Grade Level	Topic	DCI	sub-DCI	sub-sub-DCI	TOTAL	ACTIVITY	VISUALIZATION	VIDEO	Demos/ Experiments	NGSS STANDARD
Elementary School										
NOTE: CLEAN is adding elementary level resources into the collection in spring 2020. This gap analysis doesn't include the new elementary collection										
Middle School					91	81	6	0	2	
	Life Science				**28**	**25**	**0**	**0**	**2**	
		MS-LS1			2	2	0	0	0	
			MS-LS1.C		1	1	0	0	0	
				MS-LS1.C1	1	1	0	0	0	Plants, algae (including phytoplankton), and many microorganisms use the energy from light to make sugars (food) from carbon dioxide from the atmosphere and water through the process of photosynthesis, which also releases oxygen. These sugars can be used immediately o stored for growth or later use.
				MS-LS1.C2	1	0	0	1	0	Within individual organisms, food moves through a series of chemical reactions in which it is broken down and rearranged to form new molecules, to support growth, or to release energy.
				General/Other	1	0	0	0	1	
		MS-LS2			20	17	0	0	2	
			MS-LS2.A		13	13	0	0	0	
				MS-LS2.A1	11	11	0	0	0	Organisms, and populations of organisms, are dependent on their environment interactions both with other living things and with nonliving factors.
				MS-LS2.A2	5	2	0	3	0	In any ecosystem, organisms and populations with similar requirements for food, water, oxygen, or other resources may compete with each other for limited resources, access to which consequently constrains their growth and reproduction.
				MS-LS2.A3	4	4	0	0	0	Growth of organisms and population increases are limited by access to resources.
				MS-LS2.A4	0	0	0	0	0	Similarly, predatory interactions may reduce the number of organisms or eliminate whole populations of organisms. Mutually beneficial interactions, in contrast, may become so interdependent that each organism requires the other for survival. Although the species involved in these competitive, predatory, and mutually beneficial interactions vary across ecosystems, the patterns of interactions of organisms with their environments, both living and nonliving, are shared.
				General/Other	1	1	0	0	0	
			MS-LS2.B		2	1	0	0	1	
				MS-LS2.B1	2	1	0	0	1	Food webs are models that demonstrate how matter and energy is transferred between producers, consumers, and decomposers as the thre groups interact within an ecosystem. Transfers of matter into and out of the physical environment occur at every level. Decomposers recycle nutrients from dead plant or animal matter back to the soil in terrestrial environments or to the water in aquatic environments. The atoms that make up the organisms in an ecosystem are cycled repeatedly between the living and nonliving parts of the ecosystem.
			MS-LS2.C		14	13	0	0	0	
				MS-LS2.C1	12	11	0	0	0	Ecosystems are dynamic in nature; their characteristics can vary over time. Disruptions to any physical or biological component of an ecosystem can lead to shifts in all its populations.
				MS-LS2.C2	2	2	0	0	0	Biodiversity describes the variety of species found in Earth's terrestrial and oceanic ecosystems. The completeness or integrity of an ecosystem's biodiversity is often used as a measure of its health.
				General/Other	2	2	0	0	0	
			General/Other		1	0	1	0	0	
		MS-LS4			1	1	0	0	0	
			MS-LS4.A		1	1	0	0	0	
				MS-LS4.A1	1	1	0	0	0	The collection of fossils and their placements in chronological order (e.g. through the location of the sedimentary layers in which they are found or through radioactive dating) is known as the fossil record. It documents the existence, diversity, extinction, and change of many life forms throughout the history of life on Earth.
			MS-LS4.C		3	0	1	2	0	
				MS-LS4.C1	3	0	1	2	0	Adaptation by natural selection acting over generations is one important process by which species change over time in response to changes in environmental conditions. Traits that support successful survival become more common; those that do not become less common. Thus, the distribution of traits in a population changes.
			MS-LS4.D		41	1	4	36	0	
				MS-LS4.D1	41	1	4	36	0	Changes in biodiversity can influence humans' resources, such as food, energy, and medicines, as well as ecosystems services that humans rely on-- for example, water purification and recycling.
	Physical Science				**3**	**3**	**0**	**0**	**0**	
		MS-PS1			38	8	8	16	6	
			MS-PS1.A		12	6	3	0	3	
				MS-PS1.A1	4	3	1	0	0	Substances are made from different types of atoms, which combine with one another in various ways. Atoms form molecules that range in size from two to thousands of atoms.
