Stile

NEXT GENERATION SCIENCE STANDARDS

NGSS High School Scope and Sequence & Unit Guide

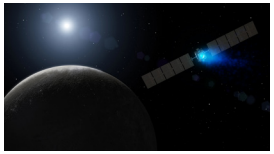
Suggested sequence of work

Earth and Space Science

Active Earth
Natural disasters

Earth Systems
The greenhouse effect

The Universe
Gravitational waves



Newton's Laws of Motion
Vehicle collisions

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Ecosystems
Plastics in the ocean

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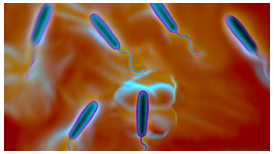
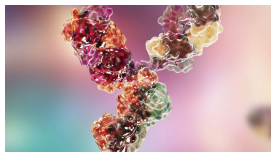


Evolution
The rise of superbugs

Genetics
Mutations



The Immune System
The resurgence of measles

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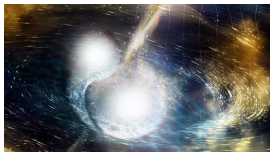
Physical Science

Radiation
Deadly cosmic radiation

Kinematics
Self-driving cars



The Periodic Table
Stardust on Earth

Reaction Types
Super-fast chemical reactions

Reactions and Energy
Fuels of the future

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Wireless electricity

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Engineering, Technology, and the Applications of Science

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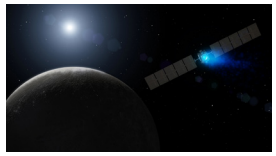

Newton's Laws of Motion
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Reactions and Energy
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How Stile aligns to the NGSS

Real-world phenomena drive the unit and connections are also made to advances in Science, Engineering, and Technology.

Disciplinary Core Ideas are covered throughout the core lessons of the unit.

Crosscutting Concepts are explored as students learn about Scale, Proportion, and Quantity.

Students apply **Science and Engineering Practices** as they develop an understanding of cell models.

Crosscutting Concepts of Structure and Function are explored as students visualize, model and describe the structure and function of cell organelles.

Cells

Introduction: Battle of the burgers

1.1 Lesson: The building blocks of life
1.2 Extension: Sizes of cells
1.3 Lesson: Introduction to microscopes
1.4 Practical activity: Using a microscope
1.5 Practical: Measuring with microscopes
1.6 Extension: Cell theory

2.1 Lesson: Parts of a cell
2.2 Lesson: Animal vs. plant cells
2.3 Practical activity: Make a cell model
2.4 Lesson: Cells under the microscope
2.5 Practical: Observing plant and animal cells

3.1 Lesson: Specialized cells
3.2 Project: Putting cells to work
3.3 Extension: Cell biology and Aboriginal art
3.4 Extension: Mythbusters – Cell division

4.1 Lesson: Science and society
4.2 Career profile

Glossary

Test: Cells

Students apply Science and Engineering Practices as they create thier own cell models.

Students apply Science and Engineering Practices as they conduct investigations to collect data as evidence to meet the goals of the investigation.

Connections to **Common Core State Standards in Literacy** are possible as students conduct a short research project on specialized cells, drawing on several sources.

Students explore a phenomenon from different perspectives through a Socratic Seminar. This also ties to **Common Core State Standards in Litearcy** as they can explore this issue through multiple avenues.

Career profiles showcase individuals exploring wonderful and fascinating careers related to STEM.

A summative test checks for understanding across the **Disciplinary Core Ideas**, as well as Science and Engineering Practices and Crosscutting Concepts.

Earth and Space Science

Active Earth: Natural disasters

How do we build future-ready cities?

The surface of Earth is continually changing. The movement of tectonic plates causes natural hazards that are outside of our control. People living under the threat of active volcanoes, earthquakes, and tsunamis can feel helpless. Learning about these natural hazards and how to mitigate them provides a sense of control and can even save lives. So how does understanding our active planet help society?

HS-ESS1-5

Evaluate evidence of the past and current movements of continental and oceanic crust and the theory of plate tectonics to explain the ages of crustal rocks.

HS-ESS2-1

Develop a model to illustrate how Earth's internal and surface processes operate at different spatial and temporal scales to form continental and ocean-floor features.

HS-ESS2-3

Develop a model based on evidence of Earth's interior to describe the cycling of matter by thermal convection.

