



NEXT GENERATION SCIENCE STANDARDS

For States, By States

ACHIEVE
SCIENCE
STANDARDS

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Who is Achieve?

Education Non-profit

- Provide national education
- Connect schools, parents, and partners
- Develop advocacy resources
- Conduct research

Next Generation Science Standards

- Core-focused development
- Shared responsibility (K-12/21st Century Learning)
- Generalists, teachers, experts, and leaders
- Core leadership and responsibility to science

nextgenscience.org

The Standards

Standards Development

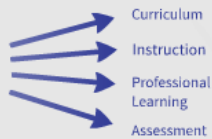
Instruction and Assessment

Implementation Planning

Vision of the Framework

ACHIEVE

- Lead the way and set the pace
- Engage in public discussions to address national issues
- Use all the components of scientific information created to build knowledge
- Approaches that connect scientific understanding to the needs of the knowledge of science of cross-cutting concepts
- Contribute to future science advances throughout their lives





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Who is Achieve?

Education Non-profit

- Provide national education
- Develop tools, exams, and patterns
- Develop advocacy resources
- Conduct research

Next Generation Science Standards

- Core-focused development
- Used for research on K-12/21st century learning
- Generalized, flexible, expert, or advanced
- Core implementation engagement in science

nextgenscience.org

The Standards

Standards Development

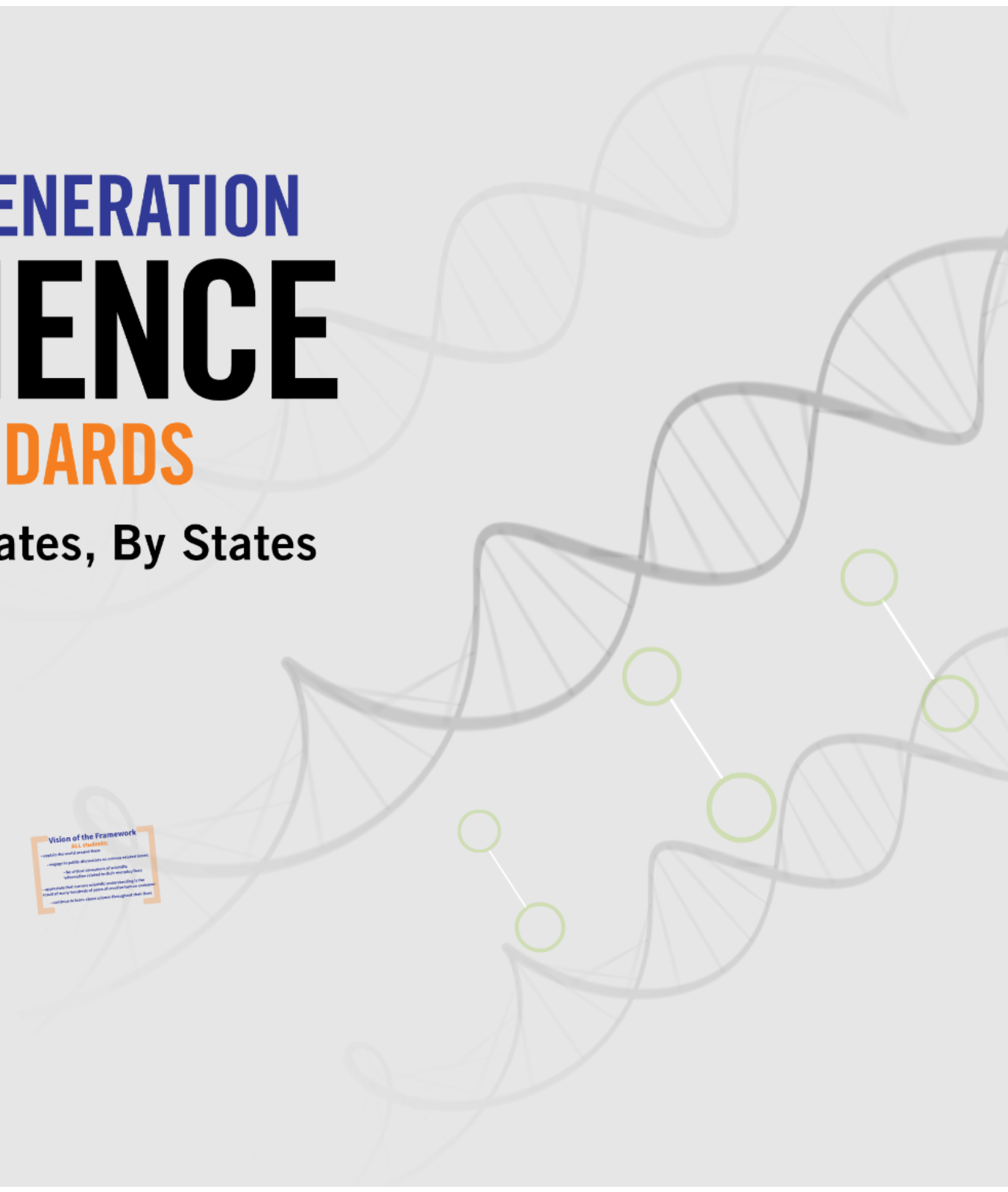
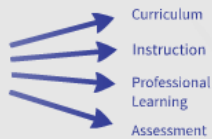
Instruction and Assessment

