Overarching Essential Questions for the NGSS Cross-Cutting Concepts

**Crosscutting Concept #1: Patterns**
*How can patterns be used to predict results and solve problems?*
*What is the relationship between patterns and natural phenomena?*
*What is involved in identifying a pattern?*
*How can you use identified patterns to justify claims?*

**Crosscutting Concept #2: Cause/Effect**
*Why is understanding cause and effect important to your life?*
*How can cause and effect relationships help predict or explain future events?*
*How can data mislead you in determining a cause & effect relationship?*
*How do you distinguish between a cause and a correlation?*

**Crosscutting Concept #3: Scale, Proportion and Quantity**
*How do scale, proportion and quantity affect what can be observed?*
*How do conceptual models allow me to observe and test what I cannot see?*
*How can mathematical models be used to understand and/or predict scientific events?*

**Crosscutting Concept #4: Systems and System Models**
*What is a system?*
*How are the parts of a system related to the entire system?*
*How are system models used to predict and understand real world situations or scientific phenomena?*

**Crosscutting Concept #5: Matter and Energy**
*What is energy, and what does it mean for it to be conserved?*
*How are energy and matter related?*
*How is energy measured?*

**Crosscutting Concept #6: Structure and Function**
*What is the connection between structure and function?*
*How does structure and function apply to a given problem?*
*What affects structure and function?*

**Crosscutting Concept #7: Stability and change**
*How do we measure change?*
*How can something appear stable when it is actually changing?*
*How does scale affect our ability to observe change?*
Overarching Essential Questions for the NGSS Science And Engineering Practices

Practice #1: Asking Questions and Defining Problems
What are the characteristics of a good, testable question?
What are the characteristics of a problem worth investigating?
Which questions would you ask if you obtained unexpected results?

Practice #2: Developing and Using Models
How does your model relate to the real world?
What are the advantages and limitations of a model?
When and why is it appropriate to change a model?

Practice #3: Planning and Carrying Out Investigations
How does planning for a scientific investigation address data collection that is valid, reliable, ethical and repeatable?
Why is it important to collect data about the performance of a proposed tool, object, process or system under a range of conditions?

Practice #4: Analyzing and Interpreting Data
How are graphical representations of large data sets constructed and used to identify relationships?
How can we analyze data with more precision and accuracy?
Why is error analysis important?

Practice #5: Using Mathematics and Computational Thinking
How can mathematics be used to solve problems?
How can mathematics be used to communicate an idea and/or defend an argument?
When and how can mathematical ideas and data be generalized?

Practice #6: Constructing Explanations and Designing Solutions
How can we identify when something is (or is not) a solution to a problem?
How can data be used to summarize and/or draw conclusions about an experiment?
When is it appropriate to use numerical data/patterns and the results of an experiment to make generalized statements about science?
Why is it important to consider the constraints and/or criteria when designing and evaluating solutions?

Practice #7: Engaging in Argument from Evidence
How do scientists respond to different perspectives?
Why is it important to acknowledge the weaknesses of your argument?
How do you construct an argument using evidence to evaluate a scientific claim?

Practice #8 – Obtaining, Evaluating, and Communicating information
How do we decide what to believe about a scientific claim?
How can we make an informed decision?
What are the benefits of communicating information in multiple ways?
How does science change over time?

Source: Stevenson High School Science Department and Feeder Middle School Science Teachers

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NGSS Core Ideas – Essential and Guiding Questions for Physical Sciences

PS1: Matter and Its Interactions
How can one explain the structure, properties and interactions of matter?

How do particles combine to form the variety of matter on observes?

PS1.B: Chemical Reactions
How do substances combine or change (react) to make new substances?
How does one characterize and explain these reactions and make predictions about them?

PS1.C: Nuclear Processes
What forces hold nuclei together and mediate nuclear processes?

PS2: Motion and Stability: Forces and Interactions
How can one explain and predict interactions between objects and within systems of objects?

PS2.A: Forces and Motion
How can one predict an object’s continued motion, change in motion, or stability?

PS2.B: Types of Interactions
What underlying forces explain the variety of interactions observed?

PS2.C: Stability and Instability in Physical Systems
Why are some physical systems more stable than others?

PS3: Energy
How is energy transferred and conserved?

PS3.A: Definitions of Energy
What is energy?

PS3.B: Conservation of Energy and Energy Transfer
What is meant by conservation of energy? How is energy transferred between objects or systems?

PS3.C: Relationship between Energy and Forces
How are forces related to energy?

PS3.D: Energy in chemical Processes and Everyday Life
How do food and fuel provide energy? If energy is conserved, why do people say it is produced or used?
PS4: Waves and Their Applications in Technologies for Information Transfer
How are waves used to transfer energy and information?

