Anchor Phenomena

Anchor Phenomenon Title	DCI	Anchor Phenomenon Question	Description/Story of Phenomenon	Scaffolding Questions (if needed)	Additional links	Video or Picture links	Resources (pdf/ word document)
Weather	**6th grade Earth and Space Science. 6.ESS2.3, 6.ESS2.5, 6.ESS2.6**	What causes differences in weather and climate?	SEE IN EARTH AND SPACE SCIENCE TAB				
	7th Grade Earth and Space Science. 7.ESS3.2	Weather happens in the troposphere. What effect can humans have on the atmosphere and how can this affect weather patterns?	See ESS3.2 - Students will investigate how human's have impacted the Earth's atmosphere and the effects it has had on weather and climate in various regions around the world.				research, graphing
	8th Grade Pysical Science 8.PS4.2	How has weather satellites improved our understanding of weather?	Students will investigate how satellites are used in weather forecasting.	Why is it important to accurately predict the weather? What are some positive outcomes of knowing when a storm is coming?	Weather Satellites https://www.weather.gov/jetstream/satellites How do satellites track weather and climate change? https://milesobrien.com/satellites-track-weather-climate-change/	How we use weather satellites https://aerospaceamerica.aiaa.org/features/storm-warning/	NASA Mission Studying Weather and Climate https://climatekids.nasa.gov/menu/weather-and-climate/ Students to select one mission and write/illustrate/ computer presentation on one of the satellite missions
COVID-19 Pandemic	**7th Grade Earth and Space Science 7.ESS3.2**	How does a pandemic cause less CO2?	Closed schools and non-essential businesses and official stay-at-home mandates kept millions of people at home and across the globe. How did concentrations of greenhouse gasses change as the world-wide spread of the coronavirus increased?	What are the layers of the atmosphere? In which layer do organisms reside? What is the importance of carbon dioxide?	https://www.nsta.org/lesson-plan/how-does-pandemic-cause-less-co2	More information and links included in original web page.	
	8th Grade Earth Science 8.ESS2.3	How has COVID 19 changed the atmosphere??	Students will compare before and after pictures of the atmosphere of different locations on the earth and explain what happened.	What are intended and unintended consequences ?What are some of the unintended consequences of COVID 19? Have all of the unintended consequences been negative? Can you name some unintended consequences that were positive?	Air pollution levels https://www.q13fox.com/news/before-and-after-images-show-how-air-pollution-levels-have-dropped-around-the-world-amid-covid-19-lockdowns Dramatic Decline of air pollution https://www.cbsnews.com/news/coronavirus-photos-decline-air-pollution-lockdown/ https://www.youtube.com/watch?v=UVxWWW63SdU	Before and After Picture in different countries around the world https://www.bbc.com/news/world-asia-india-52313972	
Mosquitoes	**6th grade Life Science- 6.LS2.1, 6.LS2.2, 6.LS2.3**	How would the extinction of mosquitoes impact ecosystems?	Mosquitoes are a known pest to anyone in the South. Not only are mosquitoes an issue, but they could have a major positive impact on the ecosystems they thrive in. These irritating insects actually add to the biodiversity in some areas and increase the stability of ecosystems. They are known to carry many diseases and cause a great number of issues for humans, but is it worth making them extinct?	1. What makes certain environments more favorable to mosquitoes? 2. Are mosquitoes themselves a parasite? Who is most at risk of illnesses from mosquitoes? 3. What organisms rely on mosquitoes for its survival? How?	1. Worst places in the world for mosquitoes 2. What is mosquitoes went extinct? 3. Can we eliminate mosquitoes for good? 10 Facts to consider.	1. Mosquito Habitats 2. What are mosquitoes good for?	
	7th Grade Life Science 7.LS1.6, 7.LS3.2	Can mosquitoes actually be helpful?	Genetically modified mosquitoes were created in the hopes of using them as a potent new weapon in the long, frustrating fight against malaria. Malaria remains one of the world's deadliest diseases, killing more than 400,000 people every year, mostly children younger than 5 years old.		Research project	https://www.npr.org/sections/goatsandsoda/2018/09/24/650501045/mosquitoes-genetically-	

Phenomena

Physical Science (PS)	Standard	Anchor Phenomenon Question	Phenomenon Description/Story	Scaffolding Questions (if needed)	Additional link here	Video or Picture link here	Resources (pdf/ word document)
PS1. Matter and its Interactions	**7.PS1.1** Develop and use models to illustrate the structure of atoms, including the subatomic particles with their relative positions and charges.	What is air? Students explore the different atoms and molecules that we breathe everyday.	The air we breathe everyday is a mixture of compounds and elements. In this simulation, students explore the different atoms and molecules that we breathe everyday. As they explore, they build a system for classifying matter.		https://interactives.ck12.org/simulations/chemistry/what-is-air/app/index.html?utm_source=projectphenomena&utm_medium=website&utm_campaign=ngss	platde.com	
	7.PS1.2 Compare and contrast elemental molecules and compound molecules.	Why does cutting an onion make you cry?	This phenomenon can be used to illustrate both chemical reactions and the particle nature of matter. Onions contain sulfur from the ground to form large organic compounds. When the cells in an onion are breached (during cutting or eating) they release sulfuric acid which becomes a sulfur containing gas that eventually reaches your eye. Your eyes produce tears to protect from irritants. Students could speculate on how the irritant reaches your eyes and even investigate possible solutions to this problem.	What are signs of a chemical reaction? What is an element? What is a compound?	https://theworldofscience.com/phenomenon/2018/7/13/why-does-cutting-an-onion-make-you-cry		https://www.sciencenewsforstudents.org/article/why-onions-make-us-cry
	7.PS1.3 Classify matter as pure substances or mixtures based on composition.	What is air? Students explore the different atoms and molecules that we breathe everyday.	The air we breathe everyday is a mixture of compounds and elements. In this simulation, students explore the different atoms and molecules that we breathe everyday. As they explore, they build a system for classifying matter.		https://interactives.ck12.org/simulations/chemistry/what-is-air/app/index.html?utm_source=projectphenomena&utm_medium=website&utm_campaign=ngss	Mixtures	elements-and-compounds
	7.PS1.4 Analyze and interpret chemical reactions to determine if the total number of atoms in the reactants and products support the Law of Conservation of Mass.	How can a frozen ice pop and a glow stick demonstrate the Law of Conservation of Mass?	The lesson begins with a discussion of the Carl Sagan quote: "The nitrogen in our DNA, the calcium in our teeth, the iron in our blood, the carbon in our apple pies were made in the interiors of collapsing stars. We are made of starstuff" and drawing an analogy to a slice of onion and our universe. The lesson continues with a lab in which students use glow sticks and goldfish crackers to investigate the mass of reactants and products before and after both physical and chemical changes in a closed system. Students then plan their own investigation on the conservation of mass using baking soda and vinegar.		https://betterlesson.com/lesson/641851/conservation-of-mass-investigation		