HS-ESS2-5

Plan and conduct an investigation of the properties of water and its effects on Earth materials and surface processes.

Earth Systems: The greenhouse effect

Why is the greenhouse effect so important to life on Earth?

The movement of matter and energy through the Earth's four major systems impacts ecosystems around the world and even our climate. So how important is the greenhouse effect in this story?

HS-ESS2-2

Analyze geoscience data to make the claim that one change to Earth's surface can create feedbacks that cause changes to other Earth systems.

HS-ESS2-4

Use a model to describe how variations in the flow of energy into and out of Earth's systems result in changes in climate.

HS-ESS2-6

Develop a quantitative model to describe the cycling of carbon among the hydrosphere, atmosphere, geosphere, and biosphere.

HS-ESS2-7

Construct an argument based on evidence about the simultaneous coevolution of Earth's systems and life on Earth.

HS-ESS3-1

Construct an explanation based on evidence for how the availability of natural resources, occurrence of natural hazards, and changes in climate have influenced human activity.

HS-ESS3-2

Evaluate competing design solutions for developing, managing, and utilizing energy and mineral resources based on cost-benefit ratios.*

HS-ESS3-3

Create a computational simulation to illustrate the relationships among management of natural resources, the sustainability of human populations, and biodiversity.

HS-ESS3-4

Evaluate or refine a technological solution that reduces impacts of human activities on natural systems.*

HS-ESS3-5

Analyze geoscience data and the results from global climate models to make an evidence-based forecast of the current rate of global or regional climate change and associated future impacts to Earth systems.

HS-ESS3-6

Use a computational representation to illustrate the relationships among Earth systems and how those relationships are being modified due to human activity

The Universe: Gravitational waves

How have gravitational waves changed our understanding of the universe?

The recent detection of gravitational waves gives us a new way of observing the universe. But for centuries, telescopes have been gradually revealing the grand scale of the universe and the weird and wonderful things it contains. Venture on a journey through time and space all the way back to the Big Bang.

HS-ESS1-1

Develop a model based on evidence to illustrate the life span of the sun and the role of nuclear fusion in the sun's core to release energy that eventually reaches Earth in the form of radiation.

HS-ESS1-2

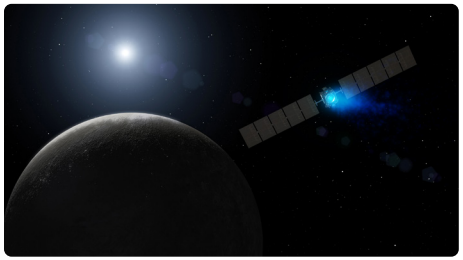
Construct an explanation of the Big Bang theory based on astronomical evidence of light spectra, motion of distant galaxies, and composition of matter in the universe.

HS-ESS1-3

Communicate scientific ideas about the way stars, over their life cycle, produce elements.

HS-ESS1-6

Apply scientific reasoning and evidence from ancient Earth materials, meteorites, and other planetary surfaces to construct an account of Earth's formation and early history.



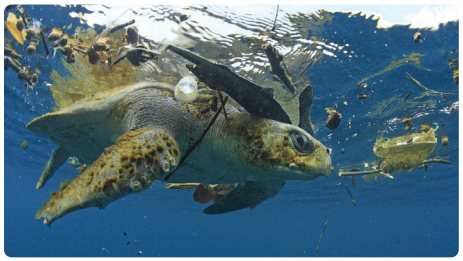
Newton's Laws of Motion: Vehicle collisions

How do Newton's Laws explain the motions of cars and spacecraft?

They might seem worlds apart, but the motions of cars and spacecraft obey the same basic rules. Isaac Newton figured them out over 300 years ago. In this unit, we explore how his three laws of motion explain the effects of forces, both on Earth and in space.

HS-ESS1-4	HS-PS2-4
Use mathematical or computational representations to predict the motion of orbiting objects in the solar system	Use mathematical representations of Newton's Law of Gravitation and Coulomb's Law to describe and predict the gravitational and electrostatic forces between objects.

Life Science



Ecosystems: Plastics in the ocean

How can we prevent plastic from harming marine life?