Implementation Planning

Vision of the Framework

Key Words

- Quality and not just content
- Engage in public discussion to address related issues
- Use of the components of scientific information created to build knowledge
- Approaches that connect scientific understanding to the needs of the knowledge of science of crosscutting concepts
- Contribute to future science advances throughout their lives





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Who is Achieve?



Education Non-profit

- Provide technical assistance
- Convene states, experts, and partners
- Develop advocacy resources
- Conduct research

Next Generation Science Standards

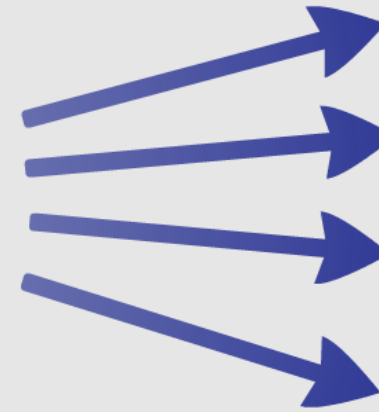
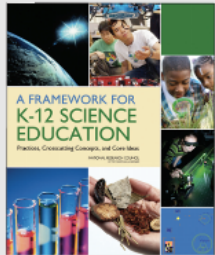


- Coordinated development
- Host the standards at <https://nextgenscience.org>
- Convene states, districts, experts, and partners
- Coordinate/develop implementation resources

Next Generation Science Standards



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Curriculum

Instruction

Professional Learning

Assessment

nextgenscience.org



The Standards



Standards Development



Instruction and Assessment



Implementation Planning



The NGSS



<https://www.nextgenscience.org/search-standards>

DCI and Topics Arrangements

Searchable

Appendices

Evidence Statements

MS-PS4 Waves and Their Applications in Technologies for Information Transfer

MS-PS4-1. Use mathematical representations to describe a simple model for waves that includes how the amplitude of a wave is related to the energy in a wave. *Clarification Statement:* Emphasis is on describing waves with both qualitative and quantitative modeling. *Assessment Boundary:* Assessment does not include electromagnetic waves and is limited to describing standing waves.

MS-PS4-2. Develop and use a model to describe that waves are reflected, absorbed, or transmitted through various materials. *Clarification Statement:* Emphasis is on both light and mechanical waves. Examples of models could include drawings, animations, and written descriptions. *Assessment Boundary:* Assessment is limited to qualitative applications pertaining to light and mechanical waves.