	7.PS1.5 Use the periodic table as a model to analyze and interpret evidence to explain how physical and chemical properties to identify a sample of matter	How can a frozen ice pop and a glow stick demonstrate the Law of Conservation of Mass?	The lesson begins with a discussion of the Carl Sagan quote: "The nitrogen in our DNA, the calcium in our teeth, the iron in our blood, the carbon in our apple pies were made in the interiors of collapsing stars. We are made of starstuff" and drawing an analogy to a slice of onion and our universe. The lesson continues with a lab in which students use glow sticks and goldfish crackers to investigate the mass of reactants and products before and after both physical and chemical changes in a closed system. Students then plan their own investigation on the conservation of mass using baking soda and vinegar.		https://www.thoughtco.com/chemical-properties-of-matter-608037 https://www.thoughtco.com/physical-properties-of-matter-608343	Physical and Chemical Properties	
	7.PS1.6 Create and interpret models of substances whose atoms represent the states of matter in respect to temperature and pressure.	Everywhere you look, you can see ice, water, or feel water. What are the many states in which water is found?	Water is a great substance for students to learn more about phase change in terms of temperature and heat energy.	What is matter? What are the states of matter? What determines the state of matter a substance is in?	http://learnkids.com/files/matter_states.html	Water in Various States	States of Matter Quiz/Sheet4kids States of Matter SIM
PS2. Motion and Stability: Forces and Interactions	**8.PS2.1** Design and conduct an investigation depicting the relationship between magnetism and electricity in electromagnets, generators, and electrical motors, emphasizing the factors that increase or diminish the strength of current and the magnetic field strength.	How can we use electricity to drive a motor?	In this simulation, students add coils and sliders to manipulate the size of the motor, the strength of the input current, the strength of the magnetic field, and the number of turns in the wire to deepen their understanding of electromagnetism and brainstorm ideas of how to improve upon one of the most promising technologies of our current age.	What are motors used for? When would you use an electric motor?	CK-12 simulations https://interactives.ck12.org/simulations/physics/electric-motor/app/index.html?utm_source=projectphenomena&utm_medium=website&utm_campaign=ngss https://www.ck12.org/c/physics/electric-motor/?utm_source=projectphenomena&utm_medium=website&utm_campaign=ngss	How does an electric motor works https://www.youtube.com/watch?v=LAAPHANEHZo	DC Motor Worksheet
	8.PS2.2 Conduct an investigation to provide evidence that fields exist between objects exerting forces on each other even though the objects are not in contact.	How do we know magnetic fields exist?	In this activity students will create a technology that uses a magnetic field.	What is a magnetic field? How can we tell when there is one present? How can magnetic fields be manipulate?	Magnetic fields basics http://www.physicsfor4kids.com/files/elec_magnetic/field.html	Magnetic Fields defined picture	Document: Electric and Magnetic Forces in Everyday Life
	8.PS2.3 Create a demonstration of an object in motion and describe the position, force, and direction of the object.	How is the design of modern cars different from cars in the past ?	This activity compare the design of cars from the past to present, noting major changes and what lead to these changes.	What factors could affect how fast a car can accelerate? What is more important how fast it can go or how much fuel it uses?	An introduction to cars https://www.youtube.com/watch?v=dHTDPEJ81A History of Cars https://blog.world-mysteries.com/science/127-years-of-modern-automobile-evolution/	Picture of the Evolution of Cars	History of Cars Worksheet, History of Cars Document
	8.PS2.4 Plan and conduct an investigation to provide evidence that the change in an object's motion depends on the sum of the forces on the object and the mass of the object.	How do planes go up and not fall back down?	This activity is for students to investigate what forces helps a large plane to lift off and to stay in the air despite its weight.	What does a plane have to overcome to lift off? What parts of a plane helps it to fly? What does each part serve?	How planes work https://www.explainthatstuff.com/howplaneswork.html	How do Planes Fly?	Document: Understanding Flight
	8.PS2.5 Evaluate and interpret that for every action force there is an equal force exerted in the opposite direction.	How much force will it take to stop a car moving 60mph?	This activity allow students to explore action/reaction simulations	What are action/ reaction forces? How do they relate to objects not stopping? What is the relationship between speeding up and slowing down objects?	CK12- https://www.ck12.org/physics/newtons-third-law/ Interactions: Newton's 3rd Law of Motion https://www.nasa.gov/stemonstrations/newtons-third-law-rocket-races.html	Action/ Reaction Forces	Document: Forces Acting on a Car in Motion (Slideshare powerpoint is embedded)
PS3. Energy	**6.PS3.1** Analyze the properties and compare the sources of kinetic, elastic potential, gravitational potential, electric potential, chemical and thermal energy	How do we use energy everyday to help us?	We encounter many types of energy everyday. Through the study of Rube Goldberg devises, several types of energy are being put to use to meet the needs of the machine and the end goal. Changes in energy can be identified, and conservations of energy can be explored.	What are the similarities and differences between energy types? How does the law of conservation of energy help describe energy transformations?	https://theworldofscience.com/phenomenon/2018/7/8/amazing-rube-goldberg-machines		
	6.PS3.2 Construct a scientific explanation of the transformation between potential and kinetic energy	How can we change the amount of energy the skate boarder has on the half pipe?	We can change how skater moves on the half pipe (how he moves or how fast he goes) increasing the potential energy will increase the kinetic energy, but there are other ways of increasing the amount of energy in the system. The mass of the skater will impact the amount of energy as well.	What happens to the potential energy as the kinetic energy increases, and vise versa?	http://phet.colorado.edu/sims/html/energy-skate-park-basics/latest/energy-skate-park-basics_en.html		
	6.PS3.3 Analyze and interpret data to show the relationship between kinetic energy and the mass of an object and its speed			What factors affect how far or fast the skater moves?			
