

# NATIONAL SCIENCE EDUCATION STANDARDS

## GRADES K-4

### UNIFYING CONCEPTS AND PROCESSES

#### *Systems, Order, and Organization*

- A system is an organized group of related objects or components (organisms, machines, fundamental particles, galaxies, ideas, numbers, transportation, and education).
- Students should analyze in terms of systems (mass, energy, objects, organisms, and events).
- Systems have structure and function.
- Feedback and equilibrium are associated with systems.
- Systems can be open or closed.
- The assumption of order establishes the basis for cause-effect relationships and predictability.
- Prediction can be used to explain change. Math can be used to do this through probability.
- Systems have levels of organization (periodic table & classification of organisms).
- Living systems have levels of organization (cells, tissues, organs, organisms, populations and communities).
- Interactions occur in systems.

#### *Evidence, Models, and Explanation*

- Evidence should be used in explanations.
- Models can be used in explanations.
- Terms such as hypothesis, model, law, principle, theory, and paradigm are used to explain scientific explanations.

#### *Constancy, Change, and Measurement*

- Interactions result in change.
- Changes vary in rate, scale, and pattern, including trends and cycles.
- Math measures change.
- Scientists use the metric system.

- Scale includes understanding that parts of a system might change as its size changes.
- Rate compares one measured quantity with another.

#### *Evolution and Equilibrium*

- Evolution is a series of changes. This includes changes in the universe.
- The present is a result of the past.
- Equilibrium is a physical state in which forces and changes occur in opposite and offsetting directions.
- Steady state, balance, and homeostasis describe equilibrium states.

#### *Form and Function*

- Form follows function.
- Students should explain function in terms of form and form in terms of function.

### A. SCIENCE AS INQUIRY

#### *Abilities Necessary to do Scientific Inquiry*

- Students answering questions using scientific resources combined with observations.
- Plan and conduct a simple systematic observation or investigation.
- Use simple instruments such as ruler, thermometer, watch, balance, magnifier, microscope, computer, or calculator to gather data and extend the senses.
- Use knowledge and evidence (data) to formulate explanation.
- Communicate or analyze investigations and explanations that might be drawn or spoken as well as written.

#### *Understanding about Scientific Inquiry*

- Recognizing that all of the above are things scientists do.

## B. PHYSICAL SCIENCE

### *Properties of Objects and Materials*

- Objects have measurable and observable properties, which use tools.
- Objects can be described by their properties and classified accordingly.
- Materials can exist in different states (solid, liquid, gas).

### *Position and Motion of Objects*

- Position of an object can be described relative to other objects.
- Object's motion can be described by observing its position over time.
- Position or motion of object can be changed by pushing or pulling.
- Sound is produced by vibration of objects and pitch can be varied.

### *Light, Heat, Electricity, and Magnetism*

- Light travels in a straight line and can be reflected, refracted, and absorbed by objects.
- Heat can be produced and conducted.
- Electricity in circuits can produce light, heat, sound, and magnetic effects.
- Magnets attract and repel.

## C. LIFE SCIENCE

### *Characteristics of Organisms*

- All organisms have different needs.
- The environment must supply the needs of organisms.
- Each organism has different structures for different functions.
- Behavior is influenced by internal cues (hunger) and external cues (change in environment).

### *Life Cycles of Organisms*

- Plants and animals have life cycles.
- A life cycle includes: birth, development, adulthood, reproduction, and death.
- Offspring resemble parents.
- Some characteristics of organisms

are inherited while others result from interactions.

### *Organisms and Their Environments*

- Plants are the base of an ecosystem.
- All animals depend on plants.
- Organisms' patterns of behavior relate directly to the environment (kinds and numbers of other organisms, the availability of food and resources, and physical characteristics of the environment).
- Organisms can cause changes.
- Humans depend on environments.