MS-PS4-3. Integrate qualitative scientific and technical information to support the claim that digitized signals are a more reliable way to encode and transmit information than analog signals. *Clarification Statement:* Emphasis is on how understanding that waves can be used for communicative purposes. Examples could include using fiber optic cables to transmit light pulses, radio waves pulses in cell phones, and conversion of analog binary pulses to analog sound or text on a computer screen. *Assessment Boundary:* Assessment does not include binary counting. *Assessment does not include the specific mathematics of any given device.*

The performance expectations below were developed using the following standards from the NRC document: *Developing a Next Generation Science Standards*

Science and Engineering Practices	Disciplinary Core Ideas	Crosscutting Concepts
<p>Developing and Using Models Modeling is 5-6 grade on 1S-2 and progresses to describing, using, and testing models to describe, test, and predict more abstract phenomena and design solutions. (MS-PS4-2)</p> <p>Using Mathematics and Computational Thinking Mathematical and computational thinking at the 5-6 level builds on 4-5 and progresses to identifying patterns in large data sets and using mathematical operations to support explanations and assessments. Use mathematical representations to describe and/or support scientific conclusions and design solutions. (MS-PS4-1)</p> <p>Obtaining, Evaluating, and Communicating Information Obtaining, analyzing, and communicating information is 4-5 grade on 6-7 and progresses to evaluating the merit and validity of data and evidence. Integrate qualitative scientific and technical information to support a claim that digitized signals are a more reliable way to encode and transmit information. (MS-PS4-3)</p> <p><i>Connections to Nature of Science</i></p> <p>Scientific Knowledge is Based on Empirical Evidence Scientific knowledge is based on empirical evidence and conceptual connections between evidence and explanation. (MS-PS4-4)</p>	<p>PS4.A: Wave Properties A simple wave has a sinusoidal pattern with a specific wavelength, frequency, and amplitude. (MS-PS4-1)</p> <p>A sound wave needs a medium through which it is transmitted. (MS-PS4-2)</p> <p>PS4.B: Electromagnetic Radiation When light shines on an object, it is reflected, absorbed, or transmitted through the object, depending on the object's material and the frequency (color) of the light. (MS-PS4-2)</p> <p>The path that light travels can be traced as straight lines, except at interfaces between different transparent materials. (MS-PS4-2)</p> <p>A ray of light, all and only when the light path bends. (MS-PS4-2)</p> <p>A wave model of light is useful for explaining reflection, color, and the frequency-dependent bending of light at a surface. (MS-PS4-2)</p> <p>However, because light can travel through space, it cannot be a transverse wave. (MS-PS4-2)</p> <p>PS4.C: Information Technologies and Modernization Digital signals travel over wires or fiber optic cables more reliably than analog and transmit information. (MS-PS4-3)</p>	<p>Patterns Graphs and charts can be used to identify patterns in data. (MS-PS4-1)</p> <p>Structure and Function Structure can be designed to serve particular functions by taking into account properties of different materials, and how properties may be adapted and used. (MS-PS4-2)</p> <p>Structure can be designed to serve particular functions. (MS-PS4-2)</p> <p><i>Connections to Engineering, Technology, and Applications of Science</i></p> <p>Influence of Science, Engineering, and Technology on Society and the Natural World Techniques associated with measurement, scientific methods, and experimental design of scientific investigations. (MS-PS4-2)</p> <p><i>Connections to Nature of Science</i></p> <p>Science is a Human Endeavor Advances in technology influence the progress of science and science has influenced advances in technology. (MS-PS4-3)</p>