	6.PS3.4 Conduct an investigation to demonstrate that the flow of heat (thermal energy) moves among objects through radiation, conduction, or convection.	Who do objects in your house feel different temperatures?	The flood in your bathroom feel so much colder than the floor outside the bathroom despite being in the same house. This is because substances absorb heat differently (insulators and conductors) Discuss the ways things are heated in the house (heating system, space heaters, cooking, microwaves) and how each heat moves through the substances.	What type of heat transfer is occurring in your home when your heat your house, cook your food, use an iron, etc.?	https://www.teachengineering.org/lessons/view/cub_housing_lesson01		
PS4. Waves and Their Applications in Technologies for Information Transfer	**8.PS4.1** Develop and use a model to represent basic properties of waves including frequency, amplitude, wavelength and speed.	How can a sound make something move? Sound from a car appears to make a window move from the parking lot, how is this possible?	Waves transfer energy. As energy travels, it causes matter or objects to move from one location to another it can cause various physical reactions (motion, temperature change, sound). The window vibrates as the air particles slam against and are absorbed by the window from the mechanical wave of sound. The amount of energy that is transferred will affect the amplitude of the wave. Wavelength determines the type of energy transfer occurring (radio to gamma) and is inversely related to frequency. Wave speed is effected by the medium that the wave is moving through and whether the wave is electromagnetic or mechanical.	How does a wave carry energy from one location to another? How much energy can a wave carry? What is the relationship between energy, amplitude, and frequency? Explain if all objects vibrate when they make sound? What transfers more energy, waves of bigger amplitude or waves with a greater frequency?	Phet simulation (wave on a string). https://phet.colorado.edu/en/simulation/wave-on-a-string The Physics classroom simulation https://www.physicsclassroom.com/Physics-Interactives/Waves-and-Sound/Simple-Wave-Simulator/Simple-Wave-Simulator-Interactive		
	8.PS4.2 Compare and contrast mechanical waves and electromagnetic waves based on refraction, reflection, transmission, and absorption and their behavior through a vacuum and/or various media.	Why are some areas in the school or community considered dead zones or phone dead zones no reception?	When considering where cell phone signals are strongest and some of the common denominators of poor reception is distance from a tower and if there are objects in between the cell phone and the tower. Since cell phone signals (radio waves) are absorbed by matter, the more walls and objects the signal has to go through, the weaker it is. Also, part of the signal is reflected every time it hits a new surface. 5G is using the wave behavior (refection) to its benefit. The smaller waves will use buildings in urban areas to reflect around corners of buildings to allow people to receive cell signal.	How can energy be used for communication? How can an object hear different through water? Why do objects appear different colors? Why does a rainbow always appear in the same color order?			
	8.PS4.3 Evaluate the role that waves play in different communication systems.	How has digital communication systems increased the quality of information exchange?	Students will view the video of an analog and digital tv. This illustrates the difference in the quality of the signal between the two. Basically, analog information suffers from interference that degrades the quality of the signal received.	What is analog? What is digital? What are common uses of analog signals in today's communication? What are common types of digital communication?	Analog vs Digital TV https://theworldofscience.com/phenomenon/2018/7/7/analog-vs-digital-television		

Phenomena

Life Science (LS)	Standard	Anchor Phenomenon Question	Phenomenon Description/Story	Scaffolding Questions (if needed)	Additional link here	Video or Picture link here	Resources (add/ word document)
LS1: From Molecules to Organisms: Structure and Process	**7.LS1.1** Develop and construct models that identify and explain the structure and function of major cell organelles as they contribute to the life activities of the cell and organism.	How do eggs become chickens and other living things?	Disagreements about why some chicken eggs hatch into baby chickens and others do not, as well as competing models about what is going on inside eggs before they hatch, spark student questions leading to investigations of where babies of chickens come from and how they develop. These investigations help students uncover the role that food, blood, cells, and tissues play in the development of embryos and growth in different animals.	What are all living things made of? What are the levels of organization for organisms? How do animal cells obtain energy?	https://www.nextgenstoryline.org/resources/how-do-eggs-become-chickens-and-other-living-things	https://youtu.be/UfILJD9NDX8	https://drive.google.com/drive/folders/1p7RWuR6QpOCgx9B3OUCu8F4RzEvpKbx
	7.LS1.2 Develop and use a model to describe how the cell membrane enables homeostasis through the process of passive transport.	Have you ever wondered why overheating on a hot day and getting a fever when you're sick feel so different?	Overheating on a hot day and getting a fever when you are sick involve an increase in your body's temperature. However, in one case your brain and body do everything they can to cool you off, while in the other they push the temperature inside your body to extreme levels.	What is the function of a cell membrane? What is homeostasis? What is equilibrium? What is passive transport?	https://www.pbslearningmedia.org/resource/ttc02.sci.life.reg.hwstress/		
	7.LS1.3 Evaluate evidence that cells have structural similarities and differences across kingdoms.	I share similarities with fungi, plants, and bacteria? No way!	All organisms are made of cells that have similar structures, similarities and differences.	https://www.ck12.org/book/ck-12-middle-school-life-science-2.0/section/1.3/	https://www.ck12.org/biology/prokaryotic-and-eukaryotic-cells/lesson/Prokaryotic-and-Eukaryotic-Cells-MS-LS/	https://youtu.be/UfILJD9NDX8