## D. EARTH AND SPACE SCIENCE

### *Properties of Earth Materials*

- Earth materials have different physical and chemical properties.
- Soils have different properties and abilities to support plants.
- Fossils provide evidence about the environment, plants, and animals of the past.

### *Objects in the Sky*

- The sun, moon, stars, birds, clouds, airplanes, all have characteristics that can be observed and described.
- The sun provides light and heat necessary to maintain Earth's temperature.

### *Changes in the Earth and Sky*

- The surface of the Earth changes.
- Weather changes from day to day and over the seasons.
- Objects in the sky have patterns of movement.

## E. SCIENCE & TECHNOLOGY

### *Abilities of Technological Design*

- Identify a simple problem.
- Propose a solution.
- Implement a proposed solution.
- Evaluate a product of design.
- Communicate a problem, design, and solution.

### *Understanding About Science and Technology*

- Science is one way of answering and explaining the natural world.
- Trying to determine the effects of solutions helps people avoid some new problems.
- Scientists and engineers work in teams.
- Women and men of all ages, backgrounds, and groups engage in a variety of scientific and technological work.
- Tools help scientists make better observations, measurements, and equipment for investigations.

### *Abilities to Distinguish Between Natural Objects and Objects Made by Humans*

- Some objects occur in nature; others have been designed and made by people to solve human problems and enhance the quality of life.
- Objects can be categorized into two groups, natural and designed.

## **F. SCIENCE IN PERSONAL AND SOCIAL PERSPECTIVES**

### *Personal Health*

- Safety and security are basic needs of humans.
- Individuals have some responsibility for their own health.
- Nutrition is essential to health.
- Different substances can damage the body and how it functions.

### *Characteristics and Changes in Populations*

- Human populations include groups of individuals living in a particular location. Population density refers to the number of people of a particular population that live in a given amount of space.
- The size of human populations can increase or decrease.

### *Types of Resources*

- Resources are things we get from the living and nonliving environment to meet the needs and wants of a population.
- Some resources are basic materials (air, water, soil).
- Some resources are produced (food, fuel, building materials).
- Some resources are nonmaterial (quiet places, beauty, security, safety).

### *Changes in Environments*

- Environments are the space, conditions, and factors that affect an individual's and a population's ability to survive and their quality of life.
- Changes in environments can be natural or influenced by humans.
- Some environmental changes occur slowly, and others occur rapidly.

### *Science and Technology in Local Challenges*

- People continue inventing new ways of doing things. It is helpful to try to determine in advance how ideas and inventions will affect other people.
- Science and technology have greatly improved food quality and quantity, transportation, health, sanitation, and communication. These benefits are not available worldwide.

## **G. HISTORY AND NATURE OF SCIENCE**

### *Science as a Human Endeavor*

- Science has a rich history.
- Many contributions have been made to science and technology.
- Science will never be finished.
- Science can be a life-long career.
- Many people derive great pleasure from doing science.

