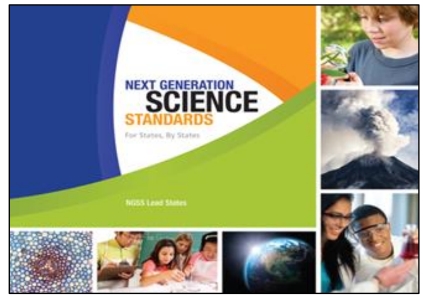
Exploring Science Standards: for Use with the NGSS *

Why?

With the adoption of the Next Generation Science Standards (NGSS)*, all K-12 science teachers are being challenged to view science teaching and learning from a new perspective. As we ponder our current practice, we may feel some anxiety about what the new standards will mean for our students and courses. This activity allows us to dig into the standards in a guided inquiry environment, learning alongside our peers to gain familiarity with the basic framework and contents of the NGSS*.



http://www.nap.edu/catalog/18290/next-generation-science-standards-for-states-by-states

Use the words and phrases from Model 1 to answer questions #1 - #4.
Be sure you **reach a consensus with your group before you write down any answers.**

Model 1
Key Words and Phrases in the NGSS*

Analyzing and interpreting data	Patterns	Systems and system models
Constructing explanations and designing solutions	Developing and using models	Scale, proportion, and quantity
Influence of engineering, technology, and science on society and the natural world	Interdependence of science, engineering, and technology	
Obtaining, evaluating, and communicating information	Asking questions	Planning and carrying out investigations
Energy and Matter	Stability and change	Structure and function
Cause and effect	Using mathematical and computational thinking	Engaging in argument from evidence

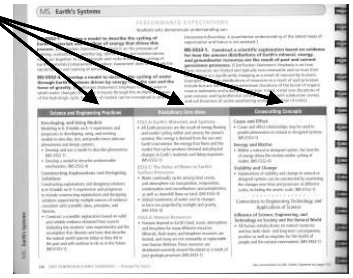
1. Cut out all of the boxes in your group's extra copy of Model 1 to create 17 separate words and phrases. Work with your group to **sort** the words/phrases into at least two different categories. **Organize and display** your sorting scheme. **Label** the categories you chose. Include a brief explanation or description of each category. Be ready for your spokesperson to present your work to the entire class.

STOP

2. Flip through the yellow- or green-edged pages of your copy of the NGSS.*
Choose any page that includes the three column format like this one.
From the column headings, write the meaning of **SEP:**

From the column headings, write the meaning of **DCI:**

From the column headings, write the meaning of **CC:**



Read This!

The NGSS* refers to the SEPs, DCIs, and CCs as **dimensions**. In the future when you hear and read about the three dimensions of the NGSS* you'll know what they are!

3. The NGSS* categorizes each of the words and phrases in Model 1 as either an SEP or a CC. Use the yellow- and green-edged pages with the three column format to decide which category matches each phrase. There are a total of 8 SEPs and 9 CCs.
Each group member will take responsibility for one set of the phrases in the table below.
Place an X in each row to indicate whether the phrase is an SEP or a CC.
Share your results with your group, providing evidence to support your categorizations.

Practice or Concept?	**SEP**	**CC**
Analyzing and interpreting data		
Asking questions		
Cause and effect		
Constructing explanations and designing solutions		
Developing and using models		
Energy and Matter		
Engaging in argument from evidence		
Influence of engineering, technology, and science on society and the natural world		
Interdependence of science, engineering, and technology		
Obtaining, evaluating, and communicating information		
Patterns		
Planning and carrying out investigations		
Scale, proportion, and quantity		
Stability and change		
Structure and function		
Systems and system models		
Using mathematical and computational thinking		

4. Based on your answers to #3, write a sentence to describe how a person can tell the difference between an SEP and a CC just by looking at the phrase.

Model 2
Introduction to The Yellow Pages – page 1

NEXT GENERATION SCIENCE STANDARDS *
Arranged by Disciplinary Core Ideas

Next Generation Science Standards — Arranged by Disciplinary Core Ideas

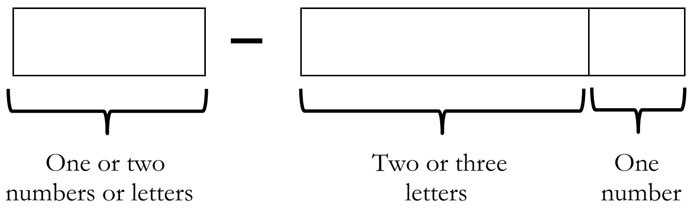
NEXT GENERATION SCIENCE STANDARDS — Arranged by Disciplinary Core Ideas 1

Use ONLY page 1 of your copy of the NGSS* to answer questions #5 - #10.
Do not search other sections of the standards quite yet.
Be sure you **reach a consensus with your group before you write down any answers.**

5. Based on the title of this section of the NGSS*, describe how the standards are arranged in the yellow section of the book.

6. With your group, spend 2-3 minutes carefully skimming just this single page and discussing any patterns you discern. Write down three distinct patterns that your group members identified. Be ready for your spokesperson to share one of your group's answers.

7. Each description of a **Disciplinary Core Idea** is preceded by a **code** with this general format:



Focus only on **the first part of the code**. Based on your list and your knowledge of the U.S. educational system, describe what this part of the code must represent.

