

2020 RECYCLING POSTER & VIDEO CONTEST

HELPFUL TIPS FOR TEACHERS

THEN, NOW & INTO THE FUTURE!

Matrix of Possible Standards to Connect to:

(Source: National Science Teacher's Association, Based on final release of NGSS 2013)

Primary School (Grades K-2)	Elementary School (Grades 3-5)	Middle School (Grades 6-8)	High School (Grades 9-12)
ESS3: Earth and Human Activity			
ESS3.A Natural Resources			
<ul style="list-style-type: none"> Living things need water, air, and resources from the land, and they live in places that have the things they need. Humans use natural resources for everything they do. (K-ESS3-1) 	<ul style="list-style-type: none"> Energy and fuels that humans use are derived from natural sources, and their use affects the environment in multiple ways. Some resources are renewable over time, and others are not. (4-ESS3-1) 	<ul style="list-style-type: none"> 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 the planet as a result of past geologic processes. (MS-ESS3-1) 	<ul style="list-style-type: none"> Resource availability has guided the development of human society. (HS-ESS3-1) All forms of energy production and other resource 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. (HS-ESS3-2)
ESS3.C Human Impacts on Earth Systems			
<ul style="list-style-type: none"> Things that people do to live comfortably can affect the world around them. But they can make choices that reduce their impacts on the land, water, air, and other living things. (K-ESS3-3) (secondary to K-ESS2-2) 	<ul style="list-style-type: none"> Human activities in agriculture, industry, and everyday life have had major effects on the land, vegetation, streams, ocean, air, and even outer space. But individuals and communities are doing things to help protect Earth's resources and environments. (5-ESS3-1) 	<ul style="list-style-type: none"> Human 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-ESS3-3) 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. (MSESS3-3),(MS-ESS3-4) 	<ul style="list-style-type: none"> The sustainability of human societies and the biodiversity that supports them requires responsible management of natural resources. (HS-ESS3-3) Scientists and engineers can make major contributions by developing technologies that produce less pollution and waste and that preclude ecosystem degradation. (HS-ESS3-4)
ESS3.D Global Climate Change			
		<ul style="list-style-type: none"> 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. (MS-ESS3-5) 	

Primary School (Grades K-2)	Elementary School (Grades 3-5)	Middle School (Grades 6-8)	High School (Grades 9-12)
Engineering, Technology, and the Application of Science			
ETS1: Engineering Design			
ETS1.A Defining and Delimiting an Engineering Problem			
<ul style="list-style-type: none"> • A situation that people want to change or create can be approached as a problem to be solved through engineering. Such problems may have many acceptable solutions. (K-2-ETS1-1) (secondary to KPS2-2) • Asking questions, making observations, and gathering information are helpful in thinking about problems. (K-2-ETS1-1) (secondary to K-ESS3-2) • Before beginning to design a solution, it is important to clearly understand the problem. (K-2-ETS1-1) 	<ul style="list-style-type: none"> • Possible solutions to a problem are limited by available materials and resources (constraints). The success of a designed solution is determined by considering the desired features of a solution (criteria). Different proposals for solutions can be compared on the basis of how well each one meets the specified criteria for success or how well each takes the constraints into account. (3-5-ETS1-1) (secondary to 4-PS3-4) 	<ul style="list-style-type: none"> • 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 is likely to limit possible solutions. (MS-ETS1-1) (secondary to MS-PS3-3) 	<ul style="list-style-type: none"> • 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-ETS1-1) (secondary to HS-PS2-3) (secondary to HS-PS3-3) • 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-ETS1-1)
ETS1.B Developing Possible Solutions			
<ul style="list-style-type: none"> • Designs can be conveyed through sketches, drawings, or physical models. These representations are useful in communicating ideas for a problem's solutions to other people. (K-2-ETS1-1) (secondary to K-ESS3-3) (secondary to 2-LS2-2) 	<ul style="list-style-type: none"> • Research on a problem should be carried out before beginning to design a solution. Testing a solution involves investigating how well it performs under a range of likely conditions. (3-5-ETS1-2) • At whatever stage, communicating with peers about proposed solutions is an important part of the design process, and shared ideas can lead to improved designs. (3-5-ETS1-2) • Tests are often designed to identify failure points or difficulties, which suggest the elements of the design that need to be improved. (3-5-ETS1-3) • Testing a solution involves investigating how well it performs under a range of likely conditions. (secondary to 4-ESS3-2) 	<ul style="list-style-type: none"> • A solution needs to be tested, and then modified on the basis of the test results, in order to improve it. (MS-ETS1-4) (secondary to MS-PS1-6) • There are systematic processes for evaluating solutions with respect to how well they meet criteria and constraints of a problem. MS-ETS1-2), (MS-ETS1-3) (secondary to MS-PS3-3) (secondary to MS-LS2-5) • Sometimes parts of different solutions can be combined to create a solution that is better than any of its predecessors. (MS-ETS1-3) • Models of all kinds are important for testing solutions. (MS-ETS1-4) 	<ul style="list-style-type: none"> • 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. (secondary to HS-LS2-7) (secondary to HS-LS4-6) (secondary to HS-ESS3-2),(secondary HS-ESS3-4) (HS-ETS1-3) • 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 simulations 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. (HS-ETS1-4) (secondary to HS-LS4-6)

