Performance Expectations at a Glance

In this unit, students will discover and practice the Science and Engineering Practices, Disciplinary Core Ideas, and Crosscutting Concepts needed to perform the following Performance Expectations.

Performance Expectations	Module: **Introduction to Waves**	Module: **Light**	Module: **Information Technologies**
MS-PS4-1	●		
MS-PS4-2	●	●	
MS-PS4-3			●
MS-ETS1-2	●		
MS-ETS1-4		●	

Correlations by Module to the NGSS

MODULE: Introduction to Waves

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 thinking.] [*Assessment Boundary: Assessment does not include electromagnetic waves and is limited to standard repeating waves.*]	20, 55-60
SEP Science and Engineering Practices		
Using Mathematics and Computational Thinking* Mathematical and computational thinking at the 6–8 level builds on K–5 and progresses to identifying patterns in large data sets and using mathematical concepts to support explanations and arguments. • Use mathematical representations to describe and/or support scientific conclusions and design solutions. (MS-PS4-1) * Other aspects of this SEP are integrated throughout this module and are listed in the *Also Integrates* section.		20, *24–26,* 26–28, *28–29,* 30, 32–34
Connections to Nature of Science **Scientific Knowledge is Based on Empirical Evidence** • Science knowledge is based upon logical and conceptual connections between evidence and explanations. (MS-PS4-1)		3, 7, *10–12, 17–18, 22–23, 24–26, 28–29,* 34, 55–60

Labs and investigations are in italics.

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DCI Disciplinary Core Ideas	
PS4.A: Wave Properties • A simple wave has a repeating pattern with a specific wavelength, frequency, and amplitude. (MS-PS4-1)	*10–12,* 13, *17–18,* 18–20, *24–26,* 26–27, 30, 32–34, 61, PhET Interactive Simulation *Wave Interference* (online)
CCC Crosscutting Concepts	
Patterns* • Graphs and charts can be used to identify patterns in data. (MS-PS4-1) * Other aspects of this CCC are integrated throughout this module and are listed in the *Also Integrates* section.	10, 13, 19–20, 23, *24–26, 28–29,* 30, 32–33, PhET Interactive Simulation *Wave Interference* (online)
CCSS ELA/Literacy Connections	
ELA SL.8.5	31, 51, 55–60, Literacy Skill Handbook (online)
CCSS Math Connections	
Math MP.2	*22–23, 24–26,* 27–28, *28–29, 40–42,* 50, Math Skill Handbook (online)
Math MP.4	20, 34, Math Skill Handbook (online)
Math 6.RP.A.1	27, Math Skill Handbook (online)
Math 6.RP.A.3	27, Math Skill Handbook (online)
Math 7.RP.A.2	18–20, *24–26,* 26–27, 28, *28–29*, Math Skill Handbook (online)
Math 6.F.A.3	20, Math Skill Handbook (online)

MS-PS4	Waves and Their Applications in Technologies for Information Transfer	
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, simulations, and written descriptions.] [*Assessment Boundary: Assessment is limited to qualitative applications pertaining to light and mechanical waves*.]	*40–42, 46–47,* 55–60, PhET Interactive Simulation *Wave Interference* (online), PhET Interactive Simulation *Sound* (online)

Labs and investigations are in italics.

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SEP Science and Engineering Practices	
Developing and Using Models* Modeling in 6–8 builds on K–5 and progresses to developing, using, and revising models to describe, test, and predict more abstract phenomena and design systems. • Develop and use a model to describe phenomena. (MS-PS4-2) * Other aspects of this SEP are integrated throughout this module and are listed in the *Also Integrates* section.	7, 20, 30, 37, *40–42,* 44, *48–50, 52,* 55–60
DCI Disciplinary Core Ideas	
PS4.A: Wave Properties • A sound wave needs a medium through which it is transmitted. (MS-PS4-2)	14, 31, 33–34, *43–44,* 44, *46–47,* 47, 52–54
CCC Crosscutting Concepts	
Structure and Function • Structures can be designed to serve particular functions by taking into account properties of different materials, and how materials can be shaped and used. (MS-PS4-2)	31, *40–42, 43–44,* 44, *46–47, 48–50,* 50, 51, 53–54, 55–60
CCSS ELA/Literacy Connections	
ELA SL.8.5	31, 51, 55–60, Literacy Skill Handbook (online)