8. Focus only on **the middle part of the code**. Four different letter combinations are used. Each is an abbreviation. Using the information available in Model 2 and your knowledge of science disciplines, fill in the following table:

Abbreviation	Science discipline represented by the abbreviation
LS	
	Earth and Space Sciences
PS	
	Engineering, Technology, and Applications of Science

9. Focus only on **the last part of the code**. List the numbers that are used:

Describe what your group thinks this part of the code means. Send your spokesperson to check your answer with two other groups. Revise your answer if necessary. Include specific evidence from Model 2 in your answer.

10. Write one or two sentences that clearly explain what the phrase "Disciplinary Core Idea" must mean.

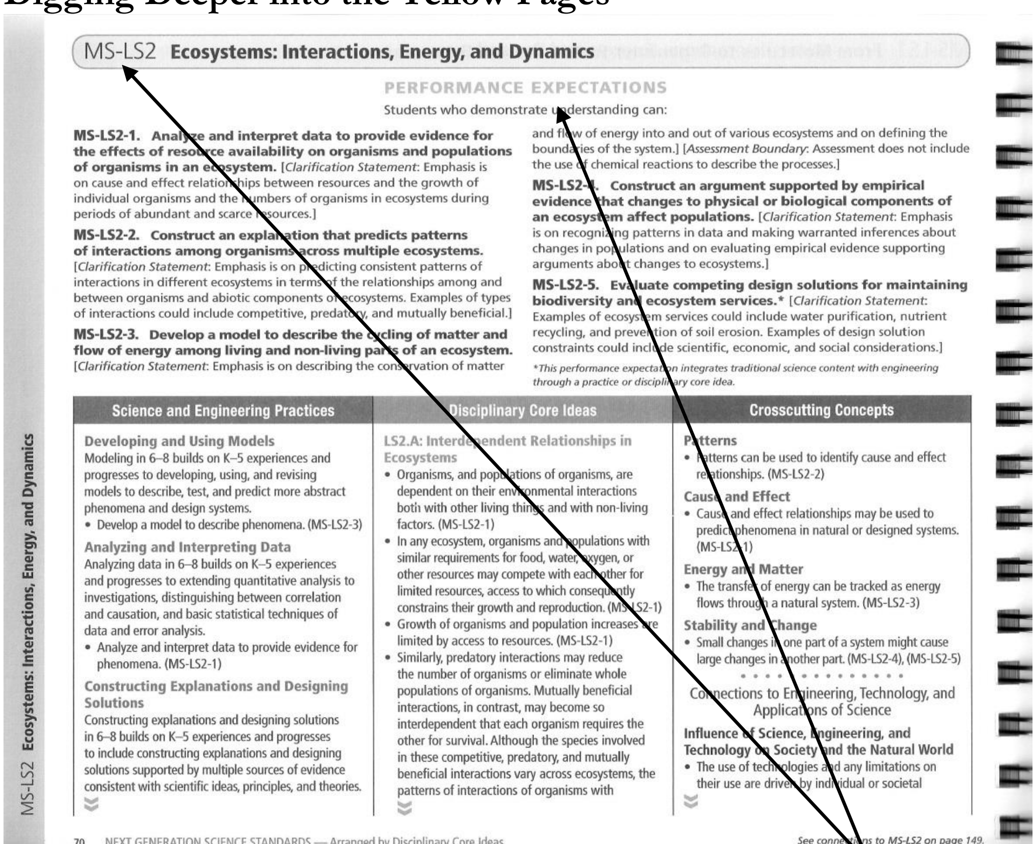
11. Turn to the NGSS* book Introduction page xv. Read the three paragraphs that explain each of the dimensions of the "Framework for K-12 Science Education." Summarize each paragraph in your own words – one sentence per dimension. Compare these summaries with your group's answers to #4 and #10.

Practices:

Crosscutting Concepts:

Disciplinary Core Ideas:

Model 3
Digging Deeper into the Yellow Pages



MS-LS2 Ecosystems: Interactions, Energy, and Dynamics

PERFORMANCE EXPECTATIONS

Students who demonstrate understanding can:

MS-LS2-1. Analyze and interpret data to provide evidence for the effects of resource availability on organisms and populations of organisms in an ecosystem. [*Clarification Statement*: Emphasis is on cause and effect relationships between resources and the growth of individual organisms and the numbers of organisms in ecosystems during periods of abundant and scarce resources.]

MS-LS2-2. Construct an explanation that predicts patterns of interactions among organisms across multiple ecosystems. [*Clarification Statement*: Emphasis is on predicting consistent patterns of interactions in different ecosystems in terms of the relationships among and between organisms and abiotic components of ecosystems. Examples of types of interactions could include competitive, predatory, and mutually beneficial.]

MS-LS2-3. Develop a model to describe the cycling of matter and flow of energy among living and non-living parts of an ecosystem. [*Clarification Statement*: Emphasis is on describing the conservation of matter and flow of energy into and out of various ecosystems and on defining the boundaries of the system.] [*Assessment Boundary*: Assessment does not include the use of chemical reactions to describe the processes.]

MS-LS2-4. Construct an argument supported by empirical evidence that changes to physical or biological components of an ecosystem affect populations. [*Clarification Statement*: Emphasis is on recognizing patterns in data and making warranted inferences about changes in populations and on evaluating empirical evidence supporting arguments about changes to ecosystems.]