				MS-PS1.A3	5	2	0	0	3	Gases and liquids are made of molecules or inert atoms that are moving about relative to each other.
				MS-PS1.A4	3	2	1	0	0	In a liquid, the molecules are constantly in contact with others; in a gas, they are widely spaced except when they happen to collide. In a solid, atoms are closely spaced and may vibrate in position but do not change relative locations.
				MS-PS1.A6	2	1	1	0	0	The changes of state that occur with variations in temperature or pressure can be described and predicted using these models of matter.
			MS-PS1.B		18	3	5	7	3	
				MS-PS1.B1	6	0	2	3	1	Substances react chemically in characteristic ways. In a chemical process, the atoms that make up the original substances are regrouped into different molecules, and these new substances have different properties from those of the reactants.
				MS-PS1.B2	2	1	0	0	1	The total number of each type of atom is conserved, and thus the mass does not change.
				MS-PS1.B3	9	1	3	4	1	Some chemical reactions release energy. Others store energy.
				General/Other	1	1	0	0	0	
		MS-PS3			3	3	0	0	0	

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			MS-PS3.A		28	5	7	15	1	
				MS-PS3.A1	4	0	1	3	0	Motion energy is properly called kinetic energy; it is proportional to the mass of the moving object and grows with the square of its speed.
				MS-PS3.A2	5	0	3	2	0	A system of objects may also contain stored (potential) energy, depending on their relative positions.
				MS-PS3.A3	3	2	1	0	0	Temperature is a measure of the average kinetic energy of particles of matter. The relationship between the temperature and the total energ of a system depends on the types, states, and amounts of matter present.
				MS-PS3.A4	17	2	2	12	1	The term "heat" as used in everyday language refers both to thermal energy (the motion of atoms or molecules within a substance) and the transfer of that thermal energy from one object to another. In science, heat is used only for this second meaning; it refers to the energy transferred due to the temperature difference between two objects.
				MS-PS3.A5	8	1	0	7	0	The temperature of a system is proportional to the average internal kinetic energy and potential energy per atom or molecule (whichever is the appropriate building block for the system's material). The details of that relationship depend on the type of atom or molecule and the interactions among the atoms in the material. Temperature is not a direct measure of a system's total thermal energy. The total thermal energy (sometimes called the total internal energy) of a system depends jointly on the temperature, the total number of atoms in the system, and the state of the material.
			MS-PS3.B		17	3	8	6	0	
				MS-PS3.B1	6	2	2	2	0	When the motion energy of an object changes, there is inevitably some other changes in energy at the same time.
				MS-PS3.B2	12	2	6	4	0	The amount of energy transfer needed to change the temperature of a matter sample by a given amount depends on the nature of the matte the size of the sample, and the environment.
				MS-PS3-B3	4	0	3	1	0	Energy is spontaneously transferred out of hotter regions or objects and into colder ones.
			MS-PS3.C		1	1	0	0	0	
				MS-PS3.C1	1	1	0	0	0	When two objects interact, each one exerts a force on the other that can cause energy to be transferred to or from the object.
			MS-PS3.D		32	2	10	18	2	
				MS-PS3.D1	31	2	9	18	2	The chemical reaction by which plants produce complex food molecules (sugars) requires an energy input (i.e., from sunlight) to occur. In this reaction, carbon dioxide and water combine to form carbon-based organic molecules and release oxygen.
				MS-PS3.D2	31	2	10	18	1	Cellular respiration in plants and animals involve chemical reactions with oxygen that release stored energy. In these processes, complex molecules containing carbon react with oxygen to produce carbon dioxide and other materials.
				General/Other	0	0	0	0	0	
		MS-PS4			2	2	0	0	0	
			MS-PS4.B		2	2	0	0	0	
				MS-PS4.B1	2	2	0	0	0	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.B2	4	1	3	0	0	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.B3	1	1	0	0	0	A wave model of light is useful for explaining brightness, color, and the frequency-dependent bending of light at a surface between media.
	Earth and Space Science				**59**	**50**	**6**	**0**	**1**	
		MS-ESS1			6	5	0	0	0	
			MS-ESS1.A		6	5	0	0	0	
				MS-ESS1.A1	6	5	0	0	0	Patterns of the apparent motion of the sun, the moon and stars in the sky can be observed, described, predicted, and explained with models.
