# **Accessible Science Instruction**

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## **Objectives**

* Locate Next Generation Science Standards online resources.
* Differentiate between the Next Generation Science Standards and previous science standards.
* Identify a minimum of 8 APH products that give access to science instruction.
* Associate APH products that can be used when teaching content from the four science knowledge domains.
* Examine grade level science expectations and differentiate products to introduce for instructional purposes.

## **Next Generation Science Standards (NGSS)**

<https://www.nextgenscience.org/>

Difference between NGSS (2013) and National Science Education Standards (1996)

Performance Expectations vs. stating facts

Four domains: Physical Science; Life Science; Earth & Space Science; Engineering

## **Physical science**

### **Next Generation Science Standards**

Tactile Demonstration Thermometer (Catalog 1-03030-00) Ages 6 and up.

Grade K. Weather and Climate

K-PS3-1. Make observations to determine the effect of sunlight on Earth’s surface.

K-PS3-2. Use tools and materials to design and build a structure that will reduce the warming effect of sunlight on an area.

K-ESS2-1. Use and share observations of local weather conditions to describe patterns over time.

### **Tactile Demonstration Thermometer Catalog #: 1-03020-00**

This demonstration thermometer has a simulated mercury column that slides up and down to allow students to set and compare temperatures.

Features:A two-textured, two-colored adjustable “mercury column” with an easy-grip tactile indicator; Comparable Fahrenheit and Celsius scales presented in both large print and braille; Tactile degree markings every 5 and 10 degrees

### **Next Generation Science Standards**

Basic Science Tactile Graphics (Catalog 1-08850-00) Ages 8 and up.

Grade 3. Motion and Stability: Forces and Interactions

3-PS2-2.  Make observations and/or measurements of an object’s motion to provide evidence that a pattern can be used to predict future motion.

Grade 4. Waves and their Applications in Technologies for Information Transfer

4-PS4-1. Develop a model of waves to describe patterns in terms of amplitude and wavelength and that waves can cause objects to move.

Grade 5. Matter and Its Interactions

5-PS1-1. Develop a model to describe that matter is made of particles too small to be seen.

### **Basic Science Tactile Graphics Catalog #:1-08850-00**

Tactile drawings depict objects, concepts, and relationships that are covered in nearly all elementary science textbooks.

They are intended to supplement, not replace, the graphics in a student’s adapted textbook.

You may highlight or outline the figures with permanent markers for sighted or low-vision students.

Braille labels are provided on the drawings, but you may easily add to or change the labels by creating self-adhesive braille labels of your own.

Instructional hints are given for each tactile drawing in the set. They focus on how you might present the concepts to blind students, and what blind students might find difficult about the drawing or concept.

### **Next Generation Science Standards**

AZER's Periodic Table Study Set  (Catalog 1-08856-01), Ages 10 and up

Middle School. Structure and Properties of Matter; Chemical Reactions; Matter and Energy in Organisms and Ecosystems

MS-PS1-1. Develop models to describe the atomic composition of simple molecules and extended structures.

MS-PS1-5. Develop and use a model to describe how the total number of atoms does not change in a chemical reaction and thus mass is conserved.

MS-LS1-7. Develop a model to describe how food is rearranged through chemical reactions forming new molecules that support growth and/or release energy as this matter moves through an organism

### **Next Generation Science Standards**

AZER's Periodic Table Study Set  (Catalog 1-08856-01), Ages 10 and up

High School. Structure and Properties of Matter; Chemical Reactions; Matter and Energy in Organisms and Ecosystems

HS-PS1-1. Use the periodic table as a model to predict the relative properties of elements based on the patterns of electrons in the outermost energy level of atoms.

HS-PS1-8. Develop models to illustrate the changes in the composition of the nucleus of the atom and the energy released during the processes of fission, fusion, and radioactive decay.

### **Next Generation Science Standards**

HS-PS1-2. Construct and revise an explanation for the outcome of a simple chemical reaction based on the outermost electron states of atoms, trends in the periodic table, and knowledge of the patterns of chemical properties.

HS-PS1-7. Use mathematical representations to support the claim that atoms, and therefore mass, are conserved during a chemical reaction.

HS-LS1-5. Use a model to illustrate how photosynthesis transforms light energy into stored chemical energy.

HS-LS1-7. Use a model to illustrate that cellular respiration is a chemical process whereby the bonds of food molecules and oxygen molecules are broken and the bonds in new compounds are formed resulting in a net transfer of energy.