MS-LS2-5. Evaluate competing design solutions for maintaining biodiversity and ecosystem services.* [*Clarification Statement*: Examples of ecosystem services could include water purification, nutrient recycling, and prevention of soil erosion. Examples of design solution constraints could include scientific, economic, and social considerations.]

**This performance expectation integrates traditional science content with engineering through a practice or disciplinary core idea.*

Science and Engineering Practices	Disciplinary Core Ideas	Crosscutting Concepts
Developing and Using Models Modeling in 6–8 builds on K–5 experiences and progresses to developing, using, and revising models to describe, test, and predict more abstract phenomena and design systems. • Develop a model to describe phenomena. (MS-LS2-3) **Analyzing and Interpreting Data** Analyzing data in 6–8 builds on K–5 experiences and progresses to extending quantitative analysis to investigations, distinguishing between correlation and causation, and basic statistical techniques of data and error analysis. • Analyze and interpret data to provide evidence for phenomena. (MS-LS2-1) **Constructing Explanations and Designing Solutions** Constructing explanations and designing solutions in 6–8 builds on K–5 experiences and progresses to include constructing explanations and designing solutions supported by multiple sources of evidence consistent with scientific ideas, principles, and theories.	**LS2.A: Interdependent Relationships in Ecosystems** • Organisms, and populations of organisms, are dependent on their environmental interactions both with other living things and with non-living factors. (MS-LS2-1) • In any ecosystem, organisms and populations with similar requirements for food, water, oxygen, or other resources may compete with each other for limited resources, access to which consequently constrains their growth and reproduction. (MS-LS2-1) • Growth of organisms and population increases are limited by access to resources. (MS-LS2-1) • Similarly, predatory interactions may reduce the number of organisms or eliminate whole populations of organisms. Mutually beneficial interactions, in contrast, may become so interdependent that each organism requires the other for survival. Although the species involved in these competitive, predatory, and mutually beneficial interactions vary across ecosystems, the patterns of interactions of organisms with	**Patterns** • Patterns can be used to identify cause and effect relationships. (MS-LS2-2) **Cause and Effect** • Cause and effect relationships may be used to predict phenomena in natural or designed systems. (MS-LS2-1) **Energy and Matter** • The transfer of energy can be tracked as energy flows through a natural system. (MS-LS2-3) **Stability and Change** • Small changes in one part of a system might cause large changes in another part. (MS-LS2-4), (MS-LS2-5) Connections to Engineering, Technology, and Applications of Science **Influence of Science, Engineering, and Technology on Society and the Natural World** • The use of technologies and any limitations on their use are driven by individual or societal

MS-LS2 Ecosystems: Interactions, Energy, and Dynamics

70 NEXT GENERATION SCIENCE STANDARDS — Arranged by Disciplinary Core Ideas

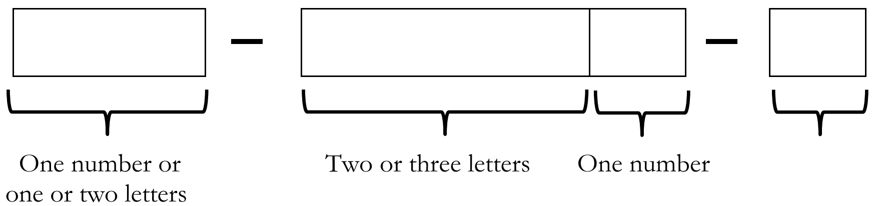
See connections to MS-LS2 on page 149.

Your group may **choose ANY YELLOW PAGE** that has these types of headings.
Use information found on your yellow page to answer questions #12 - #18.
Be sure you **reach a consensus with your group before you write down any answers**.

12. Identify the DCI code for the page you have chosen. Circle the location of the DCI code on the Model 3 diagram above.

13. Based on the subheading of your chosen yellow page, describe what the abbreviation **PE** must mean when used in discussions about the NGSS*.

14. Recall the format of the code for the DCIs (see question #7). Now look carefully at the codes for Performance Expectations. **Describe** which part of the PE code is different from the DCI code. **Label** this part on the diagram below.



15. Based on your analysis of the PEs, describe what this new part of the code indicates to the reader.

16. Choose one Performance Expectation. **Describe** how you can use this PE to design one specific **formative assessment** for your students.

17. Choose one Performance Expectation. **Describe** how you can use this PE to design one specific **summative assessment** for your students.

18. Find the term "Assessment Boundary" within one of the PEs on your chosen yellow page. (If your page does not include this term, choose a different yellow page. Read the [bracketed] statement associated with the Assessment Boundary. Describe how the "Assessment Boundary" sets limits on students' expected performance for your chosen PE.

Pulling it all together

19. As an individual, describe ways you might incorporate one or two of the listed Science and Engineering Practices into your students' learning experiences.

Analyzing and interpreting data

Asking questions

Developing and using models

Engaging in argument from evidence

Constructing explanations and designing solutions

Obtaining, evaluating, and communicating information

Planning and carrying out investigations

Using mathematical and computational thinking

20. As an individual, summarize the basic organizational framework of the NGSS*. To check your understanding, use as many of the abbreviations as you can to check your understanding.

