SCIENCE HIGH SCHOOL

ENGINEERING, TECHNOLOGY & APPLICATIONS OF SCIENCE

Theory of Action: Academic standards represent a collective commitment around what students should learn each year. The state assessment asks students to demonstrate their knowledge, skills, and understanding related to these standards using a common measure. The resulting data allows us to see patterns in performance that should guide school and district improvement, helping identify areas of strength and opportunity.

Role of Performance Level Descriptors in Defining Proficiency: Performance level descriptors bridge the state assessment to classroom instruction and the systems of formative assessments that guide local instruction and choices about individual students. ***Academic proficiency represents a <u>range</u> of observable student performance characteristics***. There are multiple pathways to proficiency, and students rely upon their strengths differently within that range of performance.

Proficiency and Difficulty: A student's ability to demonstrate proficiency is influenced by the complexity of the texts or stimuli presented, tasks they're asked to complete, and the contexts in which they are engaged. As student performance improves, students are typically able to handle more challenging texts/stimuli, tasks, and contexts, and are able to demonstrate their skills and knowledge more accurately and consistently.

Engineering, Technology and Applications of Science *Student performance indicates the ability to…*

HS-ETS1-1	Below Proficient	Approaching Proficient	Proficient	Above Proficient
Analyze a major global challenge to specify qualitative and quantitative criteria and constraints for solutions that account for societal needs and wants. **SEPs**: Asking questions and defining problems **DCI**: ETS1.A: Defining and Delimiting Engineering Problems **CCCs**: Influence of Science, Engineering, and Technology on Society and the Natural World **ACT Integrations**: Scientific Investigation, Scientific Reasoning	**Identify** major global challenges without adequately analyzing the **criteria and constraints** that would shape potential solutions. **List** some general societal needs related to a problem but show limited ability to **quantify requirements** or establish measurable goals. **Recognize** that solutions must address human concerns but provide minimal analysis of how **societal factors** influence engineering design. *For example, identify clean water access as a global challenge but provide only vague criteria like "must be affordable" without specifying quantitative constraints such as maximum cost per household, minimum water quality standards, or resource limitations that would affect implementation.*	**Describe** global challenges with some analysis of criteria and constraints but incomplete consideration of **quantitative specifications**. **Identify** several societal needs and wants related to the problem with partial **specification** of performance requirements. **Consider** some social, economic, or environmental factors but show limited ability to translate these into comprehensive **design parameters**. *For example, analyze clean water access by identifying criteria like water purity and affordability, with some specific constraints such as a cost limit, but with incomplete consideration of quantitative measures for water quality standards, implementation timeframes, maintenance requirements, or how different communities' needs might require different solution parameters.*	**Analyze** complex global challenges by systematically specifying both **qualitative and quantitative criteria** that potential solutions must satisfy. **Develop** detailed constraints that account for technological limitations, resource availability, and **societal considerations** affecting the solution space. **Balance** competing factors such as cost, safety, reliability, and environmental impact by establishing clear **performance metrics** for evaluating potential solutions. *For example, analyze the global challenge of clean water access by specifying quantitative criteria like minimum volume per person per day, maximum contaminant levels, and affordability thresholds across different economic contexts, while also establishing constraints related to local resource availability, cultural acceptability, and environmental impact limits, all supported by relevant data.*	**Integrate** multidisciplinary perspectives to develop sophisticated analyses of global challenges that account for **interconnected systems** and long-term implications. **Establish** comprehensive criteria hierarchies that prioritize critical requirements while addressing **trade-offs** between competing societal needs and wants. **Evaluate** how varying cultural, economic, and geographic contexts influence the **relative importance** of different constraints, creating contextually appropriate solution specifications. *For example, develop a nuanced analysis of clean water access that integrates engineering, public health, economic, and cultural dimensions; establishes tiered criteria frameworks with must-have versus desirable specifications; quantifies environmental impact limits alongside performance requirements; and differentiates between constraints in urban versus rural contexts, developed versus developing regions, and short-term versus long-term implementation scenarios.*

S-ETS1-2	Below Proficient	Approaching Proficient	Proficient	Above Proficient
Design a solution to a complex real-world problem by breaking it down into smaller, more manageable problems that can be solved through engineering. **SEPs**: Constructing explanations and designing solutions **DCI:** ETS1.C: Optimizing the Design Solution **CCCs**: Systems and system models **ACT Integrations**: Scientific Reasoning, Scientific Investigation	**Propose** simple solutions to problems without effectively breaking complex issues into **component parts** that can be addressed separately. **Create** basic designs that address only the most obvious aspects of a problem, showing limited understanding of **systems thinking**. **Identify** some elements of complex problems but show limited ability to develop **manageable subproblems** that can be systematically solved. *For example, suggest building more roads to address urban traffic congestion without breaking down the complex problem into component issues such as traffic flow patterns, commuter behavior, public transportation alternatives, or land use considerations that could be analyzed and addressed individually.*	**Divide** complex problems into some component parts but show partial ability to develop integrated **engineering solutions**. **Design** approaches that address several aspects of a problem with some understanding of **subsystem interactions** but incomplete system analysis. **Decompose** real-world problems with some logical structure but limited consideration of how solutions to subproblems will **function together**. *For example, break down urban traffic congestion into several components such as intersection bottlenecks and rush hour timing, proposing solutions for each, but with limited analysis of how these components interact as a system or how solutions would integrate to address the overall problem efficiently.*	**Design** comprehensive solutions by systematically breaking down complex problems into well-defined **engineering subproblems** with clear boundaries and interfaces. **Analyze** interactions between components to ensure that solutions to individual subproblems will **function together** as an effective system. **Develop** integrated approaches that address multiple aspects of real-world problems while maintaining focus on the **overall system performance.** *For example, design a solution to urban traffic congestion by breaking it down into manageable subproblems addressing physical infrastructure, traffic signal optimization, public transportation enhancement, and commuter incentive programs, with clear analysis of how these components would interact to form a comprehensive solution that addresses multiple aspects of the problem.*	**Create** sophisticated designs that decompose highly complex problems into optimal hierarchies of **interconnected subproblems** across multiple scales and domains. **Integrate** solutions to subproblems using systems engineering approaches that account for **emergent properties** and anticipate potential unintended consequences. **Evaluate** multiple problem decomposition strategies to identify the most effective approach based on **system complexity** and available resources. *For example, design a comprehensive urban mobility solution by developing a hierarchical analysis of transportation challenges across physical, technological, economic, behavioral, and policy domains; create integrated subsystem designs that address each domain while maintaining clear interfaces; and model how solutions interact across scales from individual transportation choices to metropolitan infrastructure networks, with explicit consideration of both immediate improvements and long-term system adaptability.*

HS-ETS1-3	Below Proficient	Approaching Proficient	Proficient	Above Proficient
Evaluate a solution to a complex real-world problem based on prioritized criteria and trade-offs that account for a range of constraints, including cost, safety, reliability, and aesthetics as well as possible social, cultural, and environmental impacts. **SEPs**: Constructing explanations and designing solutions **DCI:** ETS1.B: Developing Possible Solutions **CCCs**: Influence of Science, Engineering, and Technology on Society and the Natural World **ACT Integrations**: Evaluation of Models/Claims, Scientific Reasoning	**Consider** limited evaluation criteria when assessing solutions without systematically analyzing **trade-offs** between different factors. **Identify** some basic constraints but show limited ability to prioritize or balance competing considerations in **solution evaluation**. **Examine** proposed solutions with minimal attention to broader **societal impacts** or long-term consequences. *For example, evaluate a renewable energy solution primarily on initial cost alone, without systematically analyzing trade-offs between economic factors, reliability concerns, environmental benefits, land use requirements, or social equity considerations.*	**Assess** solutions using several criteria with some consideration of **trade-offs** but incomplete prioritization of competing factors. **Compare** alternatives across multiple dimensions but show partial analysis of how various constraints **interact** to affect overall solution quality. **Consider** some social, cultural, and environmental factors but with limited evaluation of **long-term impacts** or unintended consequences. *For example, evaluate renewable energy options across cost, reliability, and environmental dimensions, identifying some trade-offs between these factors, but with incomplete prioritization of which factors are most important in different contexts or limited analysis of long-term maintenance requirements, cultural land use concerns, or distributional impacts across different communities.*	**Evaluate** complex solutions systematically using clearly **prioritized criteria** that reflect the relative importance of different performance aspects. **Analyze** trade-offs between competing factors such as cost, safety, reliability, and aesthetics with explicit consideration of how these **interact** in real-world contexts. **Assess** potential solutions for their social, cultural, and environmental impacts across different **timescales and stakeholder groups**. *For example, evaluate renewable energy solutions by prioritizing criteria based on specific community needs, systematically analyzing trade-offs between initial cost, long-term reliability, environmental benefits, land use impacts, and social equity considerations, with explicit attention to how these factors might be weighted differently by various stakeholders and in different implementation contexts.*	**Develop** sophisticated evaluation frameworks that integrate quantitative and qualitative metrics across **multiple dimensions** with explicit weighting systems reflecting stakeholder priorities. **Conduct** nuanced trade-off analyses that identify non-obvious relationships between different constraints and reveal potential **synergies or conflicts** between seemingly unrelated factors. **Integrate** diverse disciplinary perspectives to assess complex solutions for their **systemic impacts** across technical, economic, social, cultural, and environmental domains. *For example, create a comprehensive evaluation system for renewable energy solutions that incorporates multi-criteria decision analysis with stakeholder-weighted priorities; analyzes complex trade-offs and identifies potential synergies between technological performance, ecosystem impacts, economic development, energy justice, and cultural considerations; and assesses how these interactions might evolve under different future scenarios, creating a robust decision framework that can adapt to changing conditions and priorities.*

HS-ETS1-4	Below Proficient	Approaching Proficient	Proficient	Above Proficient
Use a computer simulation to model the impact of proposed solutions to a complex real-world problem with numerous criteria and constraints on interactions within and between systems relevant to the problem. **SEPs**: Using mathematics and computational thinking **DCIs**: ETS1.B: Developing Possible Solutions **CCCs**: Systems and system models **ACT Integrations**: Scientific Investigation, Data Representation	**Create** or use basic computer simulations that model limited aspects of a problem without adequately representing **system interactions**. **Identify** some criteria or constraints but show limited ability to incorporate multiple factors into **computational models**. **Generate** simple simulations that provide minimal insight into how proposed solutions would affect **real-world systems**. *For example, use a simple spreadsheet to calculate the cost of different bridge designs without modeling how these designs would perform under various conditions or how they would interact with transportation systems, environmental factors, or community needs.*	**Develop** computer simulations that model several aspects of a problem with some representation of **system components** but incomplete analysis of interactions. **Incorporate** multiple criteria and constraints into models but show partial ability to represent complex **interdependencies** between factors. **Use** computational models to predict some impacts of proposed solutions but with limited exploration of how these effects propagate through **connected systems**. *For example, create a simulation that models traffic flow across a proposed bridge design under various volume scenarios, but with limited integration of how the design affects construction costs, environmental impacts, or how the bridge connects to the broader transportation network.*	**Use** computer simulations to model complex real-world problems with multiple **interacting systems** and numerous criteria and constraints. **Incorporate** diverse factors including technical, economic, social, and environmental considerations into integrated **computational models**. **Analyze** how proposed solutions affect interactions within and between systems, revealing potential **cascading effects** and unintended consequences. *For example, develop a comprehensive bridge design simulation that models structural performance under various load and environmental conditions while simultaneously analyzing traffic flow patterns, construction and maintenance costs, environmental impacts on the watershed, and effects on surrounding community access, allowing for the evaluation of multiple design alternatives against diverse criteria.*	**Create** sophisticated multi-scale simulations that capture **emergent behaviors** arising from complex interactions across different systems and domains. **Integrate** various modeling approaches to represent different aspects of complex problems, incorporating **feedback loops** and non-linear relationships between system components. **Develop** adaptive simulations that can explore solution performance across different scenarios and stakeholder priorities, revealing robust design options despite **future uncertainties**. *For example, build an integrated modeling environment for bridge design that combines structural engineering simulations with traffic flow models, economic cost-benefit analysis, environmental impact assessments, and community accessibility metrics; incorporates feedback loops between these systems; allows exploration of how designs perform under various future scenarios (climate change, population growth, economic shifts); and identifies robust solutions that perform well across multiple potential futures and stakeholder value systems.*