### **AZER's Periodic Table Study Set (Nemeth version)** Catalog #: 1-08856-01

This kit assists in the instruction and demonstration of concepts related to the arrangement of the periodic table, atomic structure, ionic and covalent bonding, and balancing of chemical equations to students who benefit from the use of a hands-on, interactive model. Special attention was given to make the materials tactually discriminable and visually appealing to the target population, yet appropriate for all students regardless of visual acuity.

### **AZER's Periodic Table Study Set (Nemeth version)**

Includes:

* 294 interactive hexagonal element pieces
* Additional interactive accessories including coefficient, oxidation, and subscript numbers, arrows, plus signs, parentheses, and assessment pieces.
* 2 atomic models with accessories for electrons, neutrons, and protons
* Storage binder
* Tri-fold felt board used to balance chemical equations and/or display the entire periodic table
* Larger Print Guidebook. Free-download of braille copy.

## **Life Science**

### **Next Generation Science Standards**

Life Science Tactile Graphics (Catalog 1-08840-00) Ages 8 and up.

Grade 3. From Molecules to Organisms: Structures and Processes

3-LS1-1. Develop models to describe that organisms have unique and diverse life cycles but all have in common birth, growth, reproduction, and death.

Grade 3. Heredity: Inheritance and Variation of Traits

3-LS3-1. Analyze and interpret data to provide evidence that plants and animals have traits inherited from parents and that variation of these traits exists in a group of similar organisms.

### **Next Generation Science Standards**

Life Science Tactile Graphics (continued)

Grade 4. From Molecules to Organisms: Structures and Processes

4-LS1-1. Construct an argument that plants and animals have internal and external structures that function to support survival, growth, behavior, and reproduction.

Grade 5. Ecosystems: Interactions, Energy, and Dynamics

5-LS2-1. Develop a model to describe the movement of matter among plants, animals, decomposers, and the environment.

### **Life Science Tactile Graphics Catalog #:1-08840-00**

Fifty-six tactile drawings depict objects, concepts, and relationships covered in nearly all Life Science textbooks.

They are intended to supplement, not replace, the graphics in a student’s adapted textbook.

Full color with printed and braille labels.

Instructional suggestions are given for each tactile drawing in the set. They focus on how you might present the concepts to blind students, and what blind students might find difficult about the drawing or concept.

### **Next Generation Science Standards**

Sense of Science PLANTS (Catalog 1-08980-00) and ANIMALS (Catalog 1-08990-00 ), Ages 5 and up.

Grade K. Interdependent Relationships in Ecosystems: Animals, Plants, and Their Environment

K-LS1-1. Use observations to describe patterns of what plants and animals (including humans) need to survive.

K-ESS2-2. Construct an argument supported by evidence for how plants and animals (including humans) can change the environment to meet their needs.

K-ESS3-1. Use a model to represent the relationship between the needs of different plants and animals (including humans) and the places they live.

### **Next Generation Science Standards**

Sense of Science PLANTS (Catalog 1-08980-00) and ANIMALS (Catalog 1-08990-00), Ages 5 and up.

Grade 1. Structure, Function, and Information Processing

1-LS1-1. Use materials to design a solution to a human problem by mimicking how plants and/or animals use their external parts to help them survive, grow, and meet their needs.

1-LS1-2. Read texts and use media to determine patterns in behavior of parents and offspring that help offspring survive.

### **Next Generation Science Standards**

Grade 3. Inheritance and Variation of Traits: Life Cycles and Traits

3-LS1-1. Develop models to describe that organisms have unique and diverse life cycles but all have in common birth, growth, reproduction, and death.

3-LS3-1. Analyze and interpret data to provide evidence that plants and animals have traits inherited from parents and that variation of these traits exists in a group of similar organisms.

3-LS3-2. Use evidence to support the explanation that traits can be influenced by the environment.

Grade 3. Interdependent Relationships in Ecosystems

3-LS4-3. Construct an argument with evidence that in a particular habitat some organisms can survive well, some survive less well, and some cannot survive at all.

### **Next Generation Science Standards**

Grade 4. Structure, Function, and Information Processing

4-LS1-1. Construct an argument that plants and animals have internal and external structures that function to support survival, growth, behavior, and reproduction.

4-LS1-2. Use a model to describe that animals receive different types of information through their senses, process the information in their brain, and respond to the information in different ways.

### **Next Generation Science Standards**

Sense of Science PLANTS (Catalog 1-08980-00) and ANIMALS (Catalog 1-08990-00 ), Ages 5 and up.