			MS-ESS1.B		5	4	0	0	0	
				MS-ESS1.B1	1	0	1	0	0	The solar system consists of the sun and a collection of objects, including planets, their moons, and asteroids that are held in orbit around the sun by its gravitational pull on them.
				MS-ESS1.B2	5	4	0	0	0	This model of the solar system can explain eclipses of the sun and the moon. Earth's spin axis is fixed in direction over the short-term but tilted relative to its orbit around the sun. The seasons are a result of that tilt and are caused by the differential intensity of sunlight on different areas of Earth across the year.
			MS-ESS1.C		2	1	1	0	0	
				MS-ESS1.C1	2	1	1	0	0	The geologic time scale interpreted from rock strata provides a way to organize Earth's history. Analyses of rock strata and the fossil record provide only relative dates, not an absolute scale.
		MS-ESS2			20	18	2	0	0	
			MS-ESS2.A		2	2	0	0	0	
				MS-ESS2.A1	19	6	3	8	2	All Earth processes are the result of energy flowing and matter cycling within and among the planet's system. This energy is derived from the sun and Earth's hot interior. The energy that flows and matter that cycles produce chemical and physical changes in Earth's materials and living organisms.
				MS-ESS2.A2	2	2	0	0	0	The planet's systems interact over scales that range from microscopic to global in size, and they operate over fractions of a second to billions of years. These interactions have shaped Earth's history and will determine its future.
				General/Other	1	1	0	0	0	
			MS-ESS2.C		12	12	0	0	0	
				MS-ESS2.C1	3	3	0	0	0	Water continually cycles among land, ocean, and atmosphere via transpiration, evaporation, condensation and crystallization, and precipitation, as well as downhill flows on land.
				MS-ESS2.C2	7	7	0	0	0	The complex patterns of the changes and the movement of water in the atmosphere, determined by winds, landforms, and ocean temperatures and currents, are major determinants of local weather patterns.
				MS-ESS2.C3	5	5	0	0	0	Global movements of water and its changes in form are propelled by sunlight and gravity.
				MS-ESS2.C4	2	2	0	0	0	Variations in density due to variations in temperature and salinity drive a global pattern of interconnected ocean currents.

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				MS-ESS2.C5	15	1	8	6	0	Water's movements-- both on land and underground-- cause weathering and erosion, which change the land's surface features and create underground formations.
				General/Other	1	1	0	0	0	
			MS-ESS2.D		12	10	2	0	0	
				MS-ESS2.D1	11	9	2	0	0	Weather and climate are influenced by interactions involving sunlight, the ocean, the atmosphere, ice, landforms, and living things. These interactions vary with latitude, altitude, and local and regional geography, all of which can affect oceanic and atmospheric flow patterns.
				MS-ESS2.D2	2	1	1	0	0	Because these patterns are so complex, weather can only be predicated probabilistically.
				MS-ESS2.D3	5	5	0	0	0	The ocean exerts a major influence on weather and climate by absorbing energy from the sun, releasing it over time, and globally redistributing it through ocean currents.
		MS-ESS3			36	30	3	0	1	
			MS-ESS3.A		5	5	0	0	0	
				MS-ESS3.A1	5	5	0	0	0	Humans depend on Earth's land, ocean, atmosphere, and biosphere for many different resources. Minerals, fresh water, and biosphere resources are limited, and many are not renewable or replaceable over human lifetimes. These resources are distributed unevenly around th planet as a result of past geologic processes.
			MS-ESS3.B		4	4	0	0	0	
				MS-ESS3.B1	4	4	0	0	0	Mapping the history of natural hazards in a region, combined with an understanding of related geologic forces can help forecast the locations and likelihoods of future events.
			MS-ESS3.C		12	8	2	0	0	
				MS-ESS3.C1	7	4	1	0	0	Humans activities have significantly altered the biosphere, sometimes damaging or destroying natural habitats and causing the extinction of other species. But changes to Earth's environments can have different impacts (negative and positive) for different living things.
				MS-ESS3.C2	6	4	1	0	0	Typically as human populations and per-capita consumption of natural resources increase, so do the negative impacts on Earth unless the activities and technologies involved are engineered otherwise.