CC	**DCI**	**ESS**
ETS	**LS**	**NGSS**
PE	**PS**	**SEP**

Extension Questions

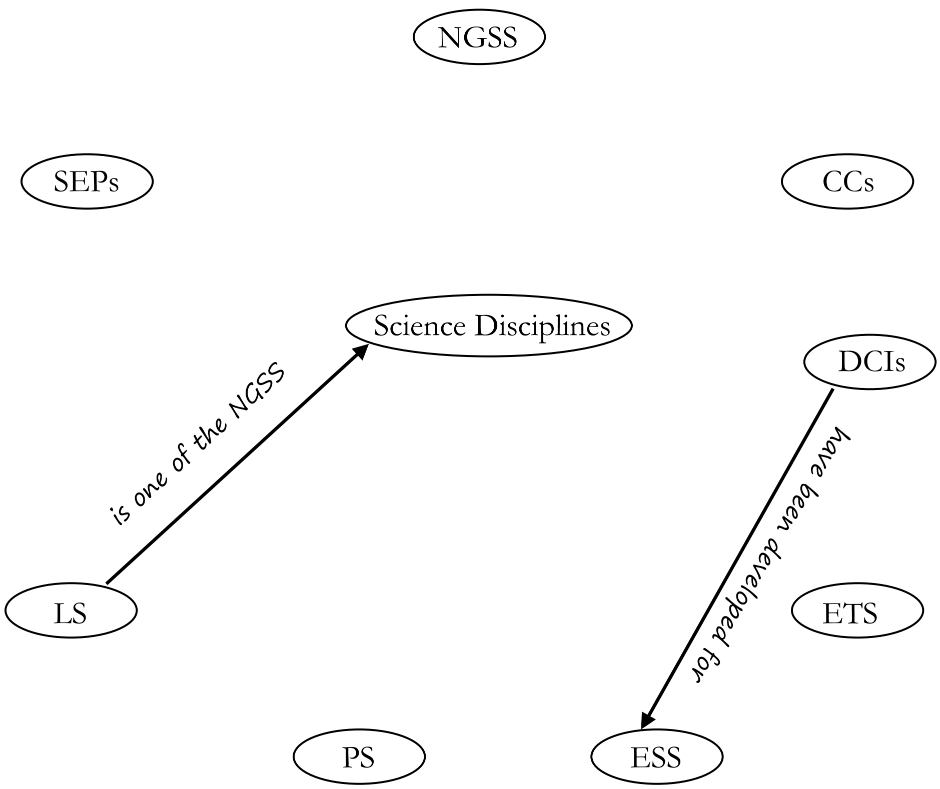
21. Practice using the language of the Next Generation Science Standards* by using the listed abbreviations to complete the statements below.

CC	**DCI**	**ESS**
ETS	**LS**	**NGSS**
PE	**PS**	**SEP**

The NGSS* organizes its framework of concepts and skills into three different dimensions, called the __________ , _________ , and __________ .

The four main branches of science and engineering included in the standards are _______ , ________ , ________ , and ________ .

22. Create a concept map that organizes all you have learned about the Next Generation Science Standards.* Start with the following concept abbreviations and linking words.
Add linking words to create propositions that are valid.



Use the information from Model 4 to answer questions #23 – #24 below.
Be sure you **reach a consensus with your group before you write down any answers**

Model 4
Comparing the NGSS* Science and Engineering Practices with the POGIL Process Skills

NGSS* Science and Engineering Practices
Asking questions / defining problems
Developing and using models
Planning and carrying out investigations
Analyzing and interpreting data
Using mathematics and computational thinking
Constructing explanations / designing solutions
Obtaining, evaluating, and communicating information
Engaging in argument from evidence

POGIL Process Skills
Oral & written communication
Teamwork
Problem solving
Critical thinking
Management (team and self)
Information processing
Assessment (self-assessment and metacognition)

23. Draw a line to connect each SEP with a Process Skill that includes similar student behaviors. You may connect each Process Skill with more than one SEP.

24. If you include the POGIL Process Skills in your classroom learning environment, describe how you might also be integrating the NGSS* Science and Engineering Practices.

Teacher Resources

Prerequisite knowledge:

- The difference between formative and summative assessments.
- How to construct a basic concept map (optional).

Outline of the activity (with Learning Targets)

Model 1 I can list and describe the three different dimensions of the NGSS.* I can distinguish SEPS from CCs.	41 minutes
Model 2 I can define DCI.	24 minutes
Model 3 I can describe how I might use the PEs and Assessment Boundaries to design formative and summative assessments for my students.	22 minutes
Pulling it all together I can summarize the basic organizational framework of the NGSS* and identify additional questions I have about this framework for K-12 science learning.	5 minutes
Extension Questions (optional) I can comfortably and accurately use most of the terms and abbreviations associated with the NGSS.*	10 minutes (optional)
Model 4 I can describe how using POGIL strategies allows me to incorporate the NGSS* Science and Engineering Practices in my classroom.	12 minutes (optional)

Academic language used and/or developed in this activity:

Assessment boundary – the upper limits of student mastery demonstration expected

CC – Crosscutting Concepts

DCI – Disciplinary Core Ideas

Dimensions – three different ways of organizing the framework of NGSS concepts and skills

ESS – Earth and Space Sciences

ETS – Engineering, Technology, and Applications of Science

LS – Life Sciences

NGSS – Next Generation Science Standards

PE – Performance Expectations

PS – Physical Sciences

SEP – Science and Engineering Practices

FACILITATION NOTES:

Each participant needs a packet of pages 1-7 (double sided/stapled).