Grade 5. Matter and Energy in Organisms and Ecosystems

5-LS1-1. Support an argument that plants get the materials they need for growth chiefly from air and water.

5-LS2-1. Develop a model to describe the movement of matter among plants, animals, decomposers, and the environment.

5-PS3-1. Use models to describe that energy in animals’ food (used for body repair, growth, motion, and to maintain body warmth) was once energy from the sun.

### **Sense of Science: PLANTS Catalog #:1-08980-00**

Sense of Science PLANTS is the first module of a tactile/visual “hands-on” series available from APH. Activities incorporate a learning objective, a list of vocabulary and needed materials, an initial inquiry, a step-by-step procedure, an extended activity, a visual adaptation, math and language connections, and a “science tidbit.” Activities using the accompanying overlays are also provided.

### **Sense of Science: PLANTS**

Kit Components Include:

Large print guidebook *(braille edition available for free download)* with hands-on activities to teach basic plant concepts relate to flowers, seeds, leaves, and more. Activities use real objects and the included colorful, raised-line overlays.

A variety of visual/tactile overlays. Use these as stand-alone displays or in combination with APH light boxes *(sold separately)*.

Two sorting trays.

### **Sense of Science: PLANTS**

The visual and tactile overlays aid in reviewing and reinforcing concepts taught through hands-on activities. This pairing of visual and tactile elements is especially useful for students with low vision who need multisensory information.

### **Sense of Science: PLANTS**

Available Tactile/Visual Overlays: Bean Seed (Cross-Section); Seedling; Flower; Leaf; Taproot System; Tree; Log Cross-Section; Leaf Type Cards

### **Sense of Science: ANIMALS** Catalog No 1-08990-00

Sense of Science: ANIMALS is the second module of a tactile/visual hands-on series available from APH. Activities incorporate a learning objective, a list of vocabulary and needed materials, an initial inquiry, a step-by-step procedure, an extended activity, a visual adaptation, math and language connections, and a science tidbit. Activities using the accompanying overlays are also provided.

### **Sense of Science: ANIMALS**

Kit Components Include:

A large print guidebook *(braille edition available for free download)* with easy-to-follow activities, a glossary, list of resources, and bibliography of related children’s books.

A variety of visual and tactile overlays that can be used alone or in combination with APH light boxes *(sold separately)*.

Two sorting trays

### **Sense of Science: ANIMALS**

The visual and tactile overlays aid in reviewing and reinforcing concepts taught through hands-on activities. This pairing of visual and tactile elements is especially useful for students with low vision who need multisensory information.

### **Sense of Science: ANIMALS**

Available Tactile/Visual Overlays:

* Ant
* Bird (side-view)
* Bird (top-view)
* Butterfly
* Fish
* Mouse
* Snake
* Spider
* Turtle
* Life Cycle of the Life Cycle of the Frog
* Animal Track Overlays (cards)
* Spider Web Overlays (cards)
* Butterfly

### **Sense of Science: ANIMALS**

Exploded View Overlays

### **Next Generation Science Standards**

Touch, Label, & Learn Poster: HUMAN SKELETON

(Anterior View)  (Catalog 1-08976-00) Ages 8 and up.

Middle School/High School. From Molecules to Organisms: Structures and Processes

MS-LS1-3. Use argument supported by evidence for how the body is a system of interacting subsystems composed of groups of cells.

MS-LS4-2. Apply scientific ideas to construct an explanation for the anatomical similarities and differences among modern organisms and between modern and fossil organisms to infer evolutionary relationships.

HS-LS1-2. Develop and use a model to illustrate the hierarchical organization of interacting systems that provide specific functions within multicellular organisms.

### **TOUCH, LABEL, and LEARN POSTER: HUMAN SKELETON (Anterior View) Catalog #: 1-08976-00**

The Human Skeleton poster provides an interactive presentation for reviewing the names, locations, and relationships of human skeletal bones. The dual tactile/color design of the poster is ideal for use by students with visual impairments and blindness in a classroom setting with sighted peers. Using the provided print/braille labels, a student can build a key that correctly corresponds with the numbered parts of the human skeleton. It also bridges exploration of 3D models with 2D tactile displays

### **HUMAN SKELETON (Anterior View)**

Includes:

* Human Skeleton Poster
* 38 print/embossed skeletal bone name labels, 2 sets
* Print/embossed 1–21 number labels, 2 sets
* Skeleton answer key
* Storage panel for labels
* 3D skeleton model
* Instruction booklet, in large print and in UEB braille

### **Next Generation Science Standards**

Basic Tactile Anatomy Atlas (Catalog 1-08845-00) Ages 12+

Middle School/High School. From Molecules to Organisms: Structures and Processes

MS-LS1-3. Use argument supported by evidence for how the body is a system of interacting subsystems composed of groups of cells.

