn	ical texts, attending to important	
WHST.9-12.2	Write informative/explanatory texts, inc experiments, or technical processes. (H	luding the narration of historic S-LS4-1)	cal events, scientific procedures/	
WHST.9-12.9 SL.11-12.4	Draw evidence from informational texts Present claims and findings, emphasizin evidence, sound valid reasoning, and w and clear pronunciation. <i>(HS-LS4-1)</i>	to support analysis, reflection g salient points in a focused, o ell-chosen details; use approp	, and research. (<i>HS-LS4-1)</i> coherent manner with relevant riate eye contact, adequate volume,	
Mathematics – MD 2	Reason abstractly and quantitatively (A	15-1 54-1)		
MF.2	Reason abstractly and quantitatively. (r	15-L5T-1)		

HS. Natural Sele	ection and Evolution		
Students who den	nonstrate understanding can:		
HS-LS4-2. Con	struct an explanation based	l on evidence that the process of evolution prim	arily results from
fou	factors: (1) the potential f	or a species to increase in number, (2) the herit	able genetic
vari	ation of individuals in a spe	cies due to mutation and sexual reproduction, (3) competition
for	limited resources, and (4) the	ne proliferation of those organisms that are bett	er able to
surv	vive and reproduce in the en	vironment. [Clarification Statement: Emphasis is or	n using evidence to
expl	ain the influence each of the fo	ur factors has on number of organisms, behaviors, mo	rphology, or
phys	siology in terms of ability to com	npete for limited resources and subsequent survival of	individuals and
adar	ptation of species. Examples of	evidence could include mathematical models such as s	imple distribution
grap	hs and proportional reasoning.]	[Assessment Boundary: Assessment does not include	e other mechanisms
ofe	volution, such as genetic drift, g	ene flow through migration, and co-evolution.]	
The performance	expectations above were develo	preducing the following elements from the NPC docur	mont A Framework
for K-12 Science I	Expectations above were develo	oped using the following elements from the fixe docur	HEIL A HAINEWOIK
TOT K-12 SCIENCE L			
Science and	Engineering Practices	Disciplinary Core Ideas	Crossoutting
Constructing Ex	nlanations and Designing	LS4 B: Natural Selection	Concepts
Solutions	planations and Designing	 Natural selection occurs only if there is both (1) 	Cause and
Constructing over	postions and decigning	- Natural Selection occurs only if there is both (1)	Effect
collisticucting expla	huilde on K. 8 experiences	organisms in a nonulation and (2) variation in	- Empirical
solutions in 9-12	ovelopations and designs	the expression of that genetic information, that	
that are supported	explanations and designs	is trait variation, that loads to differences in	required to
independent stud	a by multiple and	is, trait variation—triat leads to differences in	differentiate
	at with acientific ideas	performance among mulviduals. $(\Box S - LS + 2)$	
evidence consister	nt with scientific liteas,	LS4.C: Adaptation	Detween Cause
principles, and the	corres.	 Evolution is a consequence of the interaction of four factors (1) the netential for a species to 	
 Construct an e and reliable ov 	idence obtained from a	increases in number (2) the constitution of	dhu make
	idence obtained from a	increase in number, (2) the genetic variation of	
variety of sources (including students' own		sorved reproduction (2) competition for an	specific causes
investigations, models, theories,		environment's limited supply of the resources	(HS_1SA_2)
accumption the	at theories and laws that	that individuals need in order to survive and	(113-L3+-2)
describe the n	at theories and laws that	reproduce, and (4) the onsuing proliferation of	
they did in the	nast and will continue to do	these organisms that are better able to survive	
so in the future		and reproduce in that environment (HS-I S4-2)	
Connections to at	her DCIs in this grade-hand: H	SIS2 A (HS-1 S4-2): HS IS2 D (HS-1 S4-2): HS IS3	B (HS-1 S4-2):
HS FSS2 F (HS-I	S4-2). HS FSS3 A (HS-1 S4-2)	5.152.A (115-157-2), 115.152.D (115-157-2), 115.155 .	D (113-L3+-2),
Articulation across	arade-bands: MSIS2 A (HS-		MSISAC (HS-
194-2)			
Common Core Sta	te Standards Connections:		
FI Δ/I iteracy -			
DCT 11-17 1	Cite specific textual evidence	to support analysis of science and technical toxts, att	ending to important
K31.11-12.1	distinctions the author maker	and to any gaps or inconsistencies in the account (H	$(c_1 c_{1-2})$
WHST 0-12 2	Write informative/evolution	w texts including the parration of historical events, so	entific procedures/
WIIJ1.3-12.2	experiments or technical pro	y terms, including the narration of historical events, scheroscope (HS-1S4-2)	chanc procedures/
WHST 0-12 0	Draw evidence from informat	tional texts to support analysis, reflection, and research	h (HS_I S4_2)
SI 11.17 A	Draw evidence from mormational texts to support analysis, reflection, and research. (HS-LS4-2)		
56.11-12.7	evidence sound valid reasoning and well-chosen details: use appropriate eve contact adequate		
volume and clear pronunciation (HS-1S4-2)			acy aucyuale
Mathematics		(II) (II) (II) (II) (II) (II) (II) (II)	
	Boscon shetraetly and event	itativoly (HCICA 2)	
	Model with mothematics	$\frac{1}{2} \left(\frac{1}{2} - \frac{1}{2} \right)$	
MP.4	model with mathematics. (HS	5-L54-Z)	