With millions of tons of plastic ending up in our oceans every year, marine ecosystems are in trouble. Plastic waste is damaging habitats and turning up in the bodies of many species, including turtles and whales. We all need to work together to solve this problem. Students will dive into this unit to explore the importance of healthy ecosystems and discover ways they can minimize their plastic impact.

HS-LS1-5

Use a model to illustrate how photosynthesis transforms light energy into stored chemical energy.

HS-LS1-6

Construct and revise an explanation based on evidence for how carbon, hydrogen, and oxygen from sugar molecules may combine with other elements to form amino acids and/or other large carbon-based molecules.

HS-LS1-7

Use a model to illustrate that cellular respiration is a chemical process whereby the bonds of food molecules and oxygen molecules are broken and the bonds in new compounds are formed resulting in a net transfer of energy.

HS-LS2-1

Use mathematical and/or computational representations to support explanations of factors that affect carrying capacity of ecosystems at different scales.

HS-LS2-2

Use mathematical representations to support and revise explanations based on evidence about factors affecting biodiversity and populations in ecosystems of different scales.

HS-LS2-3

Construct and revise an explanation based on evidence for the cycling of matter and flow of energy in aerobic and anaerobic conditions.

HS-LS2-4

Use mathematical representations to support claims for the cycling of matter and flow of energy among organisms in an ecosystem.

HS-LS2-5

Develop a model to illustrate the role of photosynthesis and cellular respiration in the cycling of carbon among the biosphere, atmosphere, hydrosphere, and geosphere.

HS-LS2-6

Evaluate the claims, evidence, and reasoning that the complex interactions in ecosystems maintain relatively consistent numbers and types of organisms in stable conditions, but changing conditions may result in a new ecosystem.

HS-LS2-7

Design, evaluate, and refine a solution for reducing the impacts of human activities on the environment and biodiversity.*

HS-LS4-6

Create or revise a simulation to test a solution to mitigate adverse impacts of human activity on biodiversity.*

The Endocrine System: Hormone disorders

Will staring at a screen before bed affect your sleep?

New research stresses the importance of darkness for a good night's sleep. Artificial light can disrupt the release of the hormone melatonin, which regulates sleep patterns. Light up your students' minds as they explore the endocrine system through this relevant and real-world context.

HS-LS1-3

Plan and conduct an investigation to provide evidence that feedback mechanisms maintain homeostasis.

Evolution: The rise of superbugs

Are we responsible for the rise of antibiotic-resistant superbugs?

Antibiotics save hundreds of thousands of lives every year, but antibiotic-resistant superbugs are putting all of those lives at risk. Understanding our role in their evolution could be the key to combating the biggest public health crisis of the next century.

HS-LS2-8

Evaluate the evidence for the role of group behavior on individual and species' chances to survive and reproduce.

HS-LS4-1

Communicate scientific information that common ancestry and biological evolution are supported by multiple lines of empirical evidence.

HS-LS4-2

Construct an explanation based on evidence that the process of evolution primarily results from four factors: (1) the potential for a species to increase in number, (2) the heritable genetic variation of individuals in a species due to mutation and sexual reproduction, (3) competition for limited resources, and (4) the proliferation of those organisms that are better able to survive and reproduce in the environment.

HS-LS4-3

Apply concepts of statistics and probability to support explanations that organisms with an advantageous heritable trait tend to increase in proportion to organisms lacking this trait.

HS-LS4-4

Construct an explanation based on evidence for how natural selection leads to adaptation of populations.

HS-LS4-5

Evaluate the evidence supporting claims that changes in environmental conditions may result in: (1) increases in the number of individuals of some species, (2) the emergence of new species over time, and (3) the extinction of other species.

Genetics: Mutations

How can genes increase the risk of cancer?

In a book, small changes in the way the words are put together can change how the story unfolds – little changes can have big effects. The same applies to DNA. Unravel the mysteries of how DNA controls body development and function.

HS-LS1-1

Construct an explanation based on evidence for how the structure of DNA determines the structure of proteins which carry out the essential functions of life through systems of specialized cells.

HS-LS1-4

Use a model to illustrate the role of cellular division (mitosis) and differentiation in producing and maintaining complex organisms.

