Space Mission Standards

GRADES 3-5

Key Idea	Description of Key Idea	Position
4	**Energy**	
4-PS3-1	Use evidence to construct an explanation relating the speed of an object to the energy of that object	ALL
4-PS3-2	Make observations to provide evidence that energy is conserved as it is transferred and/or converted from one form to another.	ALL
4-PS3-3	Ask questions and predict outcomes about the changes in energy that occur when objects collide.	ALL
4-PS3-4	Apply scientific ideas to design, test, and refine a device that converts energy from one form to another.	LS
5	**Structure and Properties of Matter**	
5-PS1-1	Develop a model to describe that matter is made of particles too small to be seen.	ALL
5-PS1-3	Make observations and measurements to identify materials based on their properties.	REM, LS, ISO
5-PS1-4	Conduct an investigation to determine whether the mixing of two or more substances results in new substances.	LS
5	**Space Systems: Stars and the Solar System**	
5-PS2-1	Support an argument that the gravitational force exerted by Earth on objects is directed down.	ALL
3--5	**Engineering Design**	
3-5-ETS1-1	Define a simple design problem reflecting a need or a want that includes specified criteria for success and constraints on materials, time, or cost.	PROBE, LS
3-5-ETS1-2	Generate and compare multiple possible solutions to a problem based on how well each is likely to meet the criteria and constraints of the problem.	ALL
3-5-ETS1-3	Plan and carry out fair tests in which variables are controlled and failure points are considered to identify aspects of a model or prototype that can be improved.	PROBE, LS

GRADES 6-8

Key Idea	Description of Key Idea	Position
MS	**Structure and Properties of Matter**	
MS-PS1-8	Plan and conduct an investigation to demonstrate that mixtures are combinations of substances.	LS
MS	**Chemical Reactions**	
MS-PS1-2	Analyze and interpret data on the properties of substances before and after the substances interact to determine if a chemical reaction has occurred.	LS
MS-PS1-5	Develop and use a model to describe how the total number of atoms does not change in a chemical reaction and thus mass is conserved.	LS
MS	**Forces and Interactions**	
MS-PS2-3	Ask questions about data to determine the factors that affect the strength of electric and magnetic forces.	ALL
MS-PS2-4	Construct and present arguments using evidence to support the claim that gravitational interactions are attractive and depend on the masses of interacting objects and the distance between them.	ALL
MS	**Energy**	
MS-PS3-1	Construct and interpret graphical displays of data to describe the relationships of kinetic energy to the mass of an object and to the speed of an object.	ALL
MS-PS3-2	Develop a model to describe that when the arrangement of objects interacting at a distance changes, different amounts of potential energy are stored in the system.	ALL
MS-PS3-3	Apply scientific principles to design, construct, and test a device that either minimizes or maximizes thermal energy transfer	LS
MS-PS3-5	Construct, use, and present an argument to support the claim that when work is done on or by a system, the energy of the system changes as energy is transferred to or from the system.	LS
MS-PS3-6	Make observations to provide evidence that energy can be transferred by electric currents	LS, PROBE
MS	**Structure, Function and Information Processing**	
MS-LS1-8	Gather and synthesize information that sensory receptors respond to stimuli, resulting in immediate behavior and/or storage as memories	MED

MS	**Matter and Energy in Organisms and Ecosystems**	
MS-LS1-6	Construct a scientific explanation based on evidence for the role of photosynthesis in the cycling of matter and flow of energy into and out of organisms.	REM
MS	**Groth, Development, and Reproduction of Organisms**	
MS-LS1-5	Construct a scientific explanation based on evidence for how environmental and genetic factors influence the growth of organisms	REM, MED
MS	**Space Systems**	
MS-ESS1-2	Develop and use a model to describe the role of gravity in the motions within galaxies and the solar system.	ALL
MS-ESS1-3	Analyze and interpret data to determine scale properties of objects in the solar system	ALL
MS	**History of Earth**	
MS-ESS2-2	Construct an explanation based on evidence for how geoscience processes have changed Earth's surface at varying temporal and spatial scales.	ALL
MS	**Engineering Design**	
MS-ETS1-1	Define the criteria and constraints of a design problem with sufficient precision to ensure a successful solution, taking into account relevant scientific principles and potential impacts on people and the natural environment that may limit possible solutions.	PROBE, LS
MS-ETS1-2	Evaluate competing design solutions using a systematic process to determine how well they meet the criteria and constraints of the problem.	PROBE, LS
MS-ETS1-3	Analyze 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.	PROBE, LS
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.	PROBE, LS