MS-ETS1	Engineering Design	
MS-ETS1-2.	**Evaluate competing design solutions using a systematic process to determine how well they meet the criteria and constraints of the problem.**	55–60
SEP Science and Engineering Practices		
Engaging in Argument from Evidence Engaging in argument from evidence in 6–8 builds on K–5 experiences and progresses to constructing a convincing argument that supports or refutes claims for either explanations or solutions about the natural and designed world. • Evaluate competing design solutions based on jointly developed and agreed-upon design criteria. (MS-ETS1-2)		55–60
DCI Disciplinary Core Ideas		
ETS1.B: Developing Possible Solutions • There are systematic processes for evaluating solutions with respect to how well they meet the criteria and constraints of a problem. (MS-ETS1-2) possible solutions. (MS-ETS1-1)		55–60, Science and Engineering Practices Handbook (online)

Labs and investigations are in italics.

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CCC Cause and Effect	121
CCC Systems and System Models	120
Connections to Nature of Science Science is a Way of Knowing	131
Connections to Nature of Science Science is a Human Endeavor	119, 139
Connections to Science, Technology, Society, and the Environment Influence of Engineering, Technology, and Science on Society and the Natural World	81
CCSS ELA RST.6–8.1.	68–69, 73, 88–89, 108–109, 126–127, 131
CCSS ELA RST.6–8.3	*75–76, 77–79, 90–91, 94–95, 98–99, 110–111, 114–115, 128–129*
CCSS ELA RST.6–8.6	131
CCSS ELA RST.6–8.7	93, 97, 102, 120
CCSS ELA RST.6–8.10	73, 81
CCSS ELA WHST.6–8.1	132
CCSS ELA WHST.6–8.10	140, 149
CCSS ELA SL.8.1	63, 67, 70, 73, 81, 131
CCSS ELA SL.8.4	101, 119, 139, 143–148

MODULE: Information Technologies

MS-PS4	Waves and Their Applications in Technologies for Information Transfer	
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 a basic understanding that waves can be used for communication purposes. Examples could include using fiber optic cable to transmit light pulses, radio wave pulses in wifi devices, and conversion of stored binary patterns to make sound or text on a computer screen.] [*Assessment Boundary: Assessment does not include binary counting. Assessment does not include the specific mechanism of any given device*.]	195–198

Labs and investigations are in italics.

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CCSS ELA/Literacy Connections	
ELA RST.6–8.1	8–9, 21, 31, 38–39, 51, Literacy Skill Handbook (online)
ELA RST.6–8.9	31, 43, Literacy Skill Handbook (online)
ELA WHST.6–8.7	31, 51, 55–60, Literacy Skill Handbook (online)
ELA WHST.6–8.9	16, 21, 31, 51, Literacy Skill Handbook (online)
CCSS Math Connections	
Math MP.2	*22–23, 24–26,* 27–28, *28–29, 40–42,* 50, Math Skill Handbook (online)
Math 7.EE.B.3	*46–47*, Math Skill Handbook (online)

ALSO INTEGRATES:	
SEP Asking Questions and Defining Problems	7, 51, 61
SEP Planning and Carrying Out Investigations	55–60, 61
SEP Analyzing and Interpreting Data	*22–23,* 33
SEP Using Mathematics and Computational Thinking	*46–47,* 53
SEP Constructing Explanations and Designing Solutions	8–9, *10–12,* 16, *17–18, 22–23, 24–26,* 38–39, *40–42, 43–44,* 44, *46–47,* 53–54, 55–60, 61
SEP Engaging in Argument from Evidence	50
SEP Obtaining, Evaluating, and Communicating Information	16, 21, 31, 51, 55–60
DCI LS1.D: Information Processing	45
DCI PS3.C: Relationship Between Energy and Forces	*17–18, 28–29,* 30
DCI ETS1.A: Defining and Delimiting Engineering Problems	55–60
CCC Patterns	*10–12,* 12, 16, 20, 30, *40–42, 48–50*
CCC Cause and Effect	16, 28
CCC Scale Proportion, and Quantity	16, 33
CCC Systems and System Models	32, 34

Labs and investigations are in italics.