Appendix A: Crosscutting Concepts

MS-PS4-1 MS-PS4-1.1 MS-PS4-1.2 MS-PS4-1.3 MS-PS4-1.4 MS-PS4-1.5 MS-PS4-1.6 MS-PS4-1.7 MS-PS4-1.8 MS-PS4-1.9 MS-PS4-1.10 MS-PS4-1.11 MS-PS4-1.12 MS-PS4-1.13 MS-PS4-1.14 MS-PS4-1.15 MS-PS4-1.16 MS-PS4-1.17 MS-PS4-1.18 MS-PS4-1.19 MS-PS4-1.20 MS-PS4-1.21 MS-PS4-1.22 MS-PS4-1.23 MS-PS4-1.24 MS-PS4-1.25 MS-PS4-1.26 MS-PS4-1.27 MS-PS4-1.28 MS-PS4-1.29 MS-PS4-1.30 MS-PS4-1.31 MS-PS4-1.32 MS-PS4-1.33 MS-PS4-1.34 MS-PS4-1.35 MS-PS4-1.36 MS-PS4-1.37 MS-PS4-1.38 MS-PS4-1.39 MS-PS4-1.40 MS-PS4-1.41 MS-PS4-1.42 MS-PS4-1.43 MS-PS4-1.44 MS-PS4-1.45 MS-PS4-1.46 MS-PS4-1.47 MS-PS4-1.48 MS-PS4-1.49 MS-PS4-1.50 MS-PS4-1.51 MS-PS4-1.52 MS-PS4-1.53 MS-PS4-1.54 MS-PS4-1.55 MS-PS4-1.56 MS-PS4-1.57 MS-PS4-1.58 MS-PS4-1.59 MS-PS4-1.60 MS-PS4-1.61 MS-PS4-1.62 MS-PS4-1.63 MS-PS4-1.64 MS-PS4-1.65 MS-PS4-1.66 MS-PS4-1.67 MS-PS4-1.68 MS-PS4-1.69 MS-PS4-1.70 MS-PS4-1.71 MS-PS4-1.72 MS-PS4-1.73 MS-PS4-1.74 MS-PS4-1.75 MS-PS4-1.76 MS-PS4-1.77 MS-PS4-1.78 MS-PS4-1.79 MS-PS4-1.80 MS-PS4-1.81 MS-PS4-1.82 MS-PS4-1.83 MS-PS4-1.84 MS-PS4-1.85 MS-PS4-1.86 MS-PS4-1.87 MS-PS4-1.88 MS-PS4-1.89 MS-PS4-1.90 MS-PS4-1.91 MS-PS4-1.92 MS-PS4-1.93 MS-PS4-1.94 MS-PS4-1.95 MS-PS4-1.96 MS-PS4-1.97 MS-PS4-1.98 MS-PS4-1.99 MS-PS4-1.100 MS-PS4-1.101 MS-PS4-1.102 MS-PS4-1.103 MS-PS4-1.104 MS-PS4-1.105 MS-PS4-1.106 MS-PS4-1.107 MS-PS4-1.108 MS-PS4-1.109 MS-PS4-1.110 MS-PS4-1.111 MS-PS4-1.112 MS-PS4-1.113 MS-PS4-1.114 MS-PS4-1.115 MS-PS4-1.116 MS-PS4-1.117 MS-PS4-1.118 MS-PS4-1.119 MS-PS4-1.120 MS-PS4-1.121 MS-PS4-1.122 MS-PS4-1.123 MS-PS4-1.124 MS-PS4-1.125 MS-PS4-1.126 MS-PS4-1.127 MS-PS4-1.128 MS-PS4-1.129 MS-PS4-1.130 MS-PS4-1.131 MS-PS4-1.132 MS-PS4-1.133 MS-PS4-1.134 MS-PS4-1.135 MS-PS4-1.136 MS-PS4-1.137 MS-PS4-1.138 MS-PS4-1.139 MS-PS4-1.140 MS-PS4-1.141 MS-PS4-1.142 MS-PS4-1.143 MS-PS4-1.144 MS-PS4-1.145 MS-PS4-1.146 MS-PS4-1.147 MS-PS4-1.148 MS-PS4-1.149 MS-PS4-1.150 MS-PS4-1.151 MS-PS4-1.152 MS-PS4-1.153 MS-PS4-1.154 MS-PS4-1.155 MS-PS4-1.156 MS-PS4-1.157 MS-PS4-1.158 