Each group of four needs access to 1-2 hard copies of the Next Generation Science Standards* - http://www.nap.edu/catalog/18290/next-generation-science-standards-for-states-by-states

Each group needs a pair of scissors and one large copy of the Model 1 table (page 12). To save time, pre-cut the cells of Model 1 and give each group one set.

Facilitator needs copies of page 8 to hand out to groups who finish early.

The session can end when all groups have finished through page 7.

This activity is designed **to be used in a POGIL setting** where the teacher acts as a facilitator, participants work collaboratively in groups of 3-4 to answer all questions, each group member has an assigned role to follow, etc. See one of these references for further information on facilitating a POGIL activity: https://pogil.org/resources/implementation/instructors-guide or https://pogil.org/resources/implementation/hspi-implementation-guide

This is an extra copy of the phrases in Model 1. Each group will need only ONE of these pages.

Analyzing and interpreting data	Patterns	Systems and system models
Constructing explanations and designing solutions	Developing and using models	Scale, proportion, and quantity

Influence of engineering, technology, and science on society and the natural world	Interdependence of science, engineering, and technology	
Obtaining, evaluating, and communicating information	Asking questions	Planning and carrying out investigations

Energy and Matter	Stability and change	Structure and function
Cause and effect	Using mathematical and computational thinking	Engaging in argument from evidence

ANSWER KEY

Exploring Science Standards: for Use with the NGSS *

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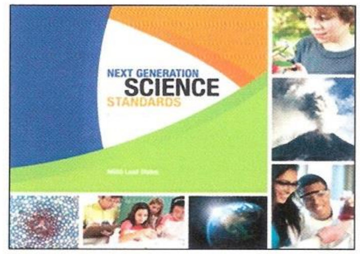

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Use the words and phrases from Model 1 to answer questions #1 - #4.
Be sure you **reach a consensus with your group before you write down any answers.**

Model 1
Key Words and Phrases in the NGSS*

Analyzing and interpreting data	Patterns	Systems and system models
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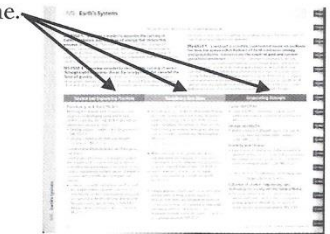
Obtaining, evaluating, and communicating information	Asking questions	Planning and carrying out investigations
Energy and Matter	Stability and change	Structure and function
Cause and effect	Using mathematical and computational thinking	Engaging in argument from evidence

1. Cut out all of the boxes in your group's extra copy of Model 1 to create 17 separate words and phrases. Work with your group to **sort** the words/phrases into at least two different categories. **Organize and display** your sorting scheme. **Label** the categories you chose. Include a brief explanation or description of each category. Be ready for your spokesperson to present your work to the entire class.

* NGSS and Next Generation Science Standards are registered trademarks of Achieve. Neither Achieve nor the lead states and partners that developed the Next Generation Science Standards was involved in the production of, and does not endorse, this product.

2. Flip through the yellow- or green-edged pages of your copy of the NGSS.*
Choose any page that includes the three column format like this one.
From the column headings, write the meaning of **SEP:**
Science and Engineering Practices
From the column headings, write the meaning of **DCI:**
Disciplinary Core Ideas
From the column headings, write the meaning of **CC:**
Crosscutting Concepts



Read This!

> The NGSS* refers to the SEPs, DCIs, and CCs as **dimensions**. In the future when you hear and read about the three dimensions of the NGSS* you'll know what they are!

3. The NGSS* categorizes each of the words and phrases in Model 1 as either an SEP or a CC. Use the yellow- and green-edged pages with the three column format to decide which category matches each phrase. There are a total of 8 SEPs and 9 CCs.
Each group member will take responsibility for one set of the phrases in the table below.
Place an X in each row to indicate whether the phrase is an SEP or a CC.
Share your results with your group, providing evidence to support your categorizations.

Practice or Concept?	**SEP**	**CC**
Analyzing and interpreting data	X	
Asking questions	X	
Cause and effect		X
Constructing explanations and designing solutions	X	
Developing and using models	X	
Energy and Matter		X
Engaging in argument from evidence	X	
Influence of engineering, technology, and science on society and the natural world		X
Interdependence of science, engineering, and technology		X
Obtaining, evaluating, and communicating information	X	
Patterns		X
Planning and carrying out investigations	X	
Scale, proportion, and quantity		X
Stability and change		X
Structure and function		X
Systems and system models		X
Using mathematical and computational thinking	X	

4. Based on your answers to #3, write a sentence to describe how a person can tell the difference between an SEP and a CC just by looking at the phrase. Answers will vary.
Big idea: SEPs are actions (verbs) and CCs are organizing/descriptive ideas (nouns)

Model 2
Introduction to The Yellow Pages – page 1

NEXT GENERATION SCIENCE STANDARDS *
Arranged by Disciplinary Core Ideas

Next Generation Science Standards — Arranged by Disciplinary Core Ideas

Use ONLY page 1 of your copy of the NGSS* to answer questions #5 - #10.
Do not search other sections of the standards quite yet.
Be sure you **reach a consensus with your group before you write down any answers.**

5. Based on the title of this section of the *NGSS*, describe how the standards are arranged in the yellow section of the book.