				General/Other	5	0	5	0	0	
			MS-ESS3.D		19	13	3	0	1	
				MS-ESS3.D1	18	13	2	0	1	Human activities, such as the release of greenhouse gases from burning fossil fuels, are major factors in the current rise in Earth's mean surface temperature (global warming). Reducing the level of climate change and reducing human vulnerability to whatever climate changes do occur depend on the understanding of climate science, engineering capabilities, and other kinds of knowledge, such as understanding of human behavior and on applying that knowledge wisely in decisions and activities.
				General/Other	9	0	9	0	0	
	Engineering, Technology, and Applications of Science				**14**	**13**	**0**	**0**	**1**	
		MS-ETS1			14	13	0	0	1	
			MS-ETS1.A		8	5	3	0	0	
				MS-EST1.A1	8	5	3	0	0	The more precisely a design task's criteria and constraints can be defined, the more likely it is that the designed solution will be successful. Specification of constraints includes consideration of scientific principles and other relevant knowledge that are likely to limit possible solutions.
			MS-ETS1.B		16	12	3	0	1	
				MS-ETS1.B1	5	3	2	0	0	A solution needs to be tested, and then modified on the basis of the test results, in order to improve it.
				MS-ETS1.B2	8	5	2	0	1	There are systematic processes for evaluating solutions with respect to how well they meet the criteria and constraints of a problem.
				MS-ETS1.B3	5	3	1	0	1	Sometimes parts of different solutions can be combined to create a solution that is better than any of its predecessors.
				MS-ETS1.B4	3	1	2	0	0	Models of all kinds are important for testing solutions.
			MS-ETS1.C		5	3	1	0	1	
				MS-ETS1.C1	5	3	1	0	1	Although one design may not perform the best across all tests, identifying the characteristics of the design that performed the best in each test can provide useful information for the redesign process-- that is, some of those characteristics may be incorporated into the new design.
				MS-ETS1.C2	1	1	0	0	0	The interactive 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.
			General/Other		4	4	0	0	0	
High School					171	140	26	0	4	
	Life Science				**33**	**29**	**1**	**0**	**3**	
		HS-LS1			5	4	0	0	1	
			HS-LS1.A		1	0	0	1	0	
				HS-LS1.A1	1	0	0	1	0	Systems of specialized cells within organisms help them perform the essential functions of life.
			HS-LS1.C		5	4	0	0	1	
				HS-LS1.C1	2	2	0	0	0	The process of photosynthesis converts light energy to stored chemical energy by converting carbon dioxide plus water into sugars plus released oxygen.
				HS-LS1.C2	1	1	0	0	0	The sugar molecules thus formed contain carbon, hydrogen, and oxygen: their hydrocarbon backbones are used to make amino acids and other carbon-based molecules that can be assembled into larger molecules (such as proteins or DNA), used for example to form new cells.
				HS-LS1.C3	3	2	0	0	1	As matter and energy flow through different organizational levels of living systems, chemical elements are recombined in different ways to form different products.

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				HS-LS1.C4	1	0	0	0	1	As a result of these chemical reactions, energy is transferred from one system of interacting molecules to another. Cellular respiration is a chemical process in which the bonds of food molecules and oxygen molecules are broken and new compounds are formed that can transport energy to muscles. Cellular respiration also releases the energy needed to maintain body temperature despite ongoing energy transfer to the surrounding environment.
		HS-LS2			29	25	1	0	3	
			HS-LS2.A		8	6	1	1	0	
				HS-LS2.A1	7	5	1	1	0	Ecosystems have carrying capacities, which are limits to the numbers of organisms and populations they can support. These limits result from such factors as the availability of living and nonliving resources and from such challenges such as predation, competition, and disease. Organisms would have the capacity to produce populations of great size were it not for the fact that environments and resources are finite. This fundamental tension affects the abundance (number of individuals) of species in any given ecosystem.
				General/Other	2	1	1	0	0	
			HS-LS2.B		46	11	20	10	5	
				HS-LS2.B1	3	1	0	1	1	Photosynthesis and cellular respiration (including anaerobic processes) provide most of the energy for life processes.
				HS-LS2.B2	6	1	1	3	1	Plants or algae form the lowest level of the food web. At each link upward in a food web, only a small fraction of the matter consumed at the lower level is transferred upward, to produce growth and release energy in cellular respiration at the higher level. Given this inefficiency, there are generally fewer organisms at higher levels of a food web. Some matter reacts to release energy for life functions, some matter is stored in newly made structures, and much is discarded. The chemical elements that make up the molecules of organisms pass through food webs and into and out of the atmosphere and soil, and they are combined and recombined in different ways. At each link in an ecosystem, matter and energy are conserved.