Unit of Study 9: Bioecology

Standards that appear this unit: HS-ESS2-7

HS. Earth's Systems					
Students who demonstrate understand	ing can:				
HS-ESS2-7. Construct an argume	nt based on evidence about the sim	ultaneous coevolution of Earth's			
systems and life on E	arth. [Clarification Statement: Emphas	is is on the dynamic causes, effects, and			
feedbacks between the	biosphere and Earth's other systems, wh	ereby geoscience factors control the			
evolution of life, which in	n turn continuously alters Earth's surface	e. Examples of include how photosynthetic			
life altered the atmosphe	ere through the production of oxygen, w	hich in turn increased weathering rates and			
allowed for the evolution	n of animal life; how microbial life on lan	d increased the formation of soil, which in			
turn allowed for the evo	lution of land plants; or how the evolution	on of corals created reefs that altered			
patterns of erosion and	deposition along coastlines and provided	habitats for the evolution of new life			
forms.] [Assessment Bo	undary: Assessment does not include a	comprehensive understanding of the			
mechanisms of how the	biosphere interacts with all of Earth's ot	her systems.]			
The performance expectations above w	vere developed using the following eleme	ents from the NRC document A Framework			
for K-12 Science Education:					
Science and Engineering	Disciplinary Core Ideas	Crosscutting Concepts			
Practices	ESS2.D: Weather and Climate	Stability and Change			
Engaging in Argument from	 Gradual atmospheric changes 	 Much of science deals with constructing 			
Evidence	were due to plants and other	explanations of how things change and			
Engaging in argument from evidence	aging in argument from evidence organisms that captured carbon how they remain stable. (HS-ESS2-7				
19–12 Dullas on K–8 experiences aloxide and released oxygen.					
and progresses to using appropriate	d sufficient evidence and scientific FSS2 F: Biogeology				
and sufficient evidence and scientific	ng to defend and critique				
reasoning to defend and childre	and explanations about the feedbacks between the biosphere				
all is and explanations about the record of the Farth systems cause a					
actural and designed world(s).					
Arguments may also come from	juments may also come from Continual co-evolution of Earth's				
	ant scientific or historical surface and the life that exists on				
episodes in science.	п. (ПЗ-ЕЗЗ2-7)				
Construct an oral and written					
based on data and evidence (HS					
Connections to other DCIs in this grade	-hand: HSIS2 A (HS-ESS2-7): HSIS	C (HS_FSS2_7): HS I SA A (HS_FSS2_7):			
HS I S4 B (HS-FSS2-7) HS I S4 C (HS	S-FSS2-7), HS I SA D (HS-FSS2-7),	LC (115-L352-7), 115.L34.A (115-L352-7),			
Articulation of DCIs across grade-band	s' MS I S2 Δ (HS-FSS2-7). MS I S2 C (H	HS-FSS2-7)· MS I S4 Δ (HS-FSS2-7)·			
MS.I.S4.B (HS-ESS2-7): MS.I.S4.C (HS-ESS2-7): MS.ESS1.C (HS-ESS2-7): MS.ESS2.A (HS-ESS2-7): MS.ESS2.C (HS-					
FSS2-7)					
Common Core State Standards Connections:					
ELA/Literacy –					
WHST.9-12.1 Write arguments focused on <i>discipline-specific content</i> . (HS-ESS2-7)					
		/			

Biology