

## PRACTICES FOR K–12 SCIENCE CLASSROOMS

1. Asking questions (for science) and defining problems (for engineering)
2. Developing and using models
3. Planning and carrying out investigations
4. Analyzing and interpreting data
5. Using mathematics and computational thinking
6. Constructing explanations (for science) and designing solutions (for engineering)
7. Engaging in argument from evidence
8. Obtaining, evaluating, and communicating information

## SEVEN CROSSCUTTING CONCEPTS OF THE FRAMEWORK

1. *Patterns.* Observed patterns of forms and events guide organization and classification, and they prompt questions about relationships and the factors that influence them.
2. *Cause and effect: Mechanism and explanation.* Events have causes, sometimes simple, sometimes multifaceted. A major activity of science is investigating and explaining causal relationships and the mechanisms by which they are mediated. Such mechanisms can then be tested across given contexts and used to predict and explain events in new contexts.
3. *Scale, proportion, and quantity.* In considering phenomena, it is critical to recognize what is relevant at different measures of size, time, and energy and to recognize how changes in scale, proportion, or quantity affect a system's structure or performance.
4. *Systems and system models.* Defining the system under study—specifying its boundaries and making explicit a model of that system—provides tools for understanding and testing ideas that are app
5. *Energy and matter: Flows, cycles, and conservation.* Tracking fluxes of energy and matter into, out of, and within systems helps one understand the systems' possibilities and limitations.

6. *Structure and function.* The way in which an object or living thing is shaped and its substructure determine many of its properties and functions.
7. *Stability and change.* For natural and built systems alike, conditions of stability and determinants of rates of change or evolution of a system are critical elements of study.

## CORE AND COMPONENT IDEAS IN THE PHYSICAL SCIENCES

### **Core Idea PS1: Matter and Its Interactions**

PS1.A: Structure and Properties of Matter

PS1.B: Chemical Reactions

PS1.C: Nuclear Processes

### **Core Idea PS2: Motion and Stability: Forces and Interactions**

PS2.A: Forces and Motion

PS2.B: Types of Interactions

PS2.C: Stability and Instability in Physical Systems

### **Core Idea PS3: Energy**

PS3.A: Definitions of Energy

PS3.B: Conservation of Energy and Energy Transfer

PS3.C: Relationship Between Energy and Forces

PS3.D: Energy in Chemical Processes and Everyday Life

### **Core Idea PS4: Waves and Their Applications in Technologies for Information Transfer**

PS4.A: Wave Properties

PS4.B: Electromagnetic Radiation

PS4.C: Information Technologies and Instrumentation

## CORE AND COMPONENT IDEAS IN THE LIFE SCIENCES

### **Core Idea LS1: From Molecules to Organisms: Structures and Processes**

LS1.A: Structure and Function

LS1.B: Growth and Development of Organisms

LS1.C: Organization for Matter and Energy Flow in Organisms

LS1.D: Information Processing

### **Core Idea LS2: Ecosystems: Interactions, Energy, and Dynamics**

LS2.A: Interdependent Relationships in Ecosystems

LS2.B: Cycles of Matter and Energy Transfer in Ecosystems

LS2.C: Ecosystem Dynamics, Functioning, and Resilience

LS2.D: Social Interactions and Group Behavior

### **Core Idea LS3: Heredity: Inheritance and Variation of Traits**

LS3.A: Inheritance of Traits

LS3.B: Variation of Traits

### **Core Idea LS4: Biological Evolution: Unity and Diversity**

LS4.A: Evidence of Common Ancestry and Diversity

LS4.B: Natural Selection

LS4.C: Adaptation

LS4.D: Biodiversity and Humans

## CORE AND COMPONENT IDEAS IN EARTH AND SPACE SCIENCES

### Core Idea ESS1: Earth's Place in the Universe

ESS1.A: The Universe and Its Stars

ESS1.B: Earth and the Solar System

ESS1.C: The History of Planet Earth

### Core Idea ESS2: Earth's Systems

ESS2.A: Earth Materials and Systems

ESS2.B: Plate Tectonics and Large-Scale System Interactions

ESS2.C: The Roles of Water in Earth's Surface Processes

ESS2.D: Weather and Climate

ESS2.E: Biogeology

### Core Idea ESS3: Earth and Human Activity

ESS3.A: Natural Resources

ESS3.B: Natural Hazards

ESS3.C: Human Impacts on Earth Systems

ESS3.D: Global Climate Change

## DEFINITIONS OF TECHNOLOGY, ENGINEERING, AND APPLICATIONS OF SCIENCE

**Technology** is any modification of the natural world made to fulfill human needs or desires.

**Engineering** is a systematic and often iterative approach to designing objects, processes, and systems to meet human needs and wants.

**An application of science** is any use of scientific knowledge for a specific purpose, whether to do more science; to design a product, process, or medical treatment; to develop a new technology; or to predict the impacts of human actions.

## CORE AND COMPONENT IDEAS IN ENGINEERING, TECHNOLOGY, AND APPLICATIONS OF SCIENCE

### **Core Idea ETS1: Engineering Design**

ETS1.A: Defining and Delimiting an Engineering Problem

ETS1.B: Developing Possible Solutions

ETS1.C: Optimizing the Design Solution

### **Core Idea ETS2: Links Among Engineering, Technology, Science, and Society**

ETS2.A: Interdependence of Science, Engineering, and Technology

ETS2.B: Influence of Engineering, Technology, and Science on Society and the Natural World