HS-LS3-1

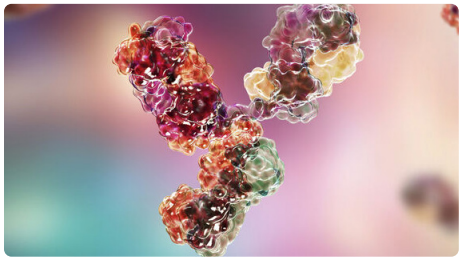
Ask questions to clarify relationships about the role of DNA and chromosomes in coding the instructions for characteristic traits passed from parents to offspring.

HS-LS3-2

Make and defend a claim based on evidence that inheritable genetic variations may result from: (1) new genetic combinations through meiosis, (2) viable errors occurring during replication, and/or (3) mutations caused by environmental factors.

HS-LS3-3

Apply concepts of statistics and probability to explain the variation and distribution of expressed traits in a population.



The Immune System: The resurgence of measles

How can we protect communities from diseases like measles?

The COVID-19 pandemic has shown how vulnerable the world is to new infectious diseases. But much older diseases still pose a threat, even when we have safe, effective vaccines against them. In recent years, measles has made a comeback, even in countries where it had been eliminated. How is this possible? In this unit, students will explore how the immune system defends the body against infection and how it can be boosted by vaccination.

HS-LS1-2

Develop and use a model to illustrate the hierarchical organization of interacting systems that provide specific functions within multicellular organisms.

Physical Science

NGSS · Scope & Sequence

Radiation: Deadly cosmic radiation

What makes cosmic radiation so dangerous?

A vacuum that would make your eyes pop out and a temperature cold enough to freeze air are obvious dangers in space. But just as deadly is the invisible stream of cosmic radiation that could kill an astronaut even if they never went outside their spacecraft. Scientists are thinking about how we can protect astronauts from these rays as they travel to Mars, a trip that will take more than two years.

HS-PS1-8

Develop models to illustrate the changes in the composition of the nucleus of the atom and the energy released during the processes of fission, fusion, and radioactive decay.

Reaction Types: Super-fast chemical reactions

Are self-healing space suits science fiction or just science?

A super-fast chemical reaction between a new liquid plastic and oxygen could mend holes in space suits in mere seconds! Take your students on a journey out of this world to discover how different types of reactions can help us develop new materials.

HS-PS1-5

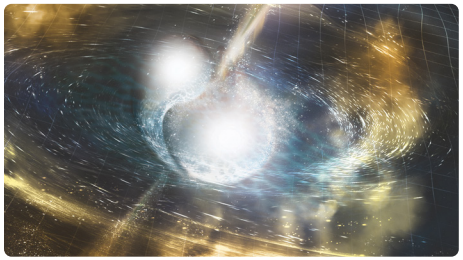
Apply scientific principles and evidence to provide an explanation about the effects of changing the temperature or concentration of the reacting particles on the rate at which a reaction occurs.

HS-PS1-6

Refine the design of a chemical system by specifying a change in conditions that would produce increased amounts of products at equilibrium.

HS-PS1-7

Use mathematical representations to support the claim that atoms, and therefore mass, are conserved during a chemical reaction.



The Periodic Table: Stardust on Earth

How do exploding stars create heavy metals?

Scientists recently detected the collision of two neutron stars, confirming theories about the origin of heavier elements such as gold and platinum. This important discovery highlights the value of the periodic table in modern chemistry. By exploring how the arrangement of electrons in atoms determines chemical bonding, students discover why the periodic table is worth its weight in gold!

HS-PS1-1	HS-PS1-2	HS-PS1-3
Use the periodic table as a model to predict the relative properties of elements based on the patterns of electrons in the outermost energy level of atoms.	Construct and revise an explanation for the outcome of a simple chemical reaction based on the outermost electron states of atoms, trends in the periodic table, and knowledge of the patterns of chemical properties.	Plan and conduct an investigation to gather evidence to compare the structure of substances at the bulk scale to infer the strength of electrical forces between particles.

Kinematics: Self-driving cars

Are we ready for self-driving cars?

Driverless vehicles are fast becoming the norm. Programming these vehicles to know whether they're on a collision course or not requires basic data about distances, times, velocities, and accelerations. Students apply their knowledge of kinematics to help a food delivery company determine the most efficient method to deliver food to a music festival. Will it be a self-driving car or a drone?