	7.LS1.4 Diagram the hierarchical organization of multicellular organisms from cells to organism.	How do eggs become chickens and other living things?	Disagreements about why some chicken eggs hatch into baby chickens and others do not, as well as competing models about what is going on inside eggs before they hatch, spark student questions leading to investigations of where babies of chickens come from and how they develop. These investigations help students uncover the role that food, blood, cells, and tissues play in the development of embryos and growth in different animals.	What are all living things made of? What are the levels of organization for organisms? How do animal cells obtain energy?	https://www.nextgenstoryline.org/resources/how-do-eggs-become-chickens-and-other-living-things		https://drive.google.com/drive/folders/1p7RWuR6QpOCgx9B3OUCu8F4RzEvpKbx
	7.LS1.5 Explain that the body is a system comprised of subsystems that support equilibrium and support life through digestion, respiration, excretion, circulation, movement (nervous and integumentary) and locomotion (musculoskeletal).	How do body systems work together to make us feel the way we do?	The human body is an incredibly complex system built with different cells. Similar cells get together to form tissues and then tissue. All of these tissues form the organs that keep everything running smoothly in the body.	http://studyjams.scholastic.com/studyjams/jams/science/human-body/human-body.htm (Open So)	https://www.scholastic.com/teachers/articles/teaching-content/human-body-14-interactive-interactive-science-activities/		
	7.LS1.6 Develop an argument based on empirical evidence and scientific reasoning to explain how behavioral and structural adaptations in animals and plants affect the probability of survival and reproductive success.	Why do sunflowers follow the sun?	This is an excellent phenomenon that can be used in many different units. According to researchers only young sunflowers follow the Sun. These flowers are following a natural circadian rhythm to receive the most light for photosynthesis. However when they mature the flowers will mainly face east. The reason for this is fairly simple, bees like warm flowers, and the flowers facing the east are warmed.	What are behavioral adaptations? What are structural adaptations?	https://thewonderofscience.com/phenomenon/2018/8/15/why-do-sunflowers-follow-the-sun	https://youtu.be/1gatIIMCZP8	
	7.LS1.7 Evaluate and communicate evidence that compares and contrasts the advantages and disadvantages of sexual and asexual reproduction.	What do strawberry plants and hydra have in common? What does it mean to reproduce?	Animals and other organisms cannot live forever. They must reproduce if their species is to survive.	Define sexual reproduction Define asexual reproduction	https://flexbooks.ck12.org/cbook/ck-12-middle-school-life-science-2.0/section/2.22/primary/lesson/asexual-vs.-sexual-reproduction-ms-ls	https://youtu.be/kGDUcQjcvs	
	7.LS1.8 Construct an explanation demonstrating that the function of mitosis for multicellular organisms is for growth and repair and that the production of genetically identical daughter cells	How does a broken arm heal?	Our bodies are unique in that we are identical in order to repair itself and grow.		Mitosis - Amoeba Sisters	How a broken bone heals.	
	7.LS1.9 Construct a scientific explanation based on compiled evidence for the processes of photosynthesis of cellular respiration, and anaerobic respiration in the cycling of matter and flow of energy into and out of organisms.	Where does food come from and where does it go next?	This unit on matter cycling and photosynthesis begins with students reflecting on what they ate for breakfast. Students are prompted to consider where their food comes from and consider which breakfast items might be from plants.	What is photosynthesis? What is cellular respiration? What is matter? What are abiotic factors? What are biotic factors?	Open SCI Ed https://www.openscied.org/instructional-materials/7-matter-cycling-photosynthesis/	Photosynthesis and Cellular respiration Video - A.S.	
LS2: Ecosystems: Interactions, Energy, and Dynamics	**7.LS2.1** Develop a model to depict the cycling of matter, including carbon and water, and including the flow of energy among biotic and abiotic parts of an ecosystem.	Where does food come from and where does it go next?	This unit on matter cycling and photosynthesis begins with students reflecting on what they ate for breakfast. Students are prompted to consider where their food comes from and consider which breakfast items might be from plants.	What is photosynthesis? What is cellular respiration? What is matter? What are abiotic factors? What are biotic factors?		https://youtu.be/aaW1HpkAJU8	
	6.LS2.1 Evaluate and communicate the impact of environmental variables on population size.	How would the extinction of mosquitoes impact ecosystems?	Mosquitoes are a known pest to anyone in the South. Not only are they annoying when they bite us, but they could have a major positive impact on the ecosystems they thrive in. These irritating insects actually add to the biodiversity in some areas and increase the stability of ecosystems. They are a food source to many diseases and parasites, and a number of issues for humans, but is it worth making them extinct?	What makes certain ecosystems more favorable to mosquitoes?	Worst places in the world for mosquitoes	Why can't we get rid of mosquitoes?	Mosquito Habitats
	6.LS2.2 Determine the impact of competitive, symbiotic, and predatory interactions in an ecosystem.	Are mosquitoes themselves a parasite? Who is the host? Do they add benefits from mosquitoes?	What is mosquitoes went extinct?	What if we killed all the mosquitoes?	
	6.LS2.3 Draw conclusions about the transfer of energy through a food web and energy pyramid in an ecosystem.	What organisms rely on mosquitoes for its survival? How?	Can we eliminate mosquitoes for good? 10 Facts to consider.	Should we make mosquitoes extinct?	What are mosquitoes good for?