MS-LS4-2. Apply scientific ideas to construct an explanation for the anatomical similarities and differences among modern organisms and between modern and fossil organisms to infer evolutionary relationships.

HS-LS1-2. Develop and use a model to illustrate the hierarchical organization of interacting systems that provide specific functions within multicellular organisms.

### **Basic Tactile Anatomy Atlas** Catalog #:1-08845-00

This two-volume set of thermoformed tactile graphics gives a comprehensive overview of the body. Includes: skeletal, muscular, nervous, endocrine, cardiovascular, lymphatic, respiratory, digestive, urinary, and reproductive systems.

Each tactual diagram has braille and print labels accompanied by a brief braille description. A print version of each brailled text is contained in the included Instructional Text.

### **Next Generation Science Standards**

Build-A-Cell (Catalog 1-08974-00) Ages 12+

Middle School. From Molecules to Organisms: Structures and Processes

MS-LS1-1. Conduct an investigation to provide evidence that living things are made of cells; either one cell or many different numbers and types of cells.

MS-LS1-2. Develop and use a model to describe the function of a cell as a whole and ways the parts of cells contribute to the function.

MS-LS1-3. Use argument supported by evidence for how the body is a system of interacting subsystems composed of groups of cells.

### **Build-A-Cell**

Two binders

Braille Student and Teacher Guide

Structure kit and large print Student and Teacher Guide

### **Two types of keys to cell structures**

### **Bacterial, Plant, Animal Cell Templates**

### **Next Generation Science Standards**

DNA Twist (Catalog 1-08978-00) Ages 12+

High School. From Molecules to Organisms: Structures and Processes

HS-LS1-1. Construct an explanation based on evidence for how the structure of DNA determines the structure of proteins, which carry out essential functions of life through systems of specialized cells.

HS-LS1-6. Construct and revise an explanation based on evidence for how carbon, hydrogen, and oxygen from sugar molecules may combine with other elements to form amino acids and/or other large carbon-based molecules.

### **Next Generation Science Standards**

DNA-RNA Kit (Catalog 1-08979-00) Ages 15+

Protein Synthesis Kit (Catalog 1-08975-00) Ages 15+

High School. From Molecules to Organisms: Structures and Processes *and*

Heredity: Inheritance and Variation of Traits

HS-LS1-1. Construct an explanation based on evidence for how the structure of DNA determines the structure of proteins, which carry out essential functions of life through systems of specialized cells.

HS-LS1-6. Construct and revise an explanation based on evidence for how carbon, hydrogen, and oxygen from sugar molecules may combine with other elements to form amino acids and/or other large carbon-based molecules.

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.

### **DNA-RNA Kit**

DNA & RNA nucleotide subunits

Complimentary Base Pairing

DNA Replication

Transcription of DNA to mRNA

### **Protein Synthesis Kit**

tRNA nucleotide subunits

Amino acid subunits

Start & Stop subunits

Genetic code in print & braille

Color/tactile diagram of mRNA translation

mRNA Translation to Amino Acid Sequence (protein)

## **Earth & space science**

### **Next Generation Science Standards**

Sense of Science ASTRONOMY (Catalog 1-08991-00) Ages 8 and up.

Grade 5. Space Systems: Stars and the Solar System

5-ESS1-1. Support an argument that differences in the apparent brightness of the sun compared to other stars is due to their relative distances from the Earth.

Middle School. Space Systems

MS-ESS1-1. Develop and use a model of the Earth-sun-moon system to describe the cyclic patterns of lunar phases, eclipses of the sun and moon, and seasons.

MS-ESS1-2. Develop and use a model to describe the role of gravity in the motions within galaxies and the solar system.

### **Next Generation Science Standards**

Sense of Science ASTRONOMY (Catalog 1-08991-00) Ages 8 and up.

High School. Space Systems

HS-ESS1-1.Develop a model based on evidence to illustrate the life span of the sun and the role of nuclear fusion in the sun’s core to release energy in the form of radiation.

HS-ESS1-2.Construct an explanation of the Big Bang theory based on astronomical evidence of light spectra, motion of distant galaxies, and composition of matter in the universe.