MS-PS4-1.159 MS-PS4-1.160 MS-PS4-1.161 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MS-PS4-1.701 MS-PS4-1.702 MS-PS4-1.703 MS-PS4-1.704 MS-PS4-1.705 MS-PS4-1.706 MS-PS4-1.707 MS-PS4-1.708 MS-PS4-1.709 MS-PS4-1.710 MS-PS4-1.711 MS-PS4-1.712 MS-PS4-1.713 MS-PS4-1.714 MS-PS4-1.715 MS-PS4-1.716 MS-PS4-1.717 MS-PS4-1.718 MS-PS4-1.719 MS-PS4-1.720 MS-PS4-1.721 MS-PS4-1.722 MS-PS4-1.723 MS-PS4-1.724 MS-PS4-1.725 MS-PS4-1.726 MS-PS4-1.727 MS-PS4-1.728 MS-PS4-1.729 MS-PS4-1.730 MS-PS4-1.731 MS-PS4-1.732 MS-PS4-1.733 MS-PS4-1.734 MS-PS4-1.735 MS-PS4-1.736 MS-PS4-1.737 MS-PS4-1.738 MS-PS4-1.739 MS-PS4-1.740 MS-PS4-1.741 MS-PS4-1.742 MS-PS4-1.743 MS-PS4-1.744 MS-PS4-1.745 MS-PS4-1.746 MS-PS4-1.747 MS-PS4-1.748 MS-PS4-1.749 MS-PS4-1.750 MS-PS4-1.751 MS-PS4-1.752 MS-PS4-1.753 MS-PS4-1.754 MS-PS4-1.755 MS-PS4-1.756 MS-PS4-1.757 MS-PS4-1.758 MS-PS4-1.759 MS-PS4-1.760 MS-PS4-1.761 MS-PS4-1.762 MS-PS4-1.763 MS-PS4-1.764 MS-PS4-1.765 MS-PS4-1.766 MS-PS4-1.767 MS-PS4-1.768 MS-PS4-1.769 MS-PS4-1.770 MS-PS4-1.771 MS-PS4-1.772 MS-PS4-1.773 MS-PS4-1.774 MS-PS4-1.775 MS-PS4-1.776 MS-PS4-1.777 MS-PS4-1.778 MS-PS4-1.779 MS-PS4-1.780 MS-PS4-1.781 MS-PS4-1.782 MS-PS4-1.783 MS-PS4-1.784 MS-PS4-1.785 MS-PS4-1.786 MS-PS4-1.787 MS-PS4-1.788 MS-PS4-1.789 MS-PS4-1.790 MS-PS4-1.791 MS-PS4-1.792 MS-PS4-1.793 MS-PS4-1.794 MS-PS4-1.795 MS-PS4-1.796 MS-PS4-1.797 MS-PS4-1.798 MS-PS4-1.799 MS-PS4-1.800 MS-PS4-1.801 MS-PS4-1.802 MS-PS4-1.803 MS-PS4-1.804 MS-PS4-1.805 MS-PS4-1.806 MS-PS4-1.807 MS-PS4-1.808 MS-PS4-1.809 MS-PS4-1.810 MS-PS4-1.811 MS-PS4-1.812 MS-PS4-1.813 MS-PS4-1.814 MS-PS4-1.815 MS-PS4-1.816 MS-PS4-1.817 MS-PS4-1.818 MS-PS4-1.819 MS-PS4-1.820 MS-PS4-1.821 MS-PS4-1.822 MS-PS4-1.823 MS-PS4-1.824 MS-PS4-1.825 MS-PS4-1.826 MS-PS4-1.827 MS-PS4-1.828 MS-PS4-1.829 MS-PS4-1.830 MS-PS4-1.831 MS-PS4-1.832 MS-PS4-1.833 MS-PS4-1.834 MS-PS4-1.835 MS-PS4-1.836 MS-PS4-1.837 MS-PS4-1.838 MS-PS4-1.839 MS-PS4-1.840 MS-PS4-1.841 MS-PS4-1.842 MS-PS4-1.843 MS-PS4-1.844 MS-PS4-1.845 MS-PS4-1.846 MS-PS4-1.847 