				HS-LS.B3	44	9	20	10	5	Photosynthesis and cellular respiration are important components of the carbon cycle, in which carbon is exchanged among the biosphere, atmosphere, oceans, and geosphere through chemical, physical, geological, and biological processes.
			HS-LS2.C		72	30	7	34	1	
				HS-LS2.C1	30	12	0	18	0	A complex set of interactions within an ecosystem can keep its numbers and types of organisms relatively constant over long periods of time under stable conditions. If a modest biological or physical disturbance to an ecosystem occurs, it may return to its more or less original status (i.e., the ecosystem is resilient), as opposed to becoming a very different ecosystem. Extreme fluctuations in conditions or the size of any population, however, can challenge the functioning of ecosystems in terms of resources and habitat availability.
				HS-LS2.C2	60	20	5	34	1	Moreover, anthropogenic changes (induced by human activity) in the environment-- including habitat destruction, pollution, introduction of invasive species, overexploitation, and climate change-- can disrupt an ecosystem and threaten the survival of some species.
				General/Other	9	7	2	0	0	
		HS-LS4			34	10	7	17	0	
			HS-LS4.C		16	7	3	6	0	
				HS-LS4.C.3	1	0	0	1	0	Adaptation also means that the distribution of traits in a population can change when conditions change.
				HS-LS4.C4	16	7	3	6	0	Changes in the physical environment, whether naturally occurring or human induced, have thus contributed to the expansion of some species, the emergence of new distinct species as populations diverge under different conditions, and the decline- and sometimes the extinction-of some species.
				HS-LS4.C5	3	1	0	2	0	Species become extinct because they can no longer survive and reproduce in their altered environment. If members cannot adjust to change that is too fast or drastic, the opportunity for the species' evolution is lost.
			HS-LS4.D		26	3	6	17	0	
				HS-LS4.D1	24	3	4	17	0	Humans depend on the living world for the resources and other benefits provided by biodiversity. But human activity is also having adverse impacts on biodiversity through overpopulation, overexploitation, habitat destruction, pollution, introduction of invasive species, and climate change. Thus sustaining biodiversity so that ecosystem functioning and productivity are maintained is essential to supporting and enhancing life on Earth. Sustaining biodiversity also aids humanity by preserving landscapes of recreational or inspirational value.
				HS-LS4.D2	22	2	0	20	0	Biodiversity is increased by the formation of new species (speciation) and decreased by the loss of species (extinction).
				General/Other	2	0	2	0	0	
				General/Other	1	0	1	0	0	
	Physical Science				**20**	**15**	**5**	**0**	**0**	
		HS-PS1			4	4	0	0	0	
			HS-PS1.A		6	1	5	0	0	
				HS-PS1.A1	2	1	1	0	0	Each atom has a charged substructure consisting of a nucleus, which is made of protons and neutrons, surrounded by electrons.
				HS-PS1.A3	3	0	3	0	0	The structure and interactions of matter at the bulk scale are determined by electrical forces within and between atoms.
				HS-PS1.A4	4	0	4	0	0	A stable molecule has less energy than the same set of atoms separated; one must provide at least this energy in order to take the molecule apart.
			HS-PS1.B		16	7	4	4	1	
				HS-PS1.B1	8	3	2	2	1	Chemical processes, their rates, and whether or not energy is stored or released can be understood in terms of the collisions of molecules and the rearrangements of atoms into new molecules, with consequent changes in the sum of all bond energies in the set of molecules that are matched by changes in kinetic energy.
				HS-PS1.B2	5	3	1	1	0	In many situations, a dynamic and condition-dependent balance between a reaction and the reverse reaction determines the numbers of all types of molecules present.
				HS-PS1.B3	5	3	1	1	0	The fact that atoms are conserved, together with knowledge of the chemical properties of the elements involved, can be used to describe an predict chemical reactions.
			HS-PS1.C		2	0	1	1	0	
				HS-PS1.C1	2	0	1	1	0	Nuclear processes, including fusion, fission, and radioactive decays of unstable nuclei, involve release or absorption of energy. The total number of neutrons plus protons does not change in any nuclear process.