	6.LS2.4 Using evidence from climate data, draw conclusions about the patterns of abiotic and biotic factors in different biomes, specifically the tundra, taiga, deciduous forest, desert, grasslands, rainforest, marine, and freshwater ecosystems.	How do Orca whales rely on each other and their environment to obtained food?	In order for Orca whales to be successful when hunting they have to rely on certain characteristics of their environment. These whales also use visual and "verbal" communication to work as a team to hunt. Students should investigate the impact the environment's characteristics have on their ability to hunt and how their hunting would be impacted if these characteristics did not exist.	What part of their environment provide help when hunting for prey? What would happen if those factors in the environment were impacted by human impact?	Killer Whale Diet		
	6.LS2.5 Analyze existing evidence about the effect of a specific invasive species on native populations in Tennessee and design a solution to mitigate its impact.	Why is kudzu a problem?	Kudzu was introduced to the United States from Japan to help soil erosion. This vine became very invasive once planted in the South. Farms and the vine was free to grow wherever they pleased. Humans introduced this vine to help solve a problem, but it has become a problem in the South". This vine has had a great impact on the physical condition of many areas and interaction within environment.	How do the whales have to communicate in order to be successful in their hunting? What methods do they use?	Communication and Echolocation		
	6.LS2.6 Research the ways in which an ecosystem has changed over time in response to changes in physical conditions, population balances, human interactions, and natural catastrophes.	What are some solutions to mitigate the Kudzu issue? What are the downfalls of those solutions?	The scariest vine you ever want to meet	Kudzu? No problem! We're bringing in the goats!	TN Resource- Kudzu
		What role did humans have in the invasion of kudzu? What effects can this invasive species have on the environment?	The story behind Kudzu, the vine that's still eating the South	Kudzu History: The Vine That Ate The South	
LS3: Heredity: Inheritance and Variation of Traits	**7.LS3.1** Demonstrate that the impact of structural changes to genes (i.e., mutations) located on chromosomes may result in harmful, beneficial, or neutral effects to the structure and function of the organism.	Why is St. Jude a world renown children's hospital?	Cancer begins when changes in DNA trigger cells to grow out of control.Through the Pediatric Cancer Genome Project, St. Jude and Washington University in St. Louis have pinpointed the DNA changes behind some of the toughest childhood cancers.	https://curriculum.org/umi/sites/teachers/staging/page.php?id=67	https://learn.genetics.utah.edu/content/basics/mutation/	Amoeba Sisters - Intro to Heredity
	7.LS3.2 Distinguish between mitosis and meiosis and compare the resulting daughter cells.	Why is St. Jude a world renown children's hospital?	Cancer begins when changes in DNA trigger cells to grow out of control.Through the Pediatric Cancer Genome Project, St. Jude and Washington University in St. Louis have pinpointed the DNA changes behind some of the toughest childhood cancers.			Amoeba Sisters - Compare Mitosis and Meiosis
	7.LS3.3 Predict the probability of individual dominant and recessive alleles to be transmitted from each parent to offspring during sexual reproduction and represent the genotypic and phenotypic ratios using ratios.	Why is St. Jude a world renown children's hospital?	The seemingly unrelated aides in the image are not just related but are twins. This is a phenomena to explain the randomness of how traits are passed from generation to generation.	Terms related to heredity	https://learn.genetics.utah.edu/content/basics/	
LS4: Biological Changes: Evolution and Diversity	**6.LS.4.1** Explain how changes in biodiversity would impact ecosystem stability and natural resources.	Why is California home to the highest number of non-native species in the United States?	Investigate why California has the greatest threat to their biodiversity and equilibrium because approximately 1,800 invasive species have introduced due to increase in human needs for given resources. Students will investigate how these invasive species are threatening California's natural resources, environment, and stability.	How does the introduction of different species cause a strain in the stability of an ecosystem?	These invasive species are eating Southern California		California Invasive Species Action Week
	6.LS.4.2 Design a possible solution for maintaining biodiversity of ecosystems while still providing necessary human resources without disrupting environmental equilibrium.	How do we know horses have changed over time?	This activity helps students to see evidence that organisms have evolved overtime.	What is "natural selection?" How do we know that natural selection occurs? What organisms undergo natural selection?	How California is being invaded and what you can do to help.	Invasive Species: A Challenge for California	
	6.LS4.1 Analyze and interpret data for patterns in the fossil record that document the existence, diversity, extinction, and change in life forms throughout Earth's history.	How do we know that whales once walked on land?	This investigate show how scientist use fossils and connections using fossils from extinct to modern animals	What are fossils? Where can we find fossils? How to we determine their age?	Evolving Ideas: How Do We Know What Happened? https://www.pbslearningmedia.org/resource/ttc02.sci.life.evo.howknowevolving/evolving-ideas-how-do-we-know-evolution-happens/support-materials/	The Evolution of Whales	Evolving Ideas: How Do We Know What Happened? Background and discussion questions
	6.LS4.2 Construct an explanation addressing similarities and differences of the anatomical structures and genetic information of ancestral and extant organisms using evidence of common ancestry and patterns between taxa.	Why can't people fly like birds or bats?	In this a activity students will investigate homologous structures of people, bats, and birds.	What are homologous structures? How do we know that different animals have some of the same body structures? What body part of a person would be similar to that of a bat? A bat?	9.9 Evidence from Comparative Anatomy—Homologous, Analogous and Vestigial Structures https://www.ck12.org/book/cbse-biology-book_class_ix/section/9.9/	Comparing Bone Density	Worksheet: Comparing a Human arm, to a Bird's wing, to a Bat's Wing
	6.LS4.3 Analyze evidence from geology, paleontology, and comparative anatomy to support the premise that phenotypes within a population can increase the probability of survival of that species and lead to adaptation.	Why does an arctic hare changes its color from summer to winter?	This activity is to determine how animal adaptations help to survive in extreme climates.	What are adaptations? Can you name an arctic animal and how it helps that organism? What may cause an organism to change?	Adaptations of Arctic Animals- https://learningmedia.org/resource/nat15.sci.lsci.arctanimadaptations-of-arctic-animals/support-materials/	Hare Color, Before and After	Animals of the Arctic-discussion questions Animals of the Arctic worksheet