| <div style="border: 1px solid black; padding: 5px;"> <p><b>Key to Symbols:</b></p> <ul style="list-style-type: none"> <li>● The science concept is the main focus of the Project WILD activity.</li> <li>⊙ The concept is one of the main focuses of the activity; is reinforced.</li> <li>○ The concept is not the main focus of the activity, but it is supported or reinforced.</li> </ul> </div> <p style="text-align: center;"><b>NATIONAL SCIENCE EDUCATION STANDARDS (Content, K–4)</b></p> | Color Crazy (gr. K–4, p. 2)            | Grasshopper Gravity (gr. K–4, p. 4) | What’s Wild? (gr. K–4, p. 7) | Classroom Carrying Capacity (gr. K–4, p. 9) | Graphananimal (gr. Pre-K–4, p. 49) | Wildlife Is Everywhere! (gr. K–4, p. 51) | Habitacks (gr. K–4, p. 53) | What’s That, Habitat? (gr. K–4, p. 56) | Beautiful Basics (gr. K–4, p. 58) | Everybody Needs a Home (gr. K–4, p. 59) | Environmental Barometer (gr. Pre-K–4, p. 77) | Habitrekking (gr. 3–4, p. 79) |
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|  | <b>UNIFYING CONCEPTS AND PROCESSES</b> |                                     |                              |   |                                    |  |                            |  |                                   |   |  |                               |
| Systems, order, and organization   | ○                                      | ○                                   | ○                            | ○   | ○                                  | ○  | ○                          | ○                                      | ○                                 | ○                                       | ○  | ○                             |
| Evidence, models, and explanation  | ⊙                                      | ⊙                                   |                              | ○   | ○                                  | ○  | ○                          | ○                                      |                                   | ○                                       | ⊙  |                               |
| Constancy, change, and measurement   |  |                                     | ○                            | ○   |                                    |  |                            |  |                                   |   |  |                               |
| Evolution and equilibrium  | ○                                      |                                     |                              | ○   |                                    |  |                            |  |                                   |   |  |                               |
| Form and function  | ●                                      | ●                                   | ○                            |   |                                    |  |                            |  |                                   |   |  |                               |
| <b>A: SCIENCE AS INQUIRY</b>   |  |                                     |                              |   |                                    |  |                            |  |                                   |   |  |                               |
| Abilities necessary to do scientific inquiry   |  | ●                                   |                              |   | ○                                  | ⊙  | ⊙                          | ○                                      | ⊙                                 | ○                                       | ○  | ○                             |
| Understanding about scientific inquiry   |  | ⊙                                   |                              |   |                                    |  |                            |  |                                   |   |  |                               |
| <b>B: PHYSICAL SCIENCE</b>   |  |                                     |                              |   |                                    |  |                            |  |                                   |   |  |                               |
| Properties of objects and materials  |  | ○                                   |                              |   |                                    |  |                            |  |                                   |   |  |                               |
| Position and motion of objects   |  |                                     |                              |   |                                    |  |                            |  |                                   |   |  |                               |
| Light, heat, electricity, and magnetism  |  |                                     |                              |   |                                    |  |                            |  |                                   |   |  |                               |
| <b>C: LIFE SCIENCE</b>   |  |                                     |                              |   |                                    |  |                            |  |                                   |   |  |                               |
| The characteristics of organisms   | ○                                      | ●                                   | ⊙                            | ●   | ○                                  | ○  | ⊙                          | ⊙                                      | ⊙                                 | ⊙                                       | ○  | ○                             |
