Proficiency Scales

Physics
High School
2020

SOUTHWESTERN UNION
EDUCATION

PROFICIENCY SCALES

Proficiency scales serve as a starting point for unit planning, creating assessments, delivering instruction, grading, and reporting progress, as well as making teaching visible to students and guiding their growth on the standards. Specifically, a proficiency scale is a continuum or learning progression that articulates distinct levels of knowledge and skills relative to specific standards. It shows teachers and students what proficiency looks like, what knowledge and skills students need to achieve proficiency, and how students might go beyond proficiency.

A proficiency scale is composed of a series of levels as follows:

Score 3.0—Heart of the proficiency scale; it defines the target content that teachers expect all students to know and be able to do. I CAN statements are provided for this level.

Score 2.0—Simpler content; it describes the foundational knowledge and skills that students will need to master before progressing to proficiency.

Score 4.0—Challenging content; it provides students the opportunity to go above and beyond expectations by applying their knowledge in new situations or demonstrating understanding beyond what the teacher teaches in class. A generic statement is provided for this level.

Scores 1.0 and 0.0—No specific content; 1.0 indicates that a student can demonstrate some knowledge or skill with help from the teacher, but not independently; 0.0 means that, even with help, a student cannot show any understanding. Generic statements are provided for these levels.

Half-point Scores—More precise measurement of knowledge and skills that is between two levels. Generic statements are provided for these levels.

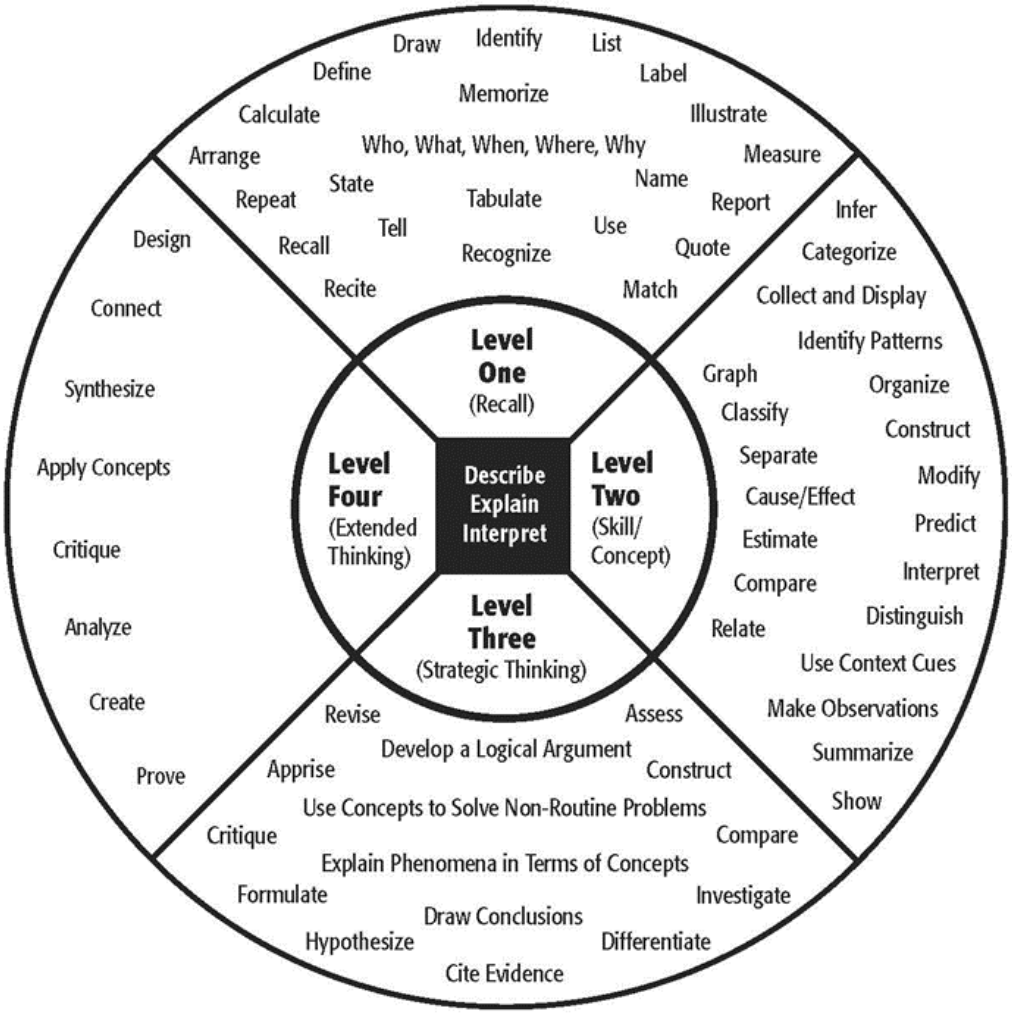
Proficiency scales become the centerpiece of communication and understanding in the classroom, as well as the common language for discussing learning between teacher and student.