	6.LS4.4 Develop a scientific explanation of how the environment can cause a new species determining the survival of a species in a changing environment.	What are the future of bionic limbs?	In this activity students will investigate how artificial limbs are changing due to technological advances.	What are artificial limbs? How do they help us? How would be the difference between the current artificial limbs and bionic limbs? Which would be more beneficial?	Bionic Limbs https://www.science.org.au/curious/people/media-bionic-limbs Videos are from Youtube	Prosthetic Limbs Through the Years	
	6.LS4.5 Obtain, evaluate, and communicate information about technologies that have changed the way humans use artificial selection to influence the inheritance of desired traits in other organisms.				https://newsinhealth.nih.gov/2018/08/bionic-movements		Task: Bionics: Pros and Cons

Phenomena

Earth and Space Science (ESS)	Standard	Anchor Phenomenon Question	Phenomenon Description/Story	Scaffolding Questions (if needed)	Additional link here	Video or Picture link here	Resources (pdf/ word document)
ESS1: Earth's Place in the Universe	**8.ESS1.1** Research, analyze, and communicate that the universe began with a period of rapid expansion using evidence from the motion of galaxies and composition of stars.	How can humans look at the beginning of time?	Light and energy that reaches the Earth can range from a few minutes old (from the Sun) to billions of years old (like the Cosmic Microwave Background). The older the source of energy, the closer to the Big Bang the energy came from, thus giving us a look at how the universe was shortly after the Big Bang. The Microwave Background was accidentally discovered using an horn antenna meant to capture radio waves. From this discovery, scientist could look back to the period of time shortly after the Big Bang when scientists allowed matter to begin forming into atoms. This contrasted to a theory that stated the universe was in a constant state of expansion with no change to its size or composition. Additional evidence of the Big Bang can be found in the red shifting of light from the motion of galaxies and stars.	What is the Big Bang theory? What evidence do scientists cite to support the Big Bang theory? What is the Cosmic Microwave Background? What is the doppler effect? How is red shift related to the doppler effect? How does red shift support the Big Bang? How do scientist detect red shift?	Cosmic Microwave Background Infographic Several videos and descriptions about the Big Bang and formation of the universe.		Put dots on a deflated balloon. Then blow up the balloon to show how an expanding universe would cause galaxies and stars to move away from each other (red shift).
	8.ESS1.2 Explain the role of gravity in the formation of our sun and planets. Extend this explanation to address gravity's affect on the motion of celestial objects in our solar system and Earth's ocean tides.	Why do solar and lunar eclipses occur?	The next solar eclipse will occur on April 18th, 2024 and Memphis will be on the edge of the full eclipse field. The next total lunar eclipse will occur on May 15th, 2022 in Memphis. By investigating the causes of solar and lunar eclipses and students will understand the motion of celestial bodies in our solar system. Gravity is the controlling force of this motion. Gravity is also responsible for the creation of the planets and stars in the first place.	What is a solar eclipse? What is a lunar eclipse? What is the alignment of the sun, Earth, and moon during each type of eclipse? How do stars form? How do planets form? What is the difference between the formation of stars and planets? What causes high and low tides?	2017 Eclipse article and video from Nashville	Bay of Fundy tide video Video of star and planet formation with actual images PHET simulation of orbits	
ESS2: Earth's Systems	**8.ESS2.1** Gather evidence to justify that oceanic currents are caused by the sun's transfer of heat energy and differences in salt concentration leading to global water movement.	How does global warming impact Earth's oceans?	The ocean and atmosphere are connected. They work together to move heat and fresh water across the globe. Wind-driven and ocean-current circulations move warm water toward the poles and colder water toward the equator. The ocean can store much more heat than the land surface or the Earth. The majority of the thermal energy at the Earth's surface is stored in the ocean. Thus, the absorption and movement of heat energy in Earth is related to the ocean's atmosphere system.	• Why is the Earth called the water planet? • How do ocean currents move very on Earth? • Why is the more freshwater near the poles? • How does melting sea ice impact Earth's oceans? • What causes sea ice to melt? • Is there a similar comparison between wind currents and deep ocean currents?	• Use current articles, Images of Change: Sea Ice Decline - and NASA's Arctic Sea Ice • Earth Observatory: Sea Ice • Fosswebr: Weather and Water Overview	Melting Permafrost	Connect to LS
	8.ESS2.2 Diagram convection patterns that flow due to uneven heating of the earth.				NASA: Perpetual Ocean	Ocean Science Simulations	
	8.ESS2.4 Apply scientific principles to design a method to monitor and interpret the impact of humans and other organisms on the hydrologic cycle.	How do human activities negatively impact the water cycle?	As water moves through the water cycle, it can dissolve and carry substances from one location to another. Substances dissolved in the earth's water affect water quality and animal habitats. The geologic processes of erosion and deposition have been occurring for millions of years but humans have disrupted this natural movement of materials and have changed land formations. Building on the land accelerates the movement of sediments.The outcome of theses geologic processes are altered when wetlands are filled in, farms are created, vegetation is removed, and/or the hard surfaces of buildings are installed.	• How does moving water affect the areas through which it flows? • How can we mitigate modern society's harmful effects on Earth's water?	Humans and the Water Cycle	How is Climate Change Affecting the Water Cycle?	Tie into "Free the Snake" Lesson