| Life cycles of organisms   |  | ○                                   | ○                            | ○   |                                    |  |                            |  |                                   |   |  |                               |
| Organisms and environments   | ○                                      | ⊙                                   | ○                            | ⊙   | ○                                  | ○  | ⊙                          | ⊙                                      | ⊙                                 | ○                                       | ⊙  | ⊙                             |
| <b>D: EARTH AND SPACE SCIENCE</b>  |  |                                     |                              |   |                                    |  |                            |  |                                   |   |  |                               |
| Properties of Earth materials  |  |                                     |                              |   |                                    |  |                            |  |                                   |   |  |                               |
| Objects in the sky   |  |                                     |                              |   |                                    |  |                            |  |                                   |   |  |                               |
| Changes in Earth and sky   |  |                                     |                              |   |                                    |  |                            |  |                                   |   |  |                               |
| <b>E: SCIENCE &amp; TECHNOLOGY</b>   |  |                                     |                              |   |                                    |  |                            |  |                                   |   |  |                               |
| Abilities of technological design  |  |                                     |                              | ○   |                                    |  |                            |  |                                   | ○                                       |  |                               |
| Understanding about science and technology   |  |                                     | ○                            | ○   | ○                                  | ○  |                            |  |                                   |   | ○  |                               |
| Abilities to distinguish between natural objects and objects made by humans  |  |                                     | ○                            |   |                                    |  |                            |  |                                   |   |  |                               |
| <b>F: SCIENCE IN PERSONAL AND SOCIAL PERSPECTIVES</b>  |  |                                     |                              |   |                                    |  |                            |  |                                   |   |  |                               |
| Personal health  |  |                                     |                              |   |                                    |  |                            |  |                                   |   |  |                               |
| Characteristics and changes in populations   |  |                                     |                              | ○   |                                    |  |                            |  |                                   |   |  |                               |
| Types of resources   |  | ○                                   | ○                            | ●   |                                    |  | ⊙                          | ⊙                                      | ●                                 | ⊙                                       |  |                               |
| Changes in environments  | ○                                      | ○                                   |                              | ○   | ○                                  |  | ○                          | ○                                      | ○                                 | ⊙                                       | ○  | ○                             |
| Science and technology in local challenges   |  |                                     |                              | ○   |                                    |  |                            |  |                                   |   |  |                               |
| <b>G: HISTORY AND NATURE OF SCIENCE</b>  |  |                                     |                              |   |                                    |  |                            |  |                                   |   |  |                               |
| Science as human endeavor  |  |                                     |                              |   |                                    |  |                            |  |                                   |   |  |                               |