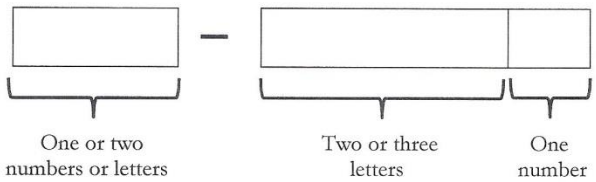
In the yellow section of the book, the standards are arranged by disciplinary core ideas.

6. With your group, spend 2-3 minutes carefully skimming just this single page and discussing any patterns you discern. Write down three distinct patterns that your group members identified. Be ready for your spokesperson to share one of your group's answers.

Answers will vary. Possible answers include:

- K, 1, 2, 3, 4, 5, MS, HS sections
- K-5 have a variety of 4-8 core ideas @ each grade level
- MS and HS have different sections for
  - life sciences
  - physical sciences
  - earth + space sciences
  - engineering design
- for Engineering Design, there are sections for primary (K-2), intermediate (3-5), middle school (6-8), + high school (9-12)
- each DCI has a code thing in **bold**

7. Each description of a **Disciplinary Core Idea** is preceded by a **code** with this general format:



Focus only on **the first part of the code**. Based on your list and your knowledge of the U.S. educational system, describe what this part of the code must represent.

The first part represents grade level K, 1, 2, 3, 4, 5, MS, HS

8. Focus only on **the middle part of the code**. Four different letter combinations are used. Each is an abbreviation. Using the information available in Model 2 and your knowledge of science disciplines, fill in the following table:

Abbreviation	Science discipline represented by the abbreviation
LS	Life sciences
ESS	Earth and Space Sciences
PS	Physical Sciences
ETS	Engineering, Technology, and Applications of Science

9. Focus only on **the last part of the code**. List the numbers that are used:

Describe what your group thinks this part of the code means. Send your spokesperson to check your answer with two other groups. Revise your answer if necessary. Include specific evidence from Model 2 in your answer.

It identifies one specific subtopic of a PS, LS, or ESS category.
For example, "Motion & Stability" = PS2
while "Energy" = PS3

10. Write one or two sentences that clearly explain what the phrase "Disciplinary Core Idea" must mean.

A DCI is a big conceptual idea that includes many subconcepts. Each DCI is an overarching or foundational concept for one of the disciplinary areas (PS, LS, ESS, ETS). A discipline is founded upon 1–4 DCIs.

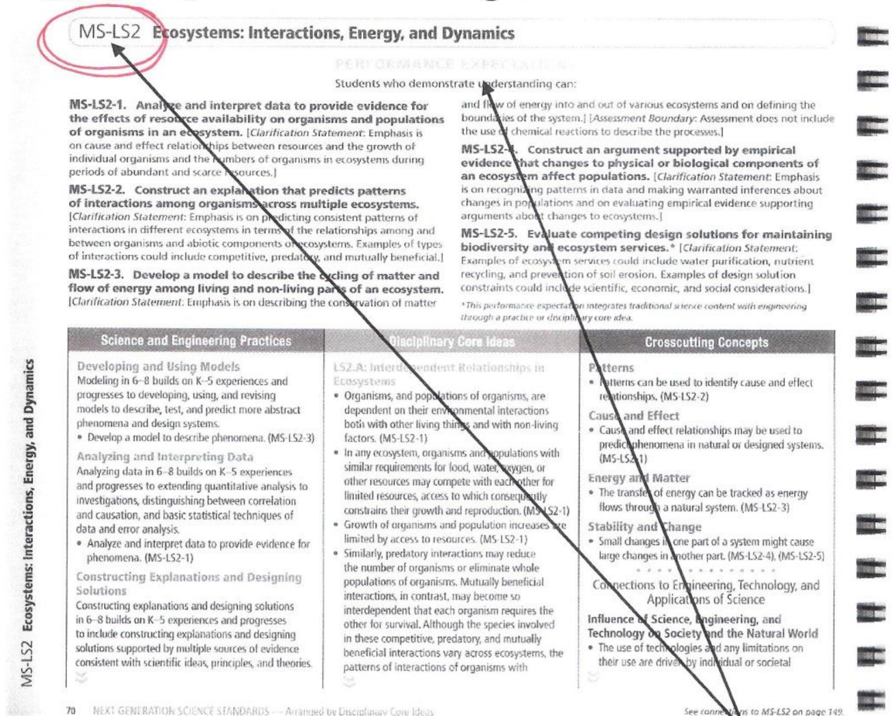
11. Turn to the NGSS* book Introduction page xv. Read the three paragraphs that explain each of the dimensions of the "Framework for K-12 Science Education." Summarize each paragraph in your own words – one sentence per dimension. Compare these summaries with your group's answers to #4 and #10.

Practices: Students themselves will engage in/experience the practices that scientists and engineers use everyday.

Crosscutting Concepts: These are the ideas and behaviors that are common to all fields of science and engineering.

Disciplinary Core Ideas: These are a limited set of ideas and practices that allow students to learn how to learn science + engineering – so they can continue to learn well beyond the 12th grade!

Model 3
Digging Deeper into the Yellow Pages



MS-LS2 **Ecosystems: Interactions, Energy, and Dynamics**

PERFORMANCE EXPECTATIONS

Students who demonstrate understanding can:

MS-LS2-1. Analyze and interpret data to provide evidence for the effects of resource availability on organisms and populations of organisms in an ecosystem. [*Clarification Statement*: Emphasis is on cause and effect relationships between resources and the growth of individual organisms and the numbers of organisms in ecosystems during periods of abundant and scarce resources.]