HS-ESS1-3.Communicate scientific ideas about the way stars, over their life cycle, produce elements.

### **Sense of Science: ASTRONOMY** Catalog #:1-08991-00

Sense of Science ASTRONOMY is the third module of this tactile/visual science series. Unlike previous modules of this series—PLANTS and ANIMALS, this set of materials is appropriate for a broader range of ages and grade levels of students with visual impairments and blindness. Activities incorporate a learning objective, a list of vocabulary and needed materials, a step-by-step procedure, extended activities, visual adaptations, math and language connections, and science tidbits. Activities are complemented by the included visual/tactile overlays and fold-out 2-dimensional displays.

### **Sense of Science: ASTRONOMY**

Available Tactile/Visual Overlays:

* Cross-Section of the Sun
* Lunar Eclipse
* Milky Way Galaxy
* Orbit of a Comet
* Phases of the Moon
* Planetary Orbits
* Relative Sizes of the Planets
* Solar Eclipse
* Ursa Major/Ursa Minor
* Moon Phases (sorting cards)
* Galaxy Types (sorting cards)
* Fold-out Displays: Northern Circumpolar Dome, Our Solar System Display, Relative Distances of the Planets

### **Sense of Science: ASTRONOMY**

Print/braille “fact cards” for each planet, the Moon, and the Sun are included in the packet of QUICK FACT CARDS. These cards can be used as independent study/review, as a quiz game, or as a springboard for students to create and expand their own fact sheets.

### **Sense of Science: ASTRONOMY**

The Astronomy Worksheets include print, braille, and electronic versions of the following worksheets:

* Planet Facts
* Planet Ranking by Distance from the Sun
* Planet Ranking by Orbital Period
* Planet Ranking by Rotation Period
* Planet Ranking by Size
* Planet Ranking by Temperature
* Famous Astronomers

### **Sense of Science: ASTRONOMY**

The guidebook activities encourage hands-on tasks such as building models and tactile representations.

### **Next Generation Science Standards**

**Earth Science Tactile Graphics** (Catalog 1-03131-00)

Ages 9 and up

Grade 4. Earth's Place in the Universe & Earth's Systems

4-ESS1-1 Identify evidence from patterns in rock formations and fossils in rock layers to support an explanation for changes in a landscape over time.

4-ESS2-2 Analyze and interpret data from maps to describe patterns of Earth’s features.

Grade 5. Earth's Systems

5-ESS2-1 Develop a model using an example to describe ways the geosphere, biosphere, hydrosphere, and/or atmosphere interact.

### **Next Generation Science Standards**

Earth Science Tactile Graphics (Catalog 1-03131-00) Ages 9 and up

Middle School. Earth's Place in the Universe & Earth and Human Activity

MS-ESS1-3 Analyze and interpret data to determine scale properties of objects in the solar system.

MS-ESS3-5 Ask questions to clarify evidence of the factors that have caused the rise in global temperatures over the past century.

High School. Earth's Place in the Universe & Earth's Systems

HS-ESS1-5 Evaluate evidence of the past and current movements of continental and oceanic crust and the theory of plate tectonics to explain the ages of crustal rocks.

HS-ESS2-3 Develop a model based on evidence of Earth’s interior to describe the cycling of matter by thermal convection.

### **Earth Science Tactile Graphics** Catalog #:1-03131-00

Earth Science Tactile Graphics depict processes, concepts, and structures typically covered in middle and high school Earth Science courses.

They are intended to supplement, not replace, the graphics in a student’s adapted textbook.

Full color with printed and braille labels.

Instructional suggestions are given for each tactile drawing in the set.

## **Engineering**

### **Next Generation Science Standards**

Kindergarten. Engineering Design

K-2-ETS1-1 Ask questions, make observations, and gather information about a situation people want to change to define a simple problem that can be solved through the development of a new or improved object or tool.

Grade 3. Engineering Design

3-5-ETS1-1 Define a simple design problem reflecting a need or a want that includes specified criteria for success and constraints on materials, time, or cost.

Middle School. Engineering Design

MS-ETS1-1 Define the criteria and constraints of a design problem with sufficient precision to ensure a successful solution, taking into account relevant scientific principles and potential impacts on people and the natural environment that may limit possible solutions.

High School. Engineering Design

HS-ETS1-1 Analyze a major global challenge to specify qualitative and quantitative criteria and constraints for solutions that account for societal needs and wants.

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### **Citation**

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<http://www.nextgenscience.org/next-generation-science-standards>

### **Thank you!**

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