The proficiency scales are organized according to the domains and strands in the NAD standards.

The cognitive rigor or complexity of the 3.0 learning targets has also been included, for it impacts the selection of instructional activities as well as assessment tasks. The Depth of Knowledge (DOK) model is generally used for this purpose, which is a taxonomy of four levels of cognitive demand. The levels are:

- **Level 1**—Recall
- **Level 2**—Skill/Concept
- **Level 3**—Strategic Thinking
- **Level 4**—Extended Thinking

Depth of Knowledge (DOK) Levels



Level One Activities	Level Two Activities	Level Three Activities	Level Four Activities
Recall elements and details of story structure, such as sequence of events, character, plot and setting.	Identify and summarize the major events in a narrative.	Support ideas with details and examples.	Conduct a project that requires specifying a problem, designing and conducting an experiment, analyzing its data, and reporting results/ solutions.
Conduct basic mathematical calculations.	Use context cues to identify the meaning of unfamiliar words.	Use voice appropriate to the purpose and audience.	Apply mathematical model to illuminate a problem or situation.
Label locations on a map.	Solve routine multiple-step problems.	Identify research questions and design investigations for a scientific problem.	Analyze and synthesize information from multiple sources.
Represent in words or diagrams a scientific concept or relationship.	Describe the cause/effect of a particular event.	Develop a scientific model for a complex situation.	Describe and illustrate how common themes are found across texts from different cultures.
Perform routine procedures like measuring length or using punctuation marks correctly.	Identify patterns in events or behavior.	Determine the author's purpose and describe how it affects the interpretation of a reading selection.	Design a mathematical model to inform and solve a practical or abstract situation.
Describe the features of a place or people.	Formulate a routine problem given data and conditions.	Apply a concept in other contexts.	
	Organize, represent and interpret data.		

Webb, Norman L. and others. "Web Alignment Tool" 24 July 2005. Wisconsin Center of Educational Research. University of Wisconsin-Madison. 2 Feb. 2006. <http://www.wcer.wisc.edu/WAT/index.aspx>.

Science and Engineering Practices

1. Asking and Defining Problems
2. Developing and Using Models
3. Using Mathematics and Computational Thinking
4. Planning and Carrying Out Investigations
5. Constructing Explanations and Designing Solutions
6. Obtaining, Evaluating, and Communicating Information
7. Analyzing and Interpreting Data
8. Engaging in Argument From Evidence

Southwestern Union Conference
Secondary Science Committee

Amy Abernathy — North Dallas Adventist Academy
Larry Camp — Sandia View Academy
Jon Dickerson — Chisholm Trail Academy
Robert Fetters — Ozark Adventist Academy
Pablo Gonzalez — Houston Adventist Academy
David Pena — South Texas Christian Academy

<table>
<tr><td colspan="3">Title: Forces and Interactions Subject: Physics</td></tr>
<tr><td colspan="3">Standard:</td></tr>
<tr><td>Score 4.0</td><td colspan="2">In addition to score 3.0 performance, the student demonstrates in-depth inferences and applications that go beyond what was taught</td></tr>
<tr><td></td><td>Score 3.5</td><td>In addition to score 3.0 performance, partial success at score 4.0 content</td></tr>
<tr><td>Score 3.0</td><td colspan="2">The student will:

HS-PS2-1 Analyze data to support the claim that Newton’s second law of motion describes the mathematical relationship among the net force on a macroscopic object, its mass, and its acceleration (for example, defend the claim that net force is equal to mass times acceleration by analyzing tables or graphs of position or velocity as a function of time for a falling object, an object rolling down a ramp, or a moving object being pulled by a constant force).

HS-PS2-2 Use mathematical representations to support the claim that the total momentum of a system of objects is conserved when there is no net force on the system (for example, use mathematical formulas to defend the law of conservation of momentum—that the total momentum of a system of two macroscopic bodies moving in one dimension is conserved when it is not acted upon by outside forces).

HS-PS2-3 Apply scientific and engineering ideas to design, evaluate, and refine a device that minimizes the force on a macroscopic object during a collision (for example, design a device—such as a football helmet or a parachute—meant to minimize force on a macroscopic object during a collision, make a qualitative assessment of the success of the device at protecting the object from damage, and modify the design to improve it).</td></tr>
<tr><td></td><td>Score 2.5</td><td>No major errors or omissions regarding score 2.0 content and partial success at score 3.0 content</td></tr>
</table>

<table>
<tr><td>Score 2.0</td><td colspan="2">HS-PS2-1 The student will:

• Recognize or recall specific vocabulary (for example, acceleration, constant force, drag, force, Isaac Newton, law, macroscopic, mass, net force, Newtonian mechanics, Newton’s second law of motion, position, relative motion, unbalanced force, velocity).
• Describe the key parts of Newton’s second law of motion.
• Describe the mathematical relationship between the net force on a macroscopic object, the object’s mass, and the object’s acceleration.

HS-PS2-2 The student will:

• Recognize or recall specific vocabulary (for example, conservation, dimension, force, law of conservation of momentum, macroscopic, momentum, net force, system).
• Describe the key parts of the law of conservation of momentum.

HS-PS2-3 The student will:

• Recognize or recall specific vocabulary (for example, collision, damage, design, device, evaluate, force, macroscopic, minimize, refine).
• Describe the forces acting on an object during a collision and the effect of those forces.</td></tr>
<tr><td></td><td>Score 1.5</td><td>Partial success at score 2.0 content and major errors or omissions regarding score 3.0 content</td></tr>
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<tr><td colspan="3">Title: Electric and Magnetic Forces Subject: Physics</td></tr>
<tr><td colspan="3">Standard:</td></tr>
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<tr><td></td><td>Score 3.5</td><td>In addition to score 3.0 performance, partial success at score 4.0 content</td></tr>
<tr><td>Score 3.0</td><td colspan="2">The student will:

HS-PS2-4(b) Use mathematical representations of Coulomb’s law to describe and predict the electrostatic forces between objects (for example, use mathematical formulas to provide quantitative and conceptual explanations Coulomb’s law and to describe and predict the electrostatic force between two objects).

HS-PS2-5 Plan and conduct an investigation to provide evidence that an electric current can produce a magnetic field and that a changing magnetic field can produce an electric current (for example, use teacher-provided materials and tools—such as copper coil, iron filings, and a magnet—to demonstrate the magnetic effect of an electric current and the principle of electromagnetic induction).</td></tr>
<tr><td></td><td>Score 2.5</td><td>No major errors or omissions regarding score 2.0 content and partial success at score 3.0 content</td></tr>
<tr><td>Score 2.0</td><td colspan="2">HS-PS2-4(b) The student will:

• Recognize or recall specific vocabulary (for example, Coulomb’s law, electric current, electric field, electrostatic force, semiconductor, superconductor).
• Describe the key parts of Coulomb’s law.
• Describe the electrostatic forces between objects.

