SPECIFIC STEM CATEGORIES: 12+ YEARS

The toy supports one or more learning goals in at least two STEM subjects.

RATING CRITERIA

Area	Criteria	Example Toy
Science	**Scientific Practices** • Investigating and evaluating the experimental design to produce data to serve as the basis for evidence that can meet the goals of the investigation **Organisms** • Understanding that living things are made of cells; either one cell or many different numbers and types of cells • Understanding the functions of a cell as a whole and how parts of cells contribute to the function, and how the body is a system of interacting subsystems composed of groups of cells • Understanding how characteristic animal behaviors and specialized plant structures affect the probability of successful reproduction of animals and plants respectively • Understanding how environmental and genetic factors influence the growth of organisms • Understanding the role of photosynthesis in the cycling of matter and flow of energy into and out of organisms • Understanding how food is rearranged through chemical reactions forming new molecules that support growth and/or release energy as this matter moves through an organism • Understanding that that sensory receptors respond to stimuli by sending messages to the brain for immediate behavior or storage as memories	**Abacus Brands Professor Maxwell's 4D Galaxy** A science kit that allows children to carry out experiments and explore space through augmented and virtual reality, learning about the solar system, gravity, and magnetism. 

RATING CRITERIA

Area	Criteria
Science	**Ecosystems** • Understanding the effects of resource availability on organisms and populations of organisms in an ecosystem • Predicting patterns of interactions among organisms across multiple ecosystems (e.g. competitive, predatory, and mutually beneficial) • Understanding the cycling of matter and flow of energy among living and non-living parts of an ecosystem • Understanding how changes to physical or biological components of an ecosystem affect populations **Evolution, Heredity, and Genetics** • Explaining why structural changes to genes (mutations) located on chromosomes may affect proteins and may result in harmful, beneficial, or neutral effects • Describing why asexual reproduction results in offspring with identical genetic information and sexual reproduction results in offspring with genetic variation • Analyzing patterns in the fossil record that document the existence, diversity, extinction, and change of life forms throughout the history of life on Earth • Comparing the anatomical similarities and differences among modern organisms and between modern and fossil organisms to infer evolutionary relationships • Comparing patterns of similarities in the embryological development across multiple species to identify relationships not evident in the fully formed anatomy • Describing how genetic variations of traits in a population increase some individuals' probability of surviving and reproducing in a specific environment • Understanding the technologies that have changed the way humans influence the inheritance of desired traits in organisms (e.g. genetic modification, animal husbandry, gene therapy) • Using mathematical representations to explain how natural selection may lead to increases and decreases of specific traits in populations over time

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RATING CRITERIA

Area	Criteria	Example Toy
Science	**Matter** • Describing the atomic composition of simple molecules and extended structures • Analyzing the properties of substances before and after interaction to determine if a chemical reaction has occurred • Understanding that synthetic materials come from natural resources • Predicting and describing changes in particle motion, temperature, and state of a pure substance when thermal energy is added or removed • Understanding that the total number of atoms does not change in a chemical reaction • Understanding that the change in an object's motion depends on the sum of the forces on the object and the mass of the object **Forces, Energy, and Waves** • Determining the factors that affect the strength of electric and magnetic forces • Understanding that gravitational interactions are attractive and depend on the masses of interacting objects • Understanding that fields exist between objects exerting forces on each other even though the objects are not in contact • Describing the relationships of kinetic energy to the mass of an object and to the speed of an object • Understanding that when the arrangement of objects interacting at a distance changes, different amounts of potential energy are stored in the system • Understanding that when the kinetic energy of an object changes, energy is transferred to or from the object • Understanding that the amplitude of a standard repeating wave is related to the energy in a wave, and that waves are reflected, absorbed, or transmitted through various materials	*See example on page 32.*

RATING CRITERIA

Area	Criteria
Science	• Understanding that digitized signals are a more reliable way to encode and transmit information than analog signals **Earth and Astronomy** • Using the Earth-sun-moon system to describe the cyclic patterns of lunar phases, eclipses of the sun and moon, and seasons • Describing the role of gravity in the motions within galaxies and the solar system • Determining scale properties of objects in the solar system (e.g. crust and atmosphere) • Understanding how the geologic time scale is used to organize Earth's 4.6-billion-year-old history **Earth's Systems and Human Activity** • Understanding the cycling of Earth's materials and the flow of energy that drives this process (e.g. melting, crystallization, weathering) • Understanding how geoscience processes have changed Earth's surface at varying time and spatial scales, and how these have led to uneven distributions of Earth's mineral, energy, and groundwater resources • Exploring the distribution of fossils and rocks, continental shapes, and seafloor structures to provide evidence of the past plate motions • Describing the cycling of water through Earth's systems driven by energy from the sun and the force of gravity • Understanding how the motions and complex interactions of air masses results in changes in weather conditions • Understanding how unequal heating and rotation of the Earth cause patterns of atmospheric and oceanic circulation that determine regional climates • Interpreting data on natural hazards to forecast future catastrophic events and inform the development of technologies to mitigate their effects