| <p><b>Key to Symbols:</b></p> <ul style="list-style-type: none"> <li>● The science concept is the main focus of the Project WILD activity.</li> <li>⊙ The concept is one of the main focuses of the activity; is reinforced.</li> <li>○ The concept is not the main focus of the activity, but it is supported or reinforced.</li> </ul> <p><b>NATIONAL SCIENCE EDUCATION STANDARDS (Content, K–4)</b></p> | <p><b>Thicket Game</b><br/>(gr. Pre-K–4, p. 114)</p> | <p><b>Seeing Is Believing!</b><br/>(gr. K–4, p. 116)</p> | <p><b>What Bear Goes Where?</b><br/>(gr. K–4, p. 118)</p> | <p><b>Surprise Terrarium</b><br/>(gr. K–4, p. 120)</p> | <p><b>First Impressions</b><br/>(gr. K–4, p. 178)</p> | <p><b>And the Wolf Wore Shoes</b><br/>(gr. K–4, p. 180)</p> | <p><b>Make a Coat!</b><br/>(gr. K–4, p. 243)</p> | <p><b>Learning to Look, Looking to See</b><br/>(gr. Pre-K–4, p. 278)</p> | <p><b>Animal Charades</b><br/>(gr. K–4, p. 280)</p> | <p><b>Too Close for Comfort</b><br/>(gr. K–4, p. 300)</p> | <p><b>Ethi-Thinking</b><br/>(gr. K–4, p. 303)</p> | <p><b>Playing Lightly on the Earth</b><br/>(gr. Pre-K–4, p. 432)</p> |
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| <b>UNIFYING CONCEPTS AND PROCESSES</b>   |  |  |   |  |   |   |  |  |   |   |   |  |
| Systems, order, and organization   | ○  |  | ○   | ○  |   | ○   | ○  | ○  | ○   | ⊙   | ○   | ○  |
| Evidence, models, and explanation  |  | ○  | ○   |  |   | ○   | ○  |  | ○   | ○   | ○   | ○  |
| Constancy, change, and measurement   |  |  |   | ○  |   |   |  |  |   | ⊙   | ○   | ○  |
| Evolution and equilibrium  |  |  |   | ○  |   |   |  |  |   |   |   |  |
| Form and function  | ○  | ⊙  |   | ⊙  | ○   |   |  |  | ○   |   |   |  |
| <b>A: SCIENCE AS INQUIRY</b>   |  |  |   |  |   |   |  |  |   |   |   |  |
| Abilities necessary to do scientific inquiry   | ○  | ⊙  | ⊙   | ○  | ○   | ○   |  | ○  | ○   | ●   | ⊙   | ○  |
| Understanding about scientific inquiry   |  |  |   |  |   |   |  |  |   |   | ○   | ○  |
| <b>B: PHYSICAL SCIENCE</b>   |  |  |   |  |   |   |  |  |   |   |   |  |
| Properties of objects and materials  |  | ○  | ○   |  |   | ○   |  |  | ○   | ○   |   |  |
| Position and motion of objects   | ○  |  |   |  |   |   |  |  |   | ○   |   |  |
| Light, heat, electricity, and magnetism  |  |  |   |  |   |   |  |  |   |   |   |  |
| <b>C: LIFE SCIENCE</b>   |  |  |   |  |   |   |  |  |   |   |   |  |
| The characteristics of organisms   | ⊙  | ⊙  | ⊙   | ⊙  | ○   | ○   | ○  |  | ⊙   | ⊙   | ⊙   | ⊙  |
| Life cycles of organisms   |  |  |   |  |   | ○   |  |  |   | ○   | ○   |  |
| Organisms and environments   | ○  | ○  | ○   | ○  | ○   | ○   |  |  | ○   | ⊙   | ⊙   | ●  |
| <b>D: EARTH AND SPACE SCIENCE</b>  |  |  |   |  |   |   |  |  |   |   |   |  |
| Properties of Earth materials  |  |  |   |  |   |   |  |  |   |   |   | ○  |
| Objects in the sky   |  |  |   |  |   |   |  |  |   |   |   |  |
| Changes in Earth and sky   |  |  |   |  |   |   |  |  |   |   |   |  |
| <b>E: SCIENCE &amp; TECHNOLOGY</b>   |  |  |   |  |   |   |  |  |   |   |   |  |
| Abilities of technological design  |  | ⊙  | ○   |  | ○   | ○   | ○  |  |   |   | ⊙   | ⊙  |
| Understanding about science and technology   |  | ⊙  |   |  | ○   |   | ○  | ○  | ○   | ○   | ○   | ○  |
| Abilities to distinguish between natural objects and objects made by humans  |  |  |   |  |   | ○   | ○  |  | ○   |   |   |  |
| <b>F: SCIENCE IN PERSONAL AND SOCIAL PERSPECTIVES</b>  |  |  |   |  |   |   |  |  |   |   |   |  |
| Personal health  |  |  |   |  |   |   |  |  |   |   |   |  |
| Characteristics and changes in populations   |  |  |   |  |   |   |  |  |   |   |   |  |
| Types of resources   |  |  | ○   |  | ○   |   | ○  | ○  | ○   |   | ⊙   | ○  |
| Changes in environments  | ○  | ○  |   | ○  |   |   |  |  |   | ●   | ●   | ⊙  |
| Science and technology in local challenges   |  |  |   |  |   |   | ○  |  |   |   |   |  |
| <b>G: HISTORY AND NATURE OF SCIENCE</b>  |  |  |   |  |   |   |  |  |   |   |   |  |
| Science as human endeavor  |  |  |   |  |   |   |  | ○  |   |   |   |  |