HS-PS2-5 The student will:

• Recognize or recall specific vocabulary (for example, electric current, electric field, electrical energy, electromagnetic induction, magnet, magnetic effect, magnetic field, moving electrical charge, moving magnet)
• Describe the relationship between electric currents and magnetic fields.</td></tr>
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<tr><td colspan="3">Title: Gravity Subject: Physics</td></tr>
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<tr><td></td><td>Score 3.5</td><td>In addition to score 3.0 performance, partial success at score 4.0 content</td></tr>
<tr><td>Score 3.0</td><td colspan="2">The student will:

HS-PS2-4(a) Use mathematical representations of Newton’s law of gravitation to describe and predict the gravitational forces between objects (for example, use mathematical formulas to provide quantitative and conceptual explanations Newton’s law of gravitation and to predict the gravitational force between two objects).</td></tr>
<tr><td></td><td>Score 2.5</td><td>No major errors or omissions regarding score 2.0 content and partial success at score 3.0 content</td></tr>
<tr><td>Score 2.0</td><td colspan="2">HS-PS2-4(a) The student will:

• Recognize or recall specific vocabulary (for example, conceptual explanation, gravitational energy, gravitational field, gravitational force, Isaac Newton, Newton’s law of gravitation, quantitative explanation).
• Describe the key parts of Newton’s law of gravitation.
• Describe the gravitational forces between objects.</td></tr>
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<tr><td colspan="3">Title: Energy and Forces Subject: Physics</td></tr>
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<tr><td>Score 4.0</td><td colspan="2">In addition to score 3.0 performance, the student demonstrates in-depth inferences and applications that go beyond what was taught</td></tr>
<tr><td></td><td>Score 3.5</td><td>In addition to score 3.0 performance, partial success at score 4.0 content</td></tr>
<tr><td>Score 3.0</td><td colspan="2">The student will:

HS-PS3-5 Develop and use a model of two objects interacting through electric or magnetic fields to illustrate the forces between objects and the changes in energy of the objects due to the interaction (for example, create a diagram, text, or drawing of two objects interacting through electric or magnetic fields—such as a drawing of what happens when two charges of opposite polarity are near each other—to show how the forces between objects and the energy of objects change as a result of the interaction).</td></tr>
<tr><td></td><td>Score 2.5</td><td>No major errors or omissions regarding score 2.0 content and partial success at score 3.0 content</td></tr>
<tr><td>Score 2.0</td><td colspan="2">HS-PS2-5 The student will:

• Recognize or recall specific vocabulary (for example, charge, electric field, energy, force, interact, magnetic field, polarity).
• Describe what happens when two objects interact through electric or magnetic fields.</td></tr>
<tr><td></td><td>Score 1.5</td><td>Partial success at score 2.0 content and major errors or omissions regarding score 3.0 content</td></tr>
<tr><td>Score 1.0</td><td colspan="2">With help, partial success at score 2.0 content and score 3.0 content</td></tr>
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<tr><td colspan="3">Title: Energy Definitions Subject: Physics</td></tr>
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<tr><td></td><td>Score 3.5</td><td>In addition to score 3.0 performance, partial success at score 4.0 content</td></tr>
<tr><td>Score 3.0</td><td colspan="2">The student will:

HS-PS3-1 Use a computational model to calculate the change in the energy of one component in a system when the change in energy of the other components(s) and energy flows in and out of the system are known (for example, use basic algebraic expressions or computations to calculate the change in the energy—thermal, kinetic, or within a gravitational, magnetic, or electric field—of one component in a two- or three- component system given energy flows in and out of the system and changes in energy of the other component(s), and explain the meaning of mathematical expressions used in the model).

HS-PS3-2 Use models to illustrate that energy at the macroscopic scale can be accounted for as a combination of energy associated with the motions of particles (objects) and energy associated with the relative position of particles (objects) (for example, create a diagram, drawing, or computer simulation that shows that energy at the macroscopic scale—such as the conversion of kinetic energy to thermal energy or the energy stored due to the position of an object above the Earth or between two electrically charge plates—can be accounted for as either the motion of particles or energy stored in fields).