MS-LS2-2. Construct an explanation that predicts patterns of interactions among organisms across multiple ecosystems. [*Clarification Statement*: Emphasis is on predicting consistent patterns of interactions in different ecosystems in terms of the relationships among and between organisms and abiotic components of ecosystems. Examples of types of interactions could include competitive, predatory, and mutually beneficial.]

MS-LS2-3. Develop a model to describe the cycling of matter and flow of energy among living and non-living parts of an ecosystem. [*Clarification Statement*: Emphasis is on describing the conservation of matter and flow of energy into and out of various ecosystems and on defining the boundaries of the system.] [*Assessment Boundary*: Assessment does not include the use of chemical reactions to describe the processes.]

MS-LS2-4. Construct an argument supported by empirical evidence that changes to physical or biological components of an ecosystem affect populations. [*Clarification Statement*: Emphasis is on recognizing patterns in data and making warranted inferences about changes in populations and on evaluating empirical evidence supporting arguments about changes to ecosystems.]

MS-LS2-5. Evaluate competing design solutions for maintaining biodiversity and ecosystem services.* [*Clarification Statement*: Examples of ecosystem services could include water purification, nutrient recycling, and prevention of soil erosion. Examples of design solution constraints could include scientific, economic, and social considerations.]

**This performance expectation integrates traditional science content with engineering through a practice or disciplinary core idea.*

Science and Engineering Practices	Disciplinary Core Ideas	Crosscutting Concepts
Developing and Using Models Modeling in 6–8 builds on K–5 experiences and progresses to developing, using, and revising models to describe, test, and predict more abstract phenomena and design systems. • Develop a model to describe phenomena. (MS-LS2-3) **Analyzing and Interpreting Data** Analyzing data in 6–8 builds on K–5 experiences and progresses to extending quantitative analysis to investigations, distinguishing between correlation and causation, and basic statistical techniques of data and error analysis. • Analyze and interpret data to provide evidence for phenomena. (MS-LS2-1) **Constructing Explanations and Designing Solutions** Constructing explanations and designing solutions in 6–8 builds on K–5 experiences and progresses to include constructing explanations and designing solutions supported by multiple sources of evidence consistent with scientific ideas, principles, and theories.	**LS2.A: Interdependent Relationships in Ecosystems** • Organisms, and populations of organisms, are dependent on their environmental interactions both with other living things and with non-living factors. (MS-LS2-1) • In any ecosystem, organisms and populations with similar requirements for food, water, oxygen, or other resources may compete with each other for limited resources, access to which consequently constrains their growth and reproduction. (MS-LS2-1) • Growth of organisms and population increases are limited by access to resources. (MS-LS2-1) • Similarly, predatory interactions may reduce the number of organisms or eliminate whole populations of organisms. Mutually beneficial interactions, in contrast, may become so interdependent that each organism requires the other for survival. Although the species involved in these competitive, predatory, and mutually beneficial interactions vary across ecosystems, the patterns of interactions of organisms with	**Patterns** • Patterns can be used to identify cause and effect relationships. (MS-LS2-2) **Cause and Effect** • Cause and effect relationships may be used to predict phenomena in natural or designed systems. (MS-LS2-1) **Energy and Matter** • The transfer of energy can be tracked as energy flows through a natural system. (MS-LS2-3) **Stability and Change** • Small changes in one part of a system might cause large changes in another part. (MS-LS2-4), (MS-LS2-5) Connections to Engineering, Technology, and Applications of Science **Influence of Science, Engineering, and Technology on Society and the Natural World** • The use of technologies and any limitations on their use are driven by individual or societal

MS-LS2 **Ecosystems: Interactions, Energy, and Dynamics**

70 NEXT GENERATION SCIENCE STANDARDS — Arranged by Disciplinary Core Ideas

See connections to MS-LS2 on page 149.

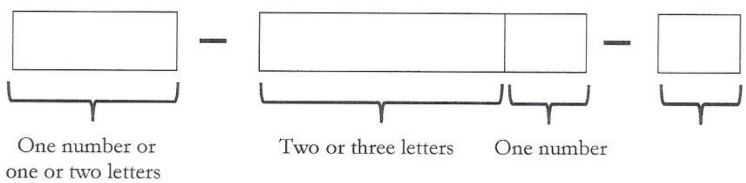
Your group may **choose ANY YELLOW PAGE** that has these types of headings.
Use information found on your yellow page to answer questions #12 - #18.
Be sure you **reach a consensus with your group before you write down any answers**.

12. Identify the DCI code for the page you have chosen. Circle the location of the DCI code on the Model 3 diagram above.

13. Based on the subheading of your chosen yellow page, describe what the abbreviation **PE** must mean when used in discussions about the NGSS*.

PE = Performance Expectations
A task ~~do~~ students can successfully complete to show mastery of a DCI.

14. Recall the format of the code for the DCIs (see question #7). Now look carefully at the codes for Performance Expectations. **Describe** which part of the PE code is different from the DCI code. **Label** this part on the diagram below.



STOP

15. Based on your analysis of the PEs, describe what this new part of the code indicates to the reader.

This new part of the code indicates a unique task that students are expected to complete as a way of demonstrating their mastery of a subpart of a DCI.

16. Choose one Performance Expectation. **Describe** how you can use this PE to design one specific **formative assessment** for your students.