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				HS-PS1.C2	1	0	0	1	0	Spontaneous radioactive decays follow a characteristic exponential decay law. Nuclear lifetimes allow radiometric dating to be used to determine the ages of rocks and other materials.
		HS-PS2			0					
			HS-PS2.A		2	0	1	1	0	
				HS-PS2.A2	2	0	1	1	0	Momentum is defined for a particular frame of reference; it is the mass times the velocity of the object.
				HS-PS2.A3	2	0	1	1	0	If a system interacts with object outside itself, the total momentum of the system can change; however, any such change is balanced by changes in the momentum of objects outside the system.
			HS-PS2.B		1	1	0	0	0	
				HS-PS2.B3	1	1	0	0	0	Attraction and repulsion between electric charges at the atomic scale explain the structure, properties, and transformations of matter, as well as the contact force between material objections.
		HS-PS3			13	9	4	0	0	
			HS-PS3.A		37	9	7	21	0	
				HS-PS3.A1	17	5	3	9	0	Energy is a quantitative property of a system that depends on the motion and interactions of matter and radiation within that system. That there is a single quantity called energy is due to the fact that a system's total energy is conserved, even as, within the system, energy is continually transferred from one object to another and between its various possible forms.
				HS-PS3.A2	29	4	4	21	0	At the macroscopic scale, energy manifests itself in multiple ways, such as in motion, sound, light, and thermal energy.
				HS-PS3.A3	7	1	1	5	0	These relationship are better understood at the microscopic scale at which all of the different manifestations of energy can be modeled as a combination of energy associated with the motion of particles and energy associated with the configuration (relative position of the particles). In some cases the relative position energy can be thought of as stored in fields (which mediate interactions between particles). This last concept includes radiation, a phenomenon in which energy stored in fields moves across space.
				HS-PS3.A5	7	2	3	2	0	"Electrical energy" may mean energy stored in a battery or energy transmitted by electric currents.
				General/Other	3	1	1	0	0	
			HS-PS3.B		43	12	14	15	2	
				HS-PS3.B1	10	4	2	4	0	Conservation of energy means that the total change of energy in any system is always equal to the total energy transferred into or out of the system.
				HS-PS3.B2	34	7	10	15	2	Energy cannot be created or destroyed, but it can be transported from one place to another and transferred between systems.
				HS-PS3.B3	2	0	1	1	0	Mathematical expressions, which quantify how the stored energy in a system depends on its configuration (e.g. relative positions of charged particles, compression of a spring) and how kinetic energy depends on mass and speed, allow the concept of conservation of energy to be used to predict and describe system behavior.
				HS-PS3.B4	18	3	10	5	0	The availability of energy limits what can occur in any system.
				HS-PS3.B5	2	0	2	0	0	Uncontrolled systems always evolve toward more stable states-- that is, toward more uniform energy distribution (e.g., water flows downhill, objects hotter that their surrounding environment cool down).
			HS-PS3.D		42	12	14	16	0	
				HS-PS3.D1	42	12	14	16	0	Although energy cannot be destroyed, it can be converted to less useful forms-- for examples, to thermal energy in the surrounding environment.
				HS-PS3.D2	34	3	12	17	2	The main way that solar energy is captured and stored on Earth is through the complex chemical process known as photosynthesis.
				HS-PS3.D3	19	6	3	10	0	Solar cells are human-made devices that likewise capture the sun's energy and procure electrical energy.
				HS-PS3.D____	0					Nuclear Fusion processes in the center of the sun release the energy that ultimately reaches Earth as radiation.
				General/Other	2	0	2	0	0	
		HS-PS4			34	15	4	15	0	
			HS-PS4.A		2	1	0	1	0	
				HS-PS4.A1	2	1	0	1	0	The wavelength and frequency of a wave are related to one another by the speed of travel of the wave, which depends on the type of wave and the medium through which it is passing.
			HS-PS4.B		25	9	3	13	0	
				HS-PS4.B1	10	0	1	9	0	Electromagnetic radiation (e.g., radio, microwaves, light) can be modeled as a wave of changing electric and magnetic fields or as particles called photons. The wave model is useful for explaining many feature of electromagnetic radiation, and the particle model explains other features.
				HS-PS4.B2	12	7	1	4	0	When light or longer wavelength electromagnetic radiation is absorbed in matter, it is generally converted into thermal energy (heat). Shorter wavelength electromagnetic radiation (ultraviolet, X-rays, gamma rays) can ionize atoms and cause damage to living cells.