HS-PS2-2	HS-PS2-3
Use mathematical representations to support the claim that the total momentum of a system of objects is conserved when there is no net force on the system.	Apply scientific and engineering ideas to design, evaluate, and refine a device that minimizes the force on a macroscopic object during a collision.*

Reactions and Energy: Fuels of the future

Are bionic leaves better than the real thing?

Scientists recently created a "bionic leaf" that manufactures fuel from sunlight ten times more efficiently than real leaves. This unit on the role of energy in chemical reactions will give your students plenty of fuel for thought!

HS-PS1-4

Use mathematical representations of Newton's Law of Gravitation and Coulomb's Law to describe and predict the gravitational and electrostatic forces between objects.

HS-PS2-1

Analyze data to support the claim that Newton's second law of motion describes the mathematical relationship among the net force on a macroscopic object, its mass, and its acceleration.

HS-PS2-6

Communicate scientific and technical information about why the molecular-level structure is important in the functioning of designed materials.*

HS-PS3-1

Create a computational model to calculate the change in the energy of one component in a system when the change in energy of the other component(s) and energy flows in and out of the system are known.

HS-PS3-3

Design, build, and refine a device that works within given constraints to convert one form of energy into another form of energy.*

HS-PS3-4

Plan and conduct an investigation to provide evidence that the transfer of thermal energy when two components of different temperature are combined within a closed system results in a more uniform energy distribution among the components in the system (second law of thermodynamics).

Magnetism: Wireless electricity

What is wireless electricity?

The world is fast becoming wireless. Now Disney Research Lab has invented a wireless charging room where devices can recharge automatically. It seems truly magical, but this ambitious project takes advantage of magnetism and its unique connection with electricity. Walk on into this unit to find out more about this mysterious force!

HS-PS2-5

Plan and conduct an investigation to provide evidence that an electric current can produce a magnetic field and that a changing magnetic field can produce an electric current.

HS-PS3-2

Develop and use models to illustrate that energy at the macroscopic scale can be accounted for as a combination of energy associated with the motions of particles (objects) and energy associated with the relative position of particles (objects).

HS-PS3-5

Develop and use a model of two objects interacting through electric or magnetic fields to illustrate the forces between objects and the changes in energy of the objects due to the interaction.

Light: Bending light

How do we turn a smartphone into a microscope?

Through their ability to bend light, lenses have been helping transform our lives for centuries. Peer into the amazing world of light with your students and discover a new type of lens that means you can now use your smartphone as a microscope.

HS-PS4-1

Use mathematical representations to support a claim regarding relationships among the frequency, wavelength, and speed of waves traveling in various media.

HS-PS4-2

Evaluate questions about the advantages of using a digital transmission and storage of information.

HS-PS4-3

Evaluate the claims, evidence, and reasoning behind the idea that electromagnetic radiation can be described either by a wave model or a particle model, and that for some situations one model is more useful than the other.

HS-PS4-4

Evaluate the validity and reliability of claims in published materials of the effects that different frequencies of electromagnetic radiation have when absorbed by matter.

HS-PS4-5

Communicate technical information about how some technological devices use the principles of wave behavior and wave interactions with matter to transmit and capture information and energy.*

Engineering, Technology, and the Application of Science

Ecosystems: Plastics in the ocean

How can we prevent plastic from harming marine life?

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HS-ETS1-1

Analyze a major global challenge to specify qualitative and quantitative criteria and constraints for solutions that account for societal needs and wants.

HS-ETS1-2

Design a solution to a complex real-world problem by breaking it down into smaller, more manageable problems that can be solved through engineering.

HS-ETS1-3

Evaluate a solution to a complex real-world problem based on prioritized criteria and trade-offs that account for a range of constraints, including cost, safety, reliability, and aesthetics, as well as possible social, cultural, and environmental impacts.

HS-ETS1-4

Use a computer simulation to model the impact of proposed solutions to a complex real-world problem with numerous criteria and constraints on interactions within and between systems relevant to the problem.

Earth Systems: The greenhouse effect

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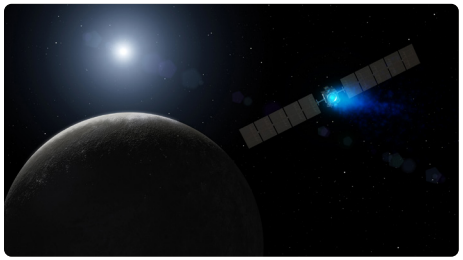

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