Answers will vary
may include: demonstrating competence at sub-tasks of a PE along the way to mastering the entire task; oral or written reporting-out; quick votes; exit tickets; mini-quizzes/warm ups

17. Choose one Performance Expectation. **Describe** how you can use this PE to design one specific **summative assessment** for your students.

Answers will vary, but should reflect a final demonstration of mastery related to the chosen PE.

18. Find the term "Assessment Boundary" within one of the PEs on your chosen yellow page. (If your page does not include this term, choose a different yellow page. Read the [bracketed] statement associated with the Assessment Boundary. Describe how the "Assessment Boundary" sets limits on students' expected performance for your chosen PE.

The assessment boundary sets an upper limit on the complexity/difficulty of a task that students are expected to complete as evidence that they've mastered a specific subpart of a DCI.
This allows teachers to focus on the important parts of a DCI and feel confident in deciding when "enough is enough."

Pulling it all together

19. As an individual, describe ways you might incorporate one or two of the listed Science and Engineering Practices into your students' learning experiences.

Analyzing and interpreting data	Constructing explanations and designing solutions
Asking questions	Obtaining, evaluating, and communicating information
Developing and using models	Planning and carrying out investigations
Engaging in argument from evidence	Using mathematical and computational thinking

Answers will vary.

20. As an individual, summarize the basic organizational framework of the NGSS*. To check your understanding, use as many of the abbreviations as you can to check your understanding.

CC	DCI	ESS
ETS	LS	NGSS
PE	PS	SEP

Answers will vary, but should demonstrate these ideas:

- SEPs and CCs cross disciplinary boundaries
- There are four science disciplines that frame all the core ideas: LS, PS, ESS, and ETS
- The NGSS has three dimensions: SEPs, CCs, and DCIs

Extension Questions

21. Practice using the language of the Next Generation Science Standards* by using the listed abbreviations to complete the statements below.

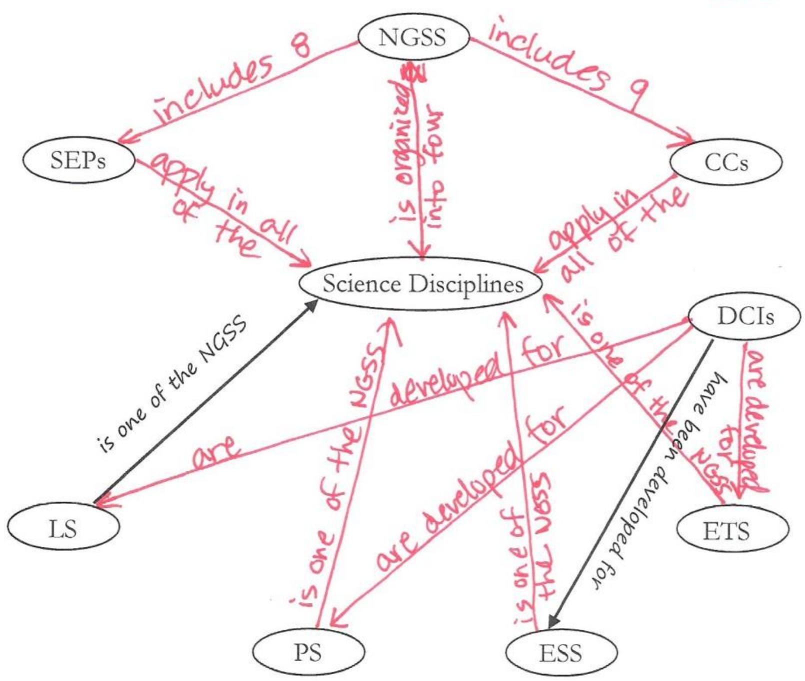
CC	DCI	ESS
ETS	LS	NGSS
PE	PS	SEP

The NGSS* organizes its framework of concepts and skills into three different dimensions, called the __SEP__, __DCI__, and __CC__. (order does not matter)

The four main branches of science and engineering included in the standards are __LS__, __PS__, __ESS__, and __ETS__. (order does not matter)

22. Create a concept map that organizes all you have learned about the Next Generation Science Standards.* Start with the following concept abbreviations and linking words.
Add linking words to create propositions that are valid.

Answers will vary - some connections are shown.



Use the information from Model 4 to answer questions #21 – #23 below.
Be sure you **reach a consensus with your group before you write down any answers**

Model 4
Comparing the NGSS* Science and Engineering Practices with the POGIL Process Skills

Answers may vary

NGSS* Science and Engineering Practices	POGIL Process Skills
Asking questions / defining problems	Oral & written communication
Developing and using models	Teamwork
Planning and carrying out investigations	Problem solving
Analyzing and interpreting data	Critical thinking
Using mathematics and computational thinking	Management (team and self)
Constructing explanations / designing solutions	Information processing
Obtaining, evaluating, and communicating information	Self-Assessment
Engaging in argument from evidence	Metacognition

23. Draw a line to connect each SEP with a Process Skill that includes similar student behaviors. You may connect each Process Skill with more than one SEP.

(have student groups justify their connections) → STOP

24. If you include the POGIL Process Skills in your classroom learning environment, describe how you might also be integrating the NGSS* Science and Engineering Practices.

Answers will vary.

Big idea – by implementing POGIL strategies, all or most of the SEPs are included in the students' learning experiences... they do not need to be "added on".