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CCC Energy and Matter	*10–12,* 16, *17–18,* 20, *22–23, 24–26,* 28, *28–29,* 33–34, 44, 52, 55–60, 61
CCC Stability and Change	16
CCSS ELA RST.6–8.2	21
CCSS ELA RST.6–8.3	*10–12, 17–18, 22–23, 24–26, 28–29, 40–42, 46–47, 48–50*
CCSS ELA RST.6–8.10	16, 21, 31
CCSS ELA WHST.6–8.2	16, 31, 51
CCSS ELA WHST.6–8.4	16, 31, 51
CCSS ELA WHST.6–8.8	55–60
CCSS ELA SL.8.4	55–60

MODULE: Light

MS-PS4	Waves and Their Applications in Technologies for Information Transfer	
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, simulations, and written descriptions.] [*Assessment Boundary: Assessment is limited to qualitative applications pertaining to light and mechanical waves.*]	*98–99*, *110–111*, 137, 143–148
SEP Science and Engineering Practices		
Developing and Using Models* Modeling in 6–8 builds on K–5 and progresses to developing, using, and revising models to describe, test, and predict more abstract phenomena and design systems. • Develop and use a model to describe phenomena. (MS-PS4-2) * Other aspects of this SEP are integrated throughout this module and are listed in the Also Integrates section.		*75–76*, 80, 82, 84, 97, *98–99*, *110–111*, 118, 120, 137, 142, 143–148

Labs and investigations are in italics.

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DCI Disciplinary Core Ideas	
PS4.A: Wave Properties • A sound wave needs a medium through which it is transmitted. (MS-PS4-2)	73–74
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)	*77–79*, 79–80, 84, *90–91*, 92–93, *94–95*, 96–97, *98–99*, 100–104, *110–111*, 112, *134–135,* 136–137, 140–142, 143–148, 149
• The path that light travels can be traced as straight lines, except at surfaces between different transparent materials (e.g., air and water, air, and glass) where the light path bends. (MS-PS4-2)	*75–76*, 76, 84, *90–91*, 92–93, 96–97, 100–103, *110–111*, 112–113, *114–115*, 116, 118–119, 120, *130,* 131–132, 149
• A wave model of light is useful for explaining brightness, color, and the frequency-dependent bending of light at a surface between media. (MS-PS4-2)	72, 113, *128–129*, 129, *130*, 131–132, *134–135,* 136–137, 140–142, 149
• However, because light can travel through space, it cannot be a matter wave, like sound or water waves. (MS-PS4-2)	73–74, 96, 101, 113, 143–148, 149
CCC Crosscutting Concepts	
Structure and Function • Structures can be designed to serve particular functions by taking into account properties of different materials, and how materials can be shaped and used. (MS-PS4-2)	79–81, 84, 97, 117, 119, 121, 132–133, 139
CCSS ELA/Literacy Connections	
ELA SL.8.5	39, 143–148, Literacy Skill Handbook (online)

MS-ETS1	Engineering Design	
MS-ETS1-4.	**Develop a model to generate data for iterative testing and modification of a proposed object, tool, or process such that an optimal design can be achieved.**	143–148
SEP Science and Engineering Practices		
Developing and Using Models*		143–148
Modeling in 6–8 builds on K–5 experiences and progresses to developing, using, and revising models to describe, test, and predict more abstract phenomena and design systems. • Develop a model to generate data to test ideas about designed systems, including those representing inputs and outputs. (MS-ETS1-4)		
* Other aspects of this SEP are integrated throughout this module and are listed in the Also Integrates section.		

Labs and investigations are in italics.

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DCI Disciplinary Core Ideas	
ETS1.B: Developing Possible Solutions • A solution needs to be tested, and then modified on the basis of the test results, in order to improve it. (MS-ETS1-4)	143–148, Science and Engineering Practices Handbook (online)
• Models of all kinds are important for testing solutions. (MS-ETS1-4)	Science and Engineering Practices Handbook (online)
ETS1.C: Optimizing the Design Solution • The iterative process of testing the most promising solutions and modifying what is proposed on the basis of the test results leads to greater refinement and ultimately to an optimal solution. (MS-ETS1-4)	143–148, Science and Engineering Practices Handbook (online)
CCSS ELA/Literacy Connections	
ELA SL.8.5	139, 143–148, Literacy Skill Handbook (online)
CCSS Math Connections	
Math MP.2	*90–91,* Math Skill Handbook (online)
Math 7.SP.C.7	Math Skill Handbook (online)

ALSO INTEGRATES:	
SEP Asking Questions and Defining Problems	63, 149
SEP Developing and Using Models	103–104, 121, *130*, 143–148
SEP Planning and Carrying Out Investigations	*75–76, 77–79, 128–129, 134–135*, 143–148
SEP Analyzing and Interpreting Data	*77–79, 90–91*
SEP Constructing Explanations and Designing Solutions	68–69, 76, 88–89, 104, 108–109, 122, 126–127, *128–129*, *134–135*, 137, 140, 149, Lab *Back to Back* (online)
SEP Engaging in Argument from Evidence	83, 113, 132, 143–148
SEP Obtaining, Evaluating, and Communicating Information	73, 83, 143–148
Connections to Nature of Science Science Models, Laws, Mechanisms, and Theories Explain Natural Phenomena	92
DCI LS1.D: Information Processing	117, 133
CCC Patterns	74, 83, *90–91*

Labs and investigations are in italics.