MS-PS4-1.848 MS-PS4-1.849 MS-PS4-1.850 MS-PS4-1.851 MS-PS4-1.852 MS-PS4-1.853 MS-PS4-1.854 MS-PS4-1.855 MS-PS4-1.856 MS-PS4-1.857 MS-PS4-1.858 MS-PS4-1.859 MS-PS4-1.860 MS-PS4-1.861 MS-PS4-1.862 MS-PS4-1.863 MS-PS4-1.864 MS-PS4-1.865 MS-PS4-1.866 MS-PS4-1.867 MS-PS4-1.868 MS-PS4-1.869 MS-PS4-1.870 MS-PS4-1.871 MS-PS4-1.872 MS-PS4-1.873 MS-PS4-1.874 MS-PS4-1.875 MS-PS4-1.876 MS-PS4-1.877 MS-PS4-1.878 MS-PS4-1.879 MS-PS4-1.880 MS-PS4-1.881 MS-PS4-1.882 MS-PS4-1.883 MS-PS4-1.884 MS-PS4-1.885 MS-PS4-1.886 MS-PS4-1.887 MS-PS4-1.888 MS-PS4-1.889 MS-PS4-1.890 MS-PS4-1.891 MS-PS4-1.892 MS-PS4-1.893 MS-PS4-1.894 MS-PS4-1.895 MS-PS4-1.896 MS-PS4-1.897 MS-PS4-1.898 MS-PS4-1.899 MS-PS4-1.900 MS-PS4-1.901 MS-PS4-1.902 MS-PS4-1.903 MS-PS4-1.904 MS-PS4-1.905 MS-PS4-1.906 MS-PS4-1.907 MS-PS4-1.908 MS-PS4-1.909 MS-PS4-1.910 MS-PS4-1.911 MS-PS4-1.912 MS-PS4-1.913 MS-PS4-1.914 MS-PS4-1.915 MS-PS4-1.916 MS-PS4-1.917 MS-PS4-1.918 MS-PS4-1.919 MS-PS4-1.920 MS-PS4-1.921 MS-PS4-1.922 MS-PS4-1.923 MS-PS4-1.924 MS-PS4-1.925 MS-PS4-1.926 MS-PS4-1.927 MS-PS4-1.928 MS-PS4-1.929 MS-PS4-1.930 MS-PS4-1.931 MS-PS4-1.932 MS-PS4-1.933 MS-PS4-1.934 MS-PS4-1.935 MS-PS4-1.936 MS-PS4-1.937 MS-PS4-1.938 MS-PS4-1.939 MS-PS4-1.940 MS-PS4-1.941 MS-PS4-1.942 MS-PS4-1.943 MS-PS4-1.944 MS-PS4-1.945 MS-PS4-1.946 MS-PS4-1.947 MS-PS4-1.948 MS-PS4-1.949 MS-PS4-1.950 MS-PS4-1.951 MS-PS4-1.952 MS-PS4-1.953 MS-PS4-1.954 MS-PS4-1.955 MS-PS4-1.956 MS-PS4-1.957 MS-PS4-1.958 MS-PS4-1.959 MS-PS4-1.960 MS-PS4-1.961 MS-PS4-1.962 MS-PS4-1.963 MS-PS4-1.964 MS-PS4-1.965 MS-PS4-1.966 MS-PS4-1.967 MS-PS4-1.968 MS-PS4-1.969 MS-PS4-1.970 MS-PS4-1.971 MS-PS4-1.972 MS-PS4-1.973 MS-PS4-1.974 MS-PS4-1.975 MS-PS4-1.976 MS-PS4-1.977 MS-PS4-1.978 MS-PS4-1.979 MS-PS4-1.980 MS-PS4-1.981 MS-PS4-1.982 MS-PS4-1.983 MS-PS4-1.984 MS-PS4-1.985 MS-PS4-1.986 MS-PS4-1.987 MS-PS4-1.988 MS-PS4-1.989 MS-PS4-1.990 MS-PS4-1.991 MS-PS4-1.992 MS-PS4-1.993 MS-PS4-1.994 MS-PS4-1.995 MS-PS4-1.996 MS-PS4-1.997 MS-PS4-1.998 MS-PS4-1.999 MS-PS4-1.1000