				HS-PS4.B3	12	1	2	9	0	Photoelectric materials emit electrons when they absorb light of a high enough frequency.
				HS-PS4.B4	1	1	0	0	0	Atoms of each element emit and absorb characteristic frequencies of light. These characteristics allow identification of the presence of an element, even in microscopic quantities.
				General/Other	1	1	0	0	0	
	Earth and Space Science				**146**	**118**	**26**	**0**	**1**	
		HS-ESS1			5	4	1	0	0	
			HS-ESS1.A		1	1	0	0	0	
				HS-ESS1.A2	1	1	0	0	0	The study of stars' light spectra and brightness is used to identify compositional elements of stars, their movements, and their distances from Earth.
			HS-ESS1.B		3	2	1	0	0	
				HS-ESS1.B1	3	2	1	0	0	Kepler's laws describe common features of the motions of orbiting objects, including their elliptical paths around the sun. Orbits may change due to the gravitational effects from, or collisions with, other objects in the solar system.
				HS-ESS1.B2	16	6	3	7	0	Cyclical changes in the shape of Earth's orbit around the sun, together with changes in the tilt of the planet's axis of rotation, both occurring over hundreds of thousands of years, have altered the intensity and distribution of sunlight falling on the earth. These phenomena cause a cycle of ice ages and other gradual climate changes.
				General/Other	1	0	1	0	0	

Grade Level	Topic	DCI	sub-DCI	sub-sub-DCI	TOTAL	ACTIVITY	VISUALIZATION	VIDEO	Demos/ Experiments	NGSS STANDARD
				General/Other	1	0	1	0	0	
			HS-ESS1.C		1	0	1	0	0	
				HS-ESS1.C2	1	0	1	0	0	Although active geologic processes, such as plate tectonics and erosion, have destroyed or altered most of the very early rock record on Earth, other objects in the solar system, such as lunar rocks, asteroids, and meteorites, have changed little over billions of years. Studying these objects can provide information about Earth's formations and early history.
		HS-ESS2			56	45	10	0	0	
			HS-ESS2.A		83	31	9	42	0	
				HS-ESS2.A1	64	17	7	39	0	Earth's systems, being dynamic and interacting, cause feedback effects that can increase or decrease the original changes.
				HS-ESS2.A2	2	0	0	2	0	Evidence from deep probes and seismic waves, reconstructions of historical changes in Earth's surface and its magnetic field, and an understanding of physical and chemical processes lead to a model of Earth with a hot but solid mantle and crust. Motions of the mantle and its plates occur primarily through thermal convection, which involves the cycling of matter due to the outward flow of energy from Earth's interior and gravitational movement of denser materials toward the interior.
				HS-ESS2.A3	43	18	5	20	0	The geological record shows that changes to global and regional climate can be caused by interactions among changes in the sun's energy output or Earth's orbit, tectonic events, ocean circulation, volcanic activity, glaciers, vegetation, and human activates. These changes can occur on a variety of time scales from sudden (e.g., volcanic ash cloud) to intermediate (ice ages) to very long-term tectonic cycles.
			HS-ESS2.B		3	0	1	2	0	
				HS-ESS2.B1	1	0	0	1	0	The radioactive decay of unstable isotopes continually generates new energy within Earth's crust and mantle, providing the primary source of the heat that drives mantle convection. Plate tectonics can be viewed as the surface expression of mantle convection.
				HS-ESS2.B2	2	0	1	1	0	Plate tectonics is the unifying theory that explains the past and current movements of the rocks at Earth's surface and provides a framework for understanding its geologic history. Plate movements are responsible for most continental and ocean-floor features and for the distribution of most rocks and minerals within Earth's crust.
			HS-ESS2.C		72	7	18	45	2	
				HS-ESS2.C1	72	7	18	45	2	The abundance of liquid water on Earth's surface and its unique combination of physical and chemical prosperities are central to the planet's dynamics. These properties include water's exceptional capacity to absorb, store, and release large amounts of energy, transmit sunlight, expand upon freezing, dissolve and transport materials, and lower the viscosities and melting points of rocks.
				General/Other	1	0	1	0	0	
			HS-ESS2.D		305	73	64	164	3	
				HS-ESS2.D1	258	56	40	159	2	The foundation for Earth's climate systems is the electromagnetic radiation from the sun, as well as its reflection, absorption, storage, and redistribution among the atmosphere, ocean, and land systems, and this energy's re-radiation into space.