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SEP Science and Engineering Practices	
Obtaining, Evaluating, and Communicating Information* Obtaining, evaluating, and communicating information in 6–8 builds on K–5 and progresses to evaluating the merit and validity of ideas and methods. • Integrate qualitative scientific and technical information in written text with that contained in media and visual displays to clarify claims and findings. (MS-PS4-3) * Other aspects of this SEP are integrated throughout this module and are listed in the *Also Integrates* section.	165, 181, 195–198, 199, Animation *Cell Phones* (online), Video *GPS Satellites* (online)
DCI Disciplinary Core Ideas	
PS4.C: Information Technologies and Instrumentation • Digitized signals (sent as wave pulses) are a more reliable way to encode and transmit information. (MS-PS4-3)	162–163, *174–175,* 176, *177,* 178, *179–180,* 181, *182–185,* 186, *187,* 188–190, 192–194, 195–198, 199
CCC Crosscutting Concepts	
Structure and Function • Structures can be designed to serve particular functions. (MS-PS4-3)	162, *162,* 163, 165, 176, 186, 188–189, 194
Connections to Engineering, Technology, and Applications of Science **Influence of Science, Engineering, and Technology on Society and the Natural World** • Technologies extend the measurement, exploration, modeling, and computational capacity of scientific investigations. (MS-PS4-3)	186, 189–191
Connections to Nature of Science **Science is a Human Endeavor*** • Advances in technology influence the progress of science and science has influenced advances in technology. (MS2-PS4-3) * Other aspects of this Connections to Nature of Science are integrated throughout this module and are listed in the *Also Integrates* section.	189–190, 195–198, 199
CCSS ELA/Literacy Connections	
ELA RST.6–8.1	156–157, 172–173, 195–198, Literacy Skill Handbook (online)
ELA RST.6–8.2	189, Literacy Skill Handbook (online)
ELA RST.6–8.9	192, 195–198, Literacy Skill Handbook (online)
ELA WHST.6–8.9	165, 189, 191, 195–198, Literacy Skill Handbook (online)
ELA SL.8.5	165, 195–198, Literacy Skill Handbook (online)

Labs and investigations are in italics.

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ALSO INTEGRATES:	
SEP Asking Questions and Defining Problems	199
SEP Developing and Using Models	*158–159, 160–161,* 167, 181, *182–185,* 193
SEP Planning and Carrying Out Investigations	*160–161,* 199
SEP Analyzing and Interpreting Data	167, *174–175, 179–180*
SEP Using Mathematics and Computational Thinking	*174–175,* 176, 178, *179–180,* 181, 188
SEP Constructing Explanations and Designing Solutions	156–157, *164,* 168, 172–173, 176, 190, 194, 195–198, 199
SEP Engaging in Argument from Evidence	163
SEP Obtaining, Evaluating, and Communicating Information	163, 189
Connections to Nature of Science Scientific Investigations Use a Variety of Methods	189
CCC Cause and Effect	178
CCC Systems and System Models	*182–185,* 193
Connections to Nature of Science Science is a Human Endeavor	189–191
Connections to Science, Technology, Society, and the Environment Interdependence of Science, Engineering, and Technology	189–191
CCSS ELA RST.6–8.3	*174–175, 179–180*
CCSS ELA RST.6–8.7	166, 192
CCSS ELA RST.6–8.10	165, 189, 191
CCSS ELA WHST.6–8.7	191
CCSS ELA WHST.6–8.8	165, 195–198
CCSS Math MP.2	*174–175,* 176, 178, *179–180,* 181, 188, 193
CCSS Math 6.SP.B.4	*174–175 , 179–180*
CCSS Math 6.SP.B.5	*174–175, 179–180*
CCSS Math 8.EE.A.3	186

Labs and investigations are in italics.