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| <b>UNIFYING CONCEPTS AND PROCESSES</b>  |                             |                             |                                  |                                 |                                 |                                 |                                   |                                     |                                      |
| Systems, order, and organization  |                             | ⊙                           | ○                                | ●                               | ○                               |                                 | ○                                 | ⊙                                   | ○                                    |
| Evidence, models, and explanation   | ○                           |                             | ○                                | ○                               | ⊙                               | ○                               | ○                                 | ○                                   | ○                                    |
| Constancy, change, and measurement  |                             |                             |                                  | ⊙                               | ○                               |                                 | ○                                 | ○                                   | ○                                    |
| Evolution and equilibrium   |                             |                             |                                  | ⊙                               | ○                               |                                 |                                   |                                     | ○                                    |
| Form and function   | ○                           |                             |                                  | ⊙                               | ●                               |                                 |                                   |                                     |                                      |
| <b>A: SCIENCE AS INQUIRY</b>  |                             |                             |                                  |                                 |                                 |                                 |                                   |                                     |                                      |
| Abilities necessary to do scientific inquiry  | ○                           | ○                           | ○                                | ○                               | ⊙                               |                                 | ⊙                                 | ⊙                                   | ○                                    |
| Understanding about scientific inquiry  |                             |                             |                                  |                                 |                                 |                                 |                                   |                                     | ○                                    |
| <b>B: PHYSICAL SCIENCE</b>  |                             |                             |                                  |                                 |                                 |                                 |                                   |                                     |                                      |
| Properties of objects and materials   |                             | ⊙                           | ○                                |                                 | ○                               |                                 | ○                                 | ⊙                                   |                                      |
| Position and motion of objects  |                             | ○                           |                                  |                                 |                                 |                                 |                                   |                                     |                                      |
| Light, heat, electricity, and magnetism   |                             |                             |                                  |                                 |                                 |                                 |                                   |                                     |                                      |
| <b>C: LIFE SCIENCE</b>  |                             |                             |                                  |                                 |                                 |                                 |                                   |                                     |                                      |
| The characteristics of organisms  | ○                           | ○                           | ○                                | ●                               | ○                               | ●                               | ⊙                                 | ⊙                                   | ○                                    |
| Life cycles of organisms  | ⊙                           | ○                           | ○                                | ⊙                               |                                 | ⊙                               |                                   | ⊙                                   |                                      |
| Organisms and environments  |                             | ⊙                           | ○                                | ●                               | ○                               |                                 | ⊙                                 | ⊙                                   | ○                                    |
| <b>D: EARTH AND SPACE SCIENCE</b>   |                             |                             |                                  |                                 |                                 |                                 |                                   |                                     |                                      |
| Properties of Earth materials   |                             | ○                           |                                  | ○                               |                                 |                                 | ○                                 |                                     |                                      |
| Objects in the sky  |                             | ⊙                           |                                  |                                 |                                 |                                 |                                   |                                     |                                      |
| Changes in Earth and sky  |                             | ●                           |                                  |                                 |                                 |                                 |                                   |                                     |                                      |
| <b>E: SCIENCE &amp; TECHNOLOGY</b>  |                             |                             |                                  |                                 |                                 |                                 |                                   |                                     |                                      |
| Abilities of technological design   |                             |                             |                                  | ○                               | ⊙                               |                                 | ⊙                                 | ●                                   |                                      |
| Understanding about science and technology  |                             |                             |                                  |                                 | ○                               |                                 |                                   | ○                                   |                                      |
| Abilities to distinguish between natural objects and objects made by humans   |                             |                             |                                  |                                 |                                 |                                 |                                   | ●                                   |                                      |
| <b>STANDARD F: SCIENCE IN PERSONAL AND SOCIAL PERSPECTIVES</b>  |                             |                             |                                  |                                 |                                 |                                 |                                   |                                     |                                      |
| Personal health   |                             | ○                           |                                  |                                 |                                 |                                 | ○                                 |                                     |                                      |
| Characteristics and changes in populations  |                             |                             |                                  | ○                               |                                 |                                 |                                   |                                     |                                      |
| Types of resources  |                             | ⊙                           |                                  | ⊙                               |                                 |                                 | ○                                 | ⊙                                   |                                      |
| Changes in environments   |                             | ⊙                           |                                  | ○                               |                                 |                                 | ⊙                                 | ●                                   |                                      |
| Science and technology in local challenges  |                             | ○                           |                                  |                                 |                                 |                                 | ⊙                                 | ○                                   |                                      |
| <b>G: HISTORY AND NATURE OF SCIENCE</b>   |                             |                             |                                  |                                 |                                 |                                 |                                   |                                     |                                      |
| Science as human endeavor   |                             |                             |                                  |                                 |                                 |                                 |                                   |                                     |                                      |