	8.ESS2.3 Construct an explanation for how atmospheric flow, geographic features, and ocean currents affect the climate of a region through heat transfer.		The weather changes a lot during the year and from location to location. Climates are described by the same conditions used to describe weather, and represent the average weather in a location over a long period of time. Climate patterns vary by latitude, altitude, and geographic land distribution. Oceans have an important affect on climate.Variations in density due to variations in temperature and salinity drive a global pattern of interconnected ocean currents that redistribute heat.The atmosphere also has currents that move air and water from one place to another. Air and water are also driven by energy from the sun and, as with ocean currents, are influenced by the Coriolis effect, which is a result of the Earth's rotation. The resulting patterns of prevailing winds affects regional weather and climate.The way that Earth's atmosphere interacts with the sun's energy and the oceans thus helps determine Earth's average temperature and its different climate zones.	• Does the distribution of climates show symmetry or global patterns • How do different surfaces on Earth gain and lose heat? • How do ocean temperatures vary over the surface of Earth? • How do clouds affect climate?	Ocean Currents and their Global Impacts	Effects of Latitude on Climate	
	8.ESS2.5 Analyze and interpret data from weather conditions, weather maps, satellites, and radar to predict probable local weather patterns and conditions.	What causes differences in weather and climate?		• How can a weather map be used to forecast weather?	Predict the Weather		
	8.ESS2.6 Explain how relationships between the movement and interactions of air masses, high- and low-pressure systems, and frontal boundaries result in weather conditions and severe storms.			• How have severe weather events affected your region? • What role does the ocean currents play in weather and climate? • What is the pattern of global winds around Earth?		A Year of Weather	Create a Weather Map
	8.ESS2.1 Analyze and interpret data to support the assertion that rapid or gradual geographic changes lead to drastic population changes and extinction events.	How do extinctions occur?	Students to investigate mass extinctions and find evidence to support why the extinctions occurred.	What is an extinction? Find evidence supports that organisms have gone extinct?	Extinct Species Explained https://www.nationalgeographic.com/animals/reference/extinct-species/ Mass Extinctions https://www.youtube.com/watch?v=plmqP8fKA	Mass Extinction events https://phys.org/news/2019-04-earth-major-mass-extinctions.html	Task: What are mass extinctions?
	8.ESS2.2 Evaluate data collected from seismographs to create a model of Earth's structure.	How to survive the next earthquake?	Students will investigate the 1811-12 New Madrid Earthquakes and the amount of damage created. Using that data they will predict the amount of damage that could be done if that same level earthquake happened tomorrow.	What is an earthquake? How are earthquakes predicted? How they how often do they happen in this area? Is there a fault line in this area and if so what is the name of the fault line?	Summary of the 1811-1812 New Madrid Earthquakes Sequencing https://www.usgs.gov/natural-hazards/earthquake-hazards/science/summary-1811-1812-new-madrid-earthquakes-sequence?qt-science_center_objects=0#qt-science_center_objects New Madrid, Missouri Official Site of the 1811-1812 Earthquakes http://www.new-madrid.mo.us/102/Earthquake-of-1811-1812 The Great Midwest Earthquake (Smithsonian Magazine) https://www.smithsonianmag.com/science-nature/the-great-midwest-earthquake-of-1811-48242/	Why do earthquakes occur? https://www.youtube.com/watch?v=cSDKRrhI8_w	Task: When the Next One Hits.
	8.ESS2.3 Describe the relationship between the process and forces that create igneous, sedimentary, and metamorphic rocks.	Is "quicksand" dangerous?	Students will learn the myths about quicksand and investigate if they are true.	What is quicksand? What myths are they around quicksand that you have heard about?	Local News: https://www.wmcactionnews5.com/2019/02/12/shelby-county-commission-votes-against-stone-gravel-pit-community/ How quicksand works? https://science.howstuffworks.com/environmental/earth/geology/quicksand.htm Can quicksand really suck you to your death? https://www.bbc.com/future/article/20160203-can-quicksand-really-suck-you-to-your-death	What happens when if you fall into quicksand? https://www.youtube.com/watch?v=tZVjfOQ6V7A	Task: Gravel and Sand? Teacher resources are included if students need help finding sites
	8.ESS2.4 Gather and evaluate evidence that energy from the Earth's interior drives convection cycles within the asthenosphere which creates pressure within the lithosphere including plate movements, plate boundaries, and sea-floor spreading.	How were the Appalachian Mountains formed?	Students will investigate the processes that created the Appalachian mountains.	How are mountains different from hills? What forces create uplift? Are the Appalachian Mountains still "growing?"	Building the Appalachian Mountains http://geology.teacherfriendlyguide.org/index.php/geologic-history-mountain-building-part-iv	Creation of the Appalachian mountains https://www.youtube.com/watch?v=pTuVfTO0MRs	Document: How the Appalachian Mountains formed. Students to complete graphic organized comparing types of mountains
	8.ESS2.5 Construct a scientific explanation using data that explains the gradual process of plate tectonics accounting for A). The distribution of fossils on different continents. B). The occurrence of earthquakes C). Continental and ocean floor features (including mountains, volcanoes, faults, and trenches).	How is Africa splitting into two continents?	Students will investigate plate tectonics and how it effect landmasses.	What drives plate tectonics? What are the types of movement that occur by plate tectonics? How quickly does it affect the earth's surface?	Why is Africa Splitting https://thepoweroftation.co m/africa-is-splitting-into-two-here-is-why-94056 The Crack in Africa https://www.pbs.org/newshour/science/large-crack-in-east-african-rift-is-evidence-of-continent-splitting-in-two (please read complete article and watch video) The forming of a new ocean https://www.youtube.com/watch?v=PsVKpDwg7nc	What made the ground split open in Kenya?	Task: The New Two African Continents. Illustrate how Africa will look like after it splits, naming both continents.
						https://www.youtube.com/watch?v=kT3mFfwXqY	
ESS3: Earth and Human Activity	**7.ESS3.1** Graphically represent the composition of the atmosphere as a mixture of gases and discuss the potential for atmospheric change.	What is air? Students explore the different atoms and molecules that we breathe everyday.					Teachers can include this DCI with PS1.3
	7.ESS3.2 Engage in a scientific argument through graphing and translating data regarding human activity and climate.	How does a pandemic cause less CO2?	Human activities, including CO2 emissions, deforestation and other forms of land cover change, exert substantial pressures on the Earth's climate system. Changes in climate that have already begun will likely unfold over decades to centuries and will be shaped by the decisions of future generations.	What are the layers of the atmosphere? In which layer do organisms reside? What is the importance of carbon dioxide?	https://www.nasa.gov/lesson-plans/how-does-pandemic-cause-less-co2		http://studentclimatedata.strh.edu/index.shtml More information and links included in original web page.