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Physical Science			
PS1: Matter and Its Interactions			
PS1.A Structures and Properties of Matter			
<ul style="list-style-type: none"> • Different kinds of matter exist. Matter can be described and classified by its observable properties. (2-PS1-1) • Different properties are suited to different purposes. (2-PS1-2),(2-PS1-3) • A great variety of objects can be built up from a small set of pieces. (2-PS1-3) 	<ul style="list-style-type: none"> • Measurements of a variety of properties can be used to identify materials. (Boundary: At this grade level, mass and weight are not distinguished, and no attempt is made to define the unseen particles or explain the atomic-scale mechanism of evaporation and condensation.) (5-PS1-3) 	<ul style="list-style-type: none"> • 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-PS1-1) • Each pure substance has characteristic physical and chemical properties (for any bulk quantity under given conditions) that can be used to identify it. (MS-PS1-2), (MS-PS1-3) 	<ul style="list-style-type: none"> • Each atom has a charged substructure consisting of a nucleus, which is made of protons and neutrons, surrounded by electrons. (HS-PS1-1) • The periodic table orders elements horizontally by the number of protons in the atom's nucleus and places those with similar chemical properties in columns. The repeating patterns of this table reflect patterns of outer electron states. (HS-PS1-1),(HS-PS1-2)

- Note, in the recycling process, many commodities undergo physical and chemical changes. For example, plastics are shredded into very tiny pieces, and sorted according to densities. When plastics of different grades or densities are combined and recombined, the integrity of the material is compromised. Thus, it is crucial to a successful recycling process that only plastics of the same grades and densities are processed together.

Recommended Possible Science and Engineering Practices

- Asking questions (for science) and defining problems (for engineering)
- Developing and using models
- Constructing explanations (for science) and designing solutions (for engineering)
- Obtaining, evaluating, and communicating information

Recommended Possible Crosscutting Concepts

- **Patterns.** Observed patterns of forms and events guide organization and classification, and they prompt questions about relationships and the factors that influence them.
- **Cause and Effect: Mechanism, Explanation and Prediction:** Events have causes, sometimes simple, sometimes multifaceted. A major activity of science is investigating and explaining causal relationships and the mechanisms by which they are mediated. Such mechanisms can then be tested across given contexts and used to predict and explain events in new contexts.
- **Systems and System Models.** Defining the system under study—specifying its boundaries and making explicit a model of that system—provides tools for understanding and testing ideas that are applicable throughout science and engineering.
- **Energy and Matter:** Flows, cycles, and conservation. Tracking fluxes of energy and matter into, out of, and within systems helps one understand the systems' possibilities and limitations.
- **Structure and Function.** The way in which an object or living thing is shaped and its substructure determine many of its properties and functions.