NGSS Appendices

- A—Conceptual Shifts
- B—Responses to Public Drafts
- C—College and Career Readiness
- D—All Standards, All Students
- E—Disciplinary Core Ideas
- F—Science and Engineering Practices
- G—Crosscutting Concepts
- H—Nature of Science
- I—Engineering Design
- J—Science, Technology, Society and the Environment
- K—Model Course Mapping
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Standards Development



Why Standards Matter

How to Read the Standards



Development of the Standards

Standards Development



Instruction and Assessment



Implementation Planning



Evaluating Instructional Materials

- better materials selection
- better materials development
- building educator capacity

NGSS Innovations

- 1. Making Sense of phenomena and designing solutions to problems**
- 2. 3-D learning and assessment**
- 3. K-12 Progressions**
 - All Three Dimensions
 - Engineering design and nature of science
- 4. Explicit connections with ELA & math**
- 5. All standards, all students**

EQuIP Suite of Tools

<http://www.nextgenscience.org/resources/equip-rubric-lessons-units-science>

- NGSS Screener
- EQuIP Rubric for Science
- PEEC

/equip
/peec

Peer Review Panel

- K-12, subject area, and EQuIP Rubric for Science expertise
- Partnership with NSTA curators
- Use EQuIP Quality Review process
- First quality examples shared

/hqngss

- Multi-year project

/prp

Assessment



- The standards themselves
- Evidence statements
- Classroom tasks

Coming soon...



- Assessment alignment criteria
- Task rubric



Implementation Resources

--District Implementation planning



--Example Bundles

--Classroom
Sample Tasks

--Phenomena paper/video

--Accelerated Course Pathways



--Communication/Messaging/videos

/resource-library

- NGSS Parent Guides
- NGSS Fact Sheet
- NGSS Overview for Principals
- videos on: bundling the standards, how to read the standards, why they are important, the accelerated course pathways, making claims from evidence, transitioning to the NGSS, SEPs, DCIs, CCCs, and more...

Vision of the Framework

ALL students:

- explain the world around them
 - engage in public discussions on science-related issues
 - be critical consumers of scientific information related to their everyday lives
- appreciate that current scientific understanding is the result of many hundreds of years of creative human endeavor
 - continue to learn about science throughout their lives



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Director, Science

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NEXT GENERATION SCIENCE STANDARDS

For States, By States

ACHIEVE
SCIENCE
STANDARDS

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Who is Achieve?

Education Non-profit

- Provide national leadership
- Develop tools, services, and patterns
- Develop advocacy resources
- Conduct research

Next Generation Science Standards

- Core-focused development
- Shared responsibility (K-12/21st Century Learning)
- Generalists, teachers, experts, and leaders
- Core leadership and responsibility to educators

nextgenscience.org

The Standards

Standards Development

Instruction and Assessment

Implementation Planning

Vision of the Framework

ACHIEVE

- Lead the way and set the pace
- Engage in public discussions to address related issues
- Use all the components of scientific information created to build knowledge
- Approaches that connect scientific understanding to the needs of the knowledge of users of constructive changes
- Contribute to future science advances throughout their lives