	8.ESS3.1 Interpret data to explain that Earth's mineral, fossil fuel, and groundwater resources are unevenly distributed as a result of tectonic processes.	Why are there no mines found along the Mississippi River valley area, but there are mines found in the central and eastern regions of TN?		What tectonic processes form mountains? What happens to in terms of temperature and pressure when plates collide to create mountains? What is the role of temperature and pressure in the formation of minerals? How are oil and coal formed?		Interactive map of mines USGS map of mines in the US (be sure to click the A records)	
	8.ESS3.2 Collect data, map, and describe patterns in the locations of volcanoes and earthquakes related to tectonic plate boundaries, interactions, and hotspots.	Why are earthquakes and volcanoes located in lines along the Earth's surface?	Students will investigate real-time maps of earthquake and volcanic activity across the world. They may map the incidents on a world map to determine the position of plate boundaries.	What are plates? Why do plates move? What are the effects of plate movement? What are the different types of plate boundaries? Where are earthquakes and volcanoes most likely to occur? Why do some earthquakes occur where there are no plate boundaries or active faults (i.e. Oklahoma?		USGS Link 3rd Party Link	Video of earthquake locations over the past 15 years
	8.ESS3.1 Differentiate between renewable and nonrenewable resources by asking questions about their availability and sustainability.	How can renewable energy sources impact the biosphere?	"Free the Snake" Urgent Call To Action: Speak Up For Endangered Salmon: After two decades and five failed attempts to write a legal and biologically-sound plan to keep Idaho's endangered salmon from going extinct, the federal government has announced a comment period and meeting schedule to gather public input on how to best manage dams in the region. Now is the time to write, call and rally on behalf of lower Snake River restoration and wild salmon recovery. The Snake River is one of the most important waterways to salmon. Salmon rely on the Snake River for migration to and from fresh water and the ocean. However, more than 13 dams spawn the Snake River for the long river. These dams are important to power generation, flood control and, irrigation. However, they negatively impact the salmon and their ability to complete their life cycle.	What is the difference between renewable and nonrenewable resources?	• Difference Between Renewable and Non-renewable Resources • 10 Examples of Renewable and Non-Renewable Resources	Free the Snake Video	• Natural Resources Free Bundle • Renewable and Nonrenewable Resources • See phenomenon doc from DLD (*this phenomenon links it ESS3.t- 6.LS and ETS1.1*)
	8.ESS3.2 Investigate and compare existing and developing technologies that will utilize renewable and alternate energy sources.			What are current technologies for renewable and alternate energy?	• Future Technology • Alternate Energy for Transportation		
	8.ESS3.3 Assess the impacts of human activities on the hydrosphere including conservation, habitat management, species endangerment, and extinction.			How do renewable energy sources impact the environment?	6 Ways Human Activity is Changing the Planet.		

Phenomena							
Engineering, Technology, and Applications of Science (ETS)	**Standard**	**Anchor Phenomenon Question**	**Phenomenon Description/Story**	**Scaffolding Questions (if needed)**	**Additional link here**	**Video or Picture link here**	**Resources (pdf/ word document)**
ETS1. Engineering Design	6.ETS1.1						
	6.ETS1.2 Evaluate design constraints on solutions for maintaining ecosystems and biodiversity.	How can people mitigate the negative impact of ecosystems while meeting the needs of their community?	Land development by humans has an impact on the environment. Human population growth leads to the need for more use of land and water resources and more impact on these resources. Responsible development reduces this impact where possible.	• How can we engineer structures to mitigate environmental impact? • What is the human impact of building construction?	Conservation Island Activity		Project Morris Woods: Help students work out a land issue with forest consequences
	8.ETS1.1 Develop a model to generate data for ongoing testing and modification of an electromagnet, a generator, and a motor such that an optimal design can be achieved.	How do engineers arrive at an optimal design for an electromagnet, motor, or generator?	The optimal design of a product is determined by the parameters of the product. It is the design that provides the most reliable performance with the use of the least amount of resources (time, money, and materials). It requires many iterations of an idea to arrive at the ideal product. Using a digital model/ simulation, students will test the different parts of electromagnets and generators. Using that information, they can design real-life products.	What is the engineering design process? What is iteration? What are models? What are the different type of models?	PHET simulations		
	8.ETS1.2 Research and communicate information to describe how data from technologies (telescopes, spectroscopes, satellites, and space probes) provide information about objects in the solar system and universe.						
ETS2. Links Among Engineering, Technology, and Science on Society and the Natural World	**7.ETS2.1** Examine a problem from the medical field pertaining to biomaterials and design a solution taking into consideration the criteria, constraints, and relevant scientific principles of the problem that may limit possible solutions.	How can genetic engineering make a COVID-19 vaccine in months rather than years?	Genetic engineering has been used to produce proteins derived from humans and other sources in organisms that normally cannot synthesize these proteins. Human insulin-synthesising bacteria were developed in 1979 and were first used as a treatment in 1982 [57] to treat patients with diabetes.	What does the prefix "bio" stand for? What are biomaterials? What does it mean to engineer? What is a vaccine? What is genetic engineering?	**Research based assignment.** https://www.nationalacademies.org/news/2020/06/the-search-for-a-covid-19-vaccine-theres-no-one-winner	Amoeba Sisters - Vaccines	pro-con-vaccines.pdf (from NewsELA)