				HS-ESS2.D2	59	6	25	27	0	Gradual atmospheric changes were due to plants and other organisms that captured carbon dioxide and released oxygen.
				HS-ESS2.D3	158	26	43	88	1	Changes in the atmosphere due to human activity have increased carbon dioxide concentrations and thus affect climate.
				HS-ESS2.D4	132	54	38	38	2	Current models predict that, although future regional climate changes will be complex and varied, average global temperatures will continue to rise. The outcomes predicted by global climate models strongly depend on the amounts of human-generated greenhouse gases added to the atmosphere each year and by the ways in which these gases are absorbed by the ocean and biosphere.
				General/Other	5	1	4	0	0	
				General/Other	1	0	1	0	0	
			HS-ESS2.E		99	8	32	58	0	
				HS-ESS2.E1	99	8	32	58	0	The many dynamic and delicate feedbacks between the biosphere and other Earth systems cause a continual co-evolution of Earth's surfaces and the life that exists on it.
				General/Other	2	0	2	0	0	
		HS-ESS3			391	130	87	170	2	
			HS-ESS3.A		128	45	18	64	1	
				HS-ESS3.A1	64	9	12	43	0	Resource availability has guided the development of human society.
				HS-ESS3.A2	105	36	16	52	1	All forms of energy production and other resources extraction have associated economic, social, environmental, and geopolitical costs and risks as well as benefits. New technologies and social regulations can change the balance of these factors.
				General/Other	7	4	3	0	0	
			HS-ESS3.B		9	2	2	5	0	
				HS-ESS3.B1	9	2	2	5	0	Natural hazards and other geologic events have shaped the course of human history; [they] have significantly altered the sizes of human populations and have driven human migrations.
			HS-ESS3.C		96	35	14	44	1	
				HS-ESS3.C1	67	15	8	43	0	The sustainability of human societies and the biodiversity that supports them requires responsible management of natural resources.
				HS-ESS3.C2	35	22	5	6	1	Scientists and engineers can make major contributions by developing technologies that produce less pollution and waste and that preclude ecosystem degradation.
				General/Other	8	2	6	0	0	
			HS-ESS3.D		175	49	51	75	0	
				HS-ESS3.D1	142	30	41	71	0	Though the magnitudes of human impacts are greater than they have ever been, so too are human abilities to model, predict, and manage current and future impacts.
				HS-ESS3.D2	44	16	15	13	0	Through computer simulations and other studies, important discoveries are still being made about how the ocean, the atmosphere, and the biosphere interact and are modified in response to human activities.
				General/Other	12	7	5	0	0	
	Engineering, Technology, and Applications of Science				**29**	**24**	**2**	**0**	**3**	
		HS-ETS1			29	24	2	0	3	
			HS-ETS1.A		71	18	10	39	4	

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				HS-ETS1.A1	16	3	3	9	1	Criteria and constraints also include satisfying any requirements set by society, such as taking issues of risk mitigation into account, and they should be quantified to the extent possible and stated in such a way that one can tell if a given design meets them.
				HS-ETS1.A2	55	15	7	30	3	Humanity faces major global challenges today, such as the need for supplies of clean water and food or for energy sources that minimize pollution, which can be addressed through engineering. These global challenges also may have manifestations in local communities.
			HS-ETS1.B		61	31	8	20	2	
				HS-ETS1.B1	49	21	6	20	2	When evaluating solutions, it is important to take into account a range of constraints, including cost, safety, reliability, and aesthetics, and to consider social, cultural, and environmental impacts.
				HS-ETS1.B2	7	5	2	0	0	Both physical models and computers can be used in various ways to aid in the engineering design process. Computers are useful for a variety of purposes, such as running simulation to test different ways of solving a problem or to see which one is most efficient or economical; and in making a persuasive presentation to a client about how a given design will meet his or her needs.
				General/Other	5	5	0	0	0	
			HS-ETS1.C		11	5	3	3	0	
				HS-ETS1.C1	10	4	3	3	0	Criteria may need to be broken down into simpler ones that can be approached systematically, and decisions about the priority of certain criteria over others (trade-offs) may be needed.
				General/Other	1	1	0	0	0	
			General/Other		1	1	0	0	0	