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RATING CRITERIA

Area	Criteria	Example Toy
Science *(Continued)*	• Understanding how increases in human population and per-capita consumption of natural resources impact Earth's systems • Exploring the factors that have caused the rise in global temperatures over the past century	*See example on page 32.*
Technology	**Digital Tools** • Building networks through online connections (e.g. email) • Using technology tools to support their learning (e.g. text to speech, audio, video, highlighting) • Using technology to seek feedback to inform learning (e.g. spellcheck, online search) • Using technology to demonstrate learning (e.g. digital posters, blogs) • Using basic devices and software applications • Solving technical problems (e.g. restarting a device, installing updates) and transferring this knowledge to new technologies **Digital Citizenship** • Cultivating and managing their digital identity (e.g. social media posts, public comments/reviews) • Understanding the permanence of their actions in the digital world • Engaging in positive, safe, legal and ethical behavior when using technology, including social interactions online or when using networked devices • Understanding the rights and obligations of using and sharing intellectual property • Managing personal data to maintain digital privacy and security and being aware of data-collection technology used to track their navigation online	**SmartLab Toys Archi-Tech Electronic Smart House** A construction kit that allows children to build working models with lights, sounds, and motion in the context of a miniature house. 

RATING CRITERIA

Area	Criteria
Technology	**Information Gathering** • Using effective research strategies to locate information and other resources through digital tools (e.g. using multiple sources, video and audio clips) • Evaluating the accuracy, perspective, credibility and relevance of information, media, data or other resources • Curating information from digital resources using a variety of tools (e.g. note taking, citation tools) • Actively exploring real-world issues and problems using digital tools **Innovation and Creation** • Using a deliberate design process for generating ideas, testing theories, creating innovative artifacts (e.g. 3D printing, computer programs, robotics, simulations, virtual representations, prototypes) or solving authentic problems using technology • Using digital tools to plan and manage a design process that considers design constraints and calculated risks • Developing, testing and refining prototypes as part of a cyclical design process • Choosing appropriate digital platforms (e.g. blog, video) and tools (e.g. digital camera) for meeting the desired objectives of their creation or communication • Creating original works or responsibly repurposing or remixing digital resources into new creations • Communicating complex ideas clearly and effectively by creating or using a variety of digital objects such as visualizations, models or simulations • Customizing content to suit the intended audience

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RATING CRITERIA

Area	Criteria	Example Toy
Technology	**Computational Thinking** • Identifying problems that can benefit from technology-assisted methods such as data analysis, abstract models, and algorithmic thinking in exploring and finding solutions • Collecting (e.g. surveys) or identifying (e.g. big data) relevant data sets and using digital tools to analyze and represent the data to facilitate problem-solving and decision-making • Understanding how technology can be used for repetitive tasks (automation) and using algorithmic thinking to develop a sequence of steps (e.g. coding) to create and test automated solutions **Global Collaboration** • Using digital tools (e.g. virtual conferencing, multiplayer online games) to connect and engage with others from a variety of backgrounds and cultures • Using collaborative technologies (e.g. digital project sites, collaborative schedulers) to work with others, examine issues and problems from multiple viewpoints • Exploring local and global issues and using collaborative technologies to work with others to investigate solutions	*See example on page 36.*

RATING CRITERIA

Area	Criteria	Example Toy
Engineering	**Applied Science** • Constructing, testing, and modifying a device that either releases or absorbs thermal energy by chemical processes • Applying Newton's Third Law to design a solution to a problem involving the motion of two colliding objects • Designing, constructing, and testing a device that either minimizes or maximizes thermal energy transfer • Evaluating design solutions for maintaining biodiversity and ecosystem services (e.g. water purification, nutrient recycling, and prevention of soil erosion) • Designing a method for monitoring and minimizing a human impact on the environment (e.g. reducing water usage, land usage, and pollution) • Defining the criteria and constraints of a design problem with enough precision to ensure a successful solution, considering relevant scientific principles and potential impacts on people and the natural environment that may limit possible solutions **General Engineering** • Evaluating competing design solutions using a systematic process to determine how well they meet the criteria and constraints of the problem • Analyzing data from tests to determine similarities and differences among several design solutions to identify the best characteristics of each that can be combined into a new solution to better meet the criteria for success • Developing 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.	**Ravensburger GraviTrax Starter Set** A construction kit that allows children to build their own working designs, exploring the effect of gravity and magnets. 

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RATING CRITERIA

Area	Criteria	Example Toy
Mathematics	**Numbers, Operations, and Algebra** • Using ratios and proportions to solve problems • Using linear equations • Solving problems using scale drawings • Recognizing the link between fractions, decimals, and percents • Using negative numbers in everyday contexts (e.g. temperature) • Adding, subtracting, multiplying and dividing with negative numbers, and rational numbers • Understanding, comparing and using functions **Shapes and Measurements** • Solving problems using the area, surface area, volume, and circumference of 3D shapes • Understanding congruence and similarity using physical geometric models • Using Pythagorean Theorem **Analysis** • Comparing populations in data • Understanding and using random sampling • Identifying patterns of association in bivariate data	**Winning Moves Rubik's Cube** A 3D puzzle game that encourages children to think mathematically, using patterns and algorithms.