HS-PS3-3 Investigate the transformation of energy from one form to another through laboratory activities (for example, based on qualitative and quantitative evaluations, use teacher-provided materials to design build, and refine a device that works within given constraints (such as use of renewable energy forms, efficiency requirements, and so on) to convert on form of energy into another form (such as a Rube Goldberg device, wind turbine, solar cell, solar oven, or generator)).</td></tr>
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<tr><td>Score 2.0</td><td colspan="2">HS-PS3-1 The student will:

• Recognize or recall specific vocabulary (for example, algebraic expression, component, electric field, energy, flow, gravitational field, kinetic energy, magnetic field, renewable energy, system, thermal energy).
• State the basic algebraic expression or computation for calculating a change in energy.
• Describe how the energy of one component in a two- or three- component system relates to the energy of the other components.

HS-PS3-2 The student will:

• Recognize or recall specific vocabulary (for example, conversion electrically charged, energy, field, kinetic energy, macroscopic scale, molecular energy motion, particle, position, relative, thermal energy).
• Describe how energy results from the motion of particles (objects).
• Describe how energy is stored in fields.

HS-PS3-3 The student will:

• Recognize or recall specific vocabulary (for example, constraint, convert, device, efficient, energy, form, generator, renewable energy, Rube Goldberg device, solar cell, solar oven, wing turbine).
• Research ways in which energy can be converted from one form to another.</td></tr>
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<tr><td colspan="3">Title: Energy Conservation and Energy Transfer Subject: Physics</td></tr>
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<tr><td>Score 4.0</td><td colspan="2">In addition to score 3.0 performance, the student demonstrates in-depth inferences and applications that go beyond what was taught</td></tr>
<tr><td></td><td>Score 3.5</td><td>In addition to score 3.0 performance, partial success at score 4.0 content</td></tr>
<tr><td>Score 3.0</td><td colspan="2">The student will:

HS-PS3-4 Plan and conduct an investigation to provide evidence that the transfer of thermal energy when two components of different temperature are combined within a closed system results in a more uniform energy distribution among the components in the system (second law of thermodynamics) (for example, use teacher-provided materials and tools to conduct an investigation in which two components of different temperatures are combined with a closed system—such as mixing liquids at different initial temperatures or adding objects at different temperatures to water—and analyze data from the investigation using mathematical thinking to describe the energy changes both quantitatively and conceptually).</td></tr>
<tr><td></td><td>Score 2.5</td><td>No major errors or omissions regarding score 2.0 content and partial success at score 3.0 content</td></tr>
<tr><td>Score 2.0</td><td colspan="2">HS-PS3-4 The student will:

• Recognize or recall specific vocabulary (for example, closed system, component, conceptual, energy change, energy distribution, quantitative, second law of thermodynamics, system, temperature, thermal energy, thermal equilibrium, transfer, uniform).
• Describe the key parts of the second law of thermodynamics.</td></tr>
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Score 0.0	Even with help, no success

Title: **Waves**		Subject: **Physics**
Standard:		
Score 4.0	In addition to score 3.0 performance, the student demonstrates in-depth inferences and applications that go beyond what was taught	
	Score 3.5	In addition to score 3.0 performance, partial success at score 4.0 content
Score 3.0	The student will: **HS-PS4-1 Use mathematical representations to support a claim regarding relationships among the frequency, wavelength, and speed of waves traveling in various media** (for example, use qualitative descriptions of algebraic relationships to explain the relationship between the frequency, wavelength , and speed of waves traveling in various media, such as electromagnetic radiation traveling in a vacuum versus through glass, sound waves traveling through air versus water, or seismic waves traveling through the Earth).	
	Score 2.5	No major errors or omissions regarding score 2.0 content and partial success at score 3.0 content
Score 2.0	**HS-PS4-1** The student will: • Recognize or recall specific vocabulary (for example, *algebraic, electromagnetic radiation, frequency, medium, properties of waves, relationship, seismic wave, sound wave, speed, travel, vacuum, wave, wave packet, wave source, wavelength*). • Describe the relationship between the frequency, wavelength, and speed of waves.	
	Score 1.5	Partial success at score 2.0 content and major errors or omissions regarding score 3.0 content
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<tr><td></td><td>Score 3.5</td><td>In addition to score 3.0 performance, partial success at score 4.0 content</td></tr>
<tr><td>Score 3.0</td><td colspan="2">The student will:

HS-PS4-3 Evaluate the wave properties and the particle properties of electromagnetic radiation through experimental observation. (for example, determine whether experimental evidence supports the claim that electromagnetic radiation can be described by either a wave model or a particle model, as well as the claim that for different phenomena—such as resonance, interference, diffraction, and photoelectric effect—one model is more useful than the other).

HS-PS4-4 Investigate the claims of the effects that different frequencies of electromagnetic radiation have when absorbed by matter (for example, that the damage to living tissue from electromagnetic radiation depends on the energy of the radiation – living near high voltage power lines, working near different forms of electromagnetic radiation, excessive x-rays, sleeping next to cell phones or using them all of the time).</td></tr>
<tr><td></td><td>Score 2.5</td><td>No major errors or omissions regarding score 2.0 content and partial success at score 3.0 content</td></tr>
<tr><td>Score 2.0</td><td colspan="2">HS-PS4-3 The student will:

• Recognize or recall specific vocabulary (for example, diffraction, electromagnetic, electromagnetic field, electromagnetic radiation, electromagnetic wave, experimental evidence, interference, model, particle model, phenomenon, photoelectric effect, resonance, wave model).
• Describe the wave model of electromagnetic radiation.
• Describe the particle model of electromagnetic radiation.
• Summarize the claims and reasoning behind the idea that electromagnetic radiation can be described either by a wave model or a particle model.

HS-PS4-4 The student will:</td></tr>
</table>

	• Recognize or recall specific vocabulary (for example, absorb, bias, damage, effect, electromagnetic radiation, energy, frequency, infrared radiation, light, living tissue, matter, photon, radiation). • Summarize claims about the effects that different frequencies of electromagnetic radiation have when absorbed by matter.	
	Score 1.5	Partial success at score 2.0 content and major errors or omissions regarding score 3.0 content
Score 1.0	With help, partial success at score 2.0 content and score 3.0 content	
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<tr><td colspan="3">Title: Information Technologies Subject: Physics</td></tr>
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<tr><td></td><td>Score 3.5</td><td>In addition to score 3.0 performance, partial success at score 4.0 content</td></tr>
<tr><td>Score 3.0</td><td colspan="2">The student will:

HS-PS4-2 Investigate the methods of using digital transmission and storage of information (for example, evaluate questions about the advantages of digitally transmitting and storing information (such as the stability of digital information due to its ability to be transferred easily, copied and shared rapidly, and stored reliably in computer memory) as well as the disadvantages (such as issues of easy deletion, security, and theft).

HS-PS4-5 Explore how some technological devices use the principles of wave behavior and wave interactions with matter to transmit and capture information and energy (for example, use qualitative information to explain how some technological devices use waves to transmit and capture information and energy, such as solar cells and technology for medical imaging and communications).</td></tr>
<tr><td></td><td>Score 2.5</td><td>No major errors or omissions regarding score 2.0 content and partial success at score 3.0 content</td></tr>
<tr><td>Score 2.0</td><td colspan="2">HS-PS4-2 The student will:

• Recognize or recall specific vocabulary (for example, digital transmission, digitize, information, memory, pixel, security, stable, store, transfer, transmission).
• Describe the advantages and disadvantages of digital transmission and storage of information.

HS-PS4-5 The student will:

• Recognize or recall specific vocabulary (for example, capture, communications technology, convert, electricity, energy, information, matter, medical imaging, principle, solar cell, technical information, technological device, transmit, wave, wave behavior, wave interaction).
• Describe the use of waves to transmit and capture information and energy.</td></tr>
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