# Ganado Unified School District
# (High School Earth Science - YR)

## *PACING Guide SY 2022-2023*

| Timeline & Resources | AZ College and Career Readiness Standard | Essential Question (HESS Matrix) | Learning Goal | Vocabulary (Content/Academic) |
|---|---|---|---|---|
| **In this course, students will explore careers and study pioneers of Science in the fields of Earth Sciences, write a Scientific Research Paper, create a Slide Show Presentation using a Computer, Design and Implement a working Scientific Investigation for the GUSD Science Fair, build a model, and create a diagram, to develop Scientific Skills and Knowledge.** | | | | |
| **First nine weeks: Astronomy**<br>• **Big Bang**<br>• **History of Cosmology**<br>• **Stars**<br>• **Galaxies**<br>• **Milky Way**<br>• **Solar Systems**<br>• **Our Solar System**<br>• **Earth**<br>• **Meteors, Asteroids, and Comets**<br>• **Moons**<br>• **Earth's Moon**<br>• **Eclipse's (Lunar and Solar)**<br>• **Space Exploration**<br>• **Observatories** | E2:HS.E2U1.17 - Construct an explanation of the origin, expansion, and scale of the universe based on astronomical evidence.<br><br>E2:HS.E2U1.15 - Construct an explanation based on evidence to illustrate the role of nuclear fusion in the life cycle of a star.<br><br>E2:HS+E.E2U1.12 - Obtain, evaluate, and communicate scientific information about the way stars, throughout their stellar stages, produce elements and energy<br><br>E2:HS+E.E2U1.16 - Obtain, evaluate, and communicate information about patterns of size and | How did the Universe form?<br>What information do we have that proves to us this is true?<br>What thoughts might early Astronomers have had regarding today's Space Exploration?<br>How might each of the Early Astronomers envisioned Space?<br>How hot are stars?<br>What happens when stars die?<br>What is on the other side of a Black Hole?<br>Will we ever be able to travel to a star?<br>How do different shapes of galaxies form?<br>What does our galaxy look like if we were outside of it?<br>How do we understand what we are seeing when we look at other galaxies through telescopes?<br>Why are we called the Milky Way?<br>What is it we are looking at when we see the "Milky | **Objectives:**<br><br>**Students will be able to:**<br><br>• Describe the big bang theory of universe formation and how it is supported by observations of distant galaxies receding from our own, first discovered by the Hubble Telescope.<br>• Understand the nebular theory of solar system formation and the evidence supporting this theory, including cosmic background radiation, variance of elements, and redshift relation.<br>• Identify the scientific evidence, such as radioactive decay, for the age of the solar system (4.6 billion years), including Earth.<br>• Examine the age of our Universe by looking at how spontaneous radioactive decay follows a characteristic exponential decay law. Nuclear lifetimes allow radiometric dating to be used to determine the ages of rocks and other materials.<br>• Describe the big bang theory of universe formation and compare it to past hypothesis of Creation. | Absolute Magnitude, Acceleration, Accretion Disk, Antimatter, Apex, Aphelion, Asteroid, Astrology, Atom, Aurora Borealis, Azimuth, Barred Spiral Galaxy, Big Bang, Binary Star System, Black Hole, Brown Dwarf, Celestial, Centripetal Force, Cluster, Coma, Comet, Conduction, Constellation, Convection, Coriolis Effect, Corona, Coronal Mass Ejection, Cosmic Background Radiation, Cosmic Ray, Cosmology, Crater, Crescent Phase, Dark Matter, Dark Nebula, Density, Differentiation, Diurnal, Doppler Effect, Dust Tail, Dwarf, Eclipse, Electromagnetic Wave, Electron, Elliptical Galaxy, Event Horizon, Fireball, Fission, Focus, Force, Frequency, Fusion, Galaxy, Gamma Ray, Gas, Gas-Giant, Geocentric, Giant, Gibbous, Gravity, Greenhouse Effect, Half-life, Heliocentric, Heliopause, Heliosphere, Hertzsprung - Russell Diagram, Horizon, Hubble's Law, Hyperbola, Inclination, Index of Refraction, Inertia, Inferior Planet, Infrared, Interstellar Matter, Ion, Irregular Galaxy, Kepler's Laws of Planetary Motion, Kuiper Belt, Light Year, Luminosity, Lunar Eclipse, Magnitude, Main Sequence, Maria, Mass, |

| Timeline & Resources | AZ College and Career Readiness Standard | Essential Question (HESS Matrix) | Learning Goal | Vocabulary (Content/Academic) |
|---|---|---|---|---|
| • **Satellites**<br>• **Space Travel**<br>• **The Future in Space**<br><br>**Resources:**<br><br>**Earth Science - by Edward J. Tarbuck & Frederick K. Lutgens**<br><br>Power Point Presentation:<br><br>• Big Bang.<br>• Cosmology,<br>• Stars,<br>• Black Holes, Electromagnetic Spectrum,<br>• Hertzsprung-Russell Diagram,<br>• Galaxies,<br>• The Sun,<br>• Solar Systems,<br>• Our Solar System,<br>• The Planet Earth,<br>• Meteors Asteroids and Comets,<br>• Moons,<br>• The Moon, | scale of our solar system, our galaxy, and the universe.<br><br>E2:HS+E.