PS4.A: Wave Properties
What are the characteristic properties and behaviors of waves?

PS4.B: Electromagnetic Radiation
What is light? How can one explain the varied effects that involve light? What other forms of electromagnetic radiation are there?

PS4.C: Information Technologies and Instrumentation
How are instruments that transmit and detect waves used to expand human senses?

NGSS Core Ideas – Essential and Guiding Questions for Life Sciences

LS1: From Molecules to Organisms: Structures and Processes
How do organisms live, grow, respond to their environment and reproduce?

LS1.A: Structure and Function
How do the structures of organisms enable life’s functions?

LS1.B: Growth and Development of Organisms
How do organisms grow and develop?

LS1.C: Organization for Matter and energy flow in Organisms
How do organisms obtain and use the matter and energy they need to live and grow?

LS1.D: Information Processing
How do organisms detect, process and use information about the environment?

LS2: Ecosystems: Interactions, Energy, and Dynamics
How (and why) do organisms interact with their environment and what are the effects of these interactions?

LS2.A: Interdependent Relationships in Ecosystems
How do organisms interact with the living and nonliving environments to obtain matter and energy?

LS2.B: Cycles of Matter and Energy Transfer in Ecosystems
How do matter and energy move through an ecosystem?

LS2.C: Ecosystems Dynamics, Functions and Resilience
What happens to ecosystems when the environment changes?
LS2.D: Social Interactions and Group Behavior
How do organisms interact in groups so as to benefit individuals?

LS3: Heredity: Inheritance and Variation of Traits
How are characteristics of one generation passed to the next?
How can individuals of the same species and even siblings have different characteristics?

LS3.A: Inheritance of Traits
How are the characteristics of one generation related to the previous generation?

LS3.B: Variation of Traits
Why and how do individuals of the same species vary in how they look, function and behave?

LS4: Biological Evolution: Unity and Diversity
How can there be so many similarities among organisms yet so many different kinds of plants, animals and microorganisms?

LS4.A: Evidence of Common Ancestry and Diversity
What evidence shows that different species are related?

LS4.B: Natural Selection
How does genetic variation among organisms affect survival and reproduction?

LS4.C: Adaptation
How does the environment influence populations of organisms over multiple generations?

LS4.D: Biodiversity and Humans
What is biodiversity, how do humans affect it, and how does it affect humans?

NGSS Core Ideas – Essential and Guiding Questions for Earth and Space Sciences

ESS1: Earth's Place in the Universe
What is the universe, and what is Earth's place in it?

ESS1.A: The Universe and Its Stars
What is the universe, and what goes on in the stars?

ESS1.B: Earth and the Solar System
What are the predictable patterns caused by Earth's movement in the solar system?

ESS1.C: The History of Planet Earth
How do people reconstruct and date events in Earth's planetary history?
ESS2: Earth Systems
How and why is Earth constantly changing?

ESS2.A: Earth Materials and Systems
How do Earth's major systems interact?

ESS2.B: Plate Tectonics and Large-Scale Systems Interactions
Why do the continents move, and what causes earthquakes and volcanoes?

ESS2.C: The Roles of Water in Earth's Surface Processes
How do the properties and movements of water shape Earth's surface and affect its systems?

ESS2.D: Weather and Climate
What regulates weather and climate?

ESS2.E: Biogeology
How do living organisms alter Earth's processes and structures?

ESS3: Earth and Human Activity
How do the Earth's surface processes and human activities affect each other?

ESS3.A: Natural Resources
How do humans depend on Earth's resources?

ESS3.B: Natural Hazards
How do natural hazards affect individuals and societies?

ESS3.C: Human Impact on Earth Systems
How do humans change the planet?

ESS3.D: Global Climate Change
How do people model and predict the effects of human activities on Earth's climate?

NGSS Core Ideas – Essential and Guiding Questions for Engineering, Technology and Applications of Science

ETS1: Engineering Design
How do engineers solve problems?

ETS1.A: Defining and Delimiting and Engineering Problem
What is a design for? What are the criteria and constraints of a successful solution?

ETS1.B: Developing Possible Solutions
What is the process for developing potential design solutions?
ETS1.C: Optimizing the Design Solution
How can various design solution be compared and improved?

ETS2: Links among Engineering, Technology, Science and Society
How are engineering, technology, science and society interconnected?

ETS2.A: Interdependence of Science, Engineering, and Technology
What are the relationships among science, engineering, and technology?

ETS2.B: Influence of Engineering, Technology and Science on Society and the Natural World
How do science, engineering, and the technologies that result from them affect the ways in which people live? How do they affect the natural world?