GRADES 9-12

Key Idea	Description of Key Idea	Position
HS	**Chemical Reactions**	
HS-PS1-11	Plan and conduct an investigation to compare properties and behaviors of acids and bases.	LS
HS	**Forces and Interactions**	
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.	ISO
HS	**Energy**	
HS-PS3-1	Create a computational model to calculate the change in the energy of one component in a system when the change in energy of the other component(s) and energy flows in and out of the system are known.	PROBE, LS
HS-PS3-3	Design, build, and refine a device that works within given constraints to convert one form of energy into another form of energy.	LS
HS	**Space Systems**	
HS-ESS1-4	Use mathematical or computational representations to predict the motion of orbiting objects in the solar system.	ALL
HS	**History of Earth**	
HS-ESS1-6	Apply scientific reasoning and evidence from ancient Earth materials, meteorites, and other planetary surfaces to construct an account of Earth's formation and early history	ALL
HS	**Engineering Design**	
HS-ETS1-2	Design a solution to a complex real-world problem by breaking it down into smaller, more manageable problems that can be solved through engineering.	PROBE

Planetarium Standards

GRADES 3-5

Key Idea	Description of Key Idea	Position
4	**Earth's Systems: Processes that Shape the Earth**	
4-ESS2-2	Analyze and interpret data from maps to describe patterns of Earth's features.	Planetarium
5	**Space Systems: Stars and the Solar System**	
5-PS2-1	Support an argument that the gravitational force exerted by Earth on objects is directed down.	Planetarium
5-ESS1-1	Support an argument that differences in the apparent brightness of the Sun compared to other stars is due to their relative distances from Earth.	Planetarium
5-ESS1-2	Represent data in graphical displays to reveal patterns of daily changes in length and direction of shadows, day and night, and the seasonal appearance of some stars in the night sky.	Planetarium

GRADES 6-8

Key Idea	Description of Key Idea	Position
MS	**Forces and Interactions**	
MS-PS2-4	Construct and present arguments using evidence to support the claim that gravitational interactions are attractive and depend on the masses of interacting objects and the distance between them.	Planetarium
MS	**Space Systems**	
MS-ESS1-1	Develop and use a model of the Earth-Sun-moon system to describe the cyclic patterns of lunar phases, eclipses of the Sun and moon, and seasons	Planetarium
MS-ESS1-2	Develop and use a model to describe the role of gravity in the motions within galaxies and the solar system.	Planetarium
MS-ESS1-3	Analyze and interpret data to determine scale properties of objects in the solar system	Planetarium
MS	**Weather and Climate**	
MS-ESS2-6	Develop and use a model to describe how unequal heating and rotation of Earth cause patterns of atmospheric and oceanic circulation that determine regional climates	Planetarium
MS-ESS3-5	Ask questions to clarify evidence of the factors that have caused the rise in global temperatures over the past century	Planetarium

GRADES 9-12

Key Idea	Description of Key Idea	Position
HS	**Forces and Interactions**	
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.	Planetarium
HS	**Space Systems**	
HS-ESS1-1	Develop a model based on evidence to illustrate the life span of the Sun and the role of nuclear fusion in the Sun's core to release energy that eventually reaches Earth in the form of radiation	Planetarium
HS-ESS1-2	Construct an explanation of the Big Bang theory based on astronomical evidence of light spectra, motion of distant galaxies, and composition of matter in the universe.	Planetarium
HS-ESS1-3	Communicate scientific ideas about the way stars, over their life cycle, produce elements	Planetarium
HS-ESS1-4	Use mathematical or computational representations to predict the motion of orbiting objects in the solar system.	Planetarium
HS-ESS1-7	Construct an explanation using evidence to support the claim that the phases of the moon, eclipses, tides and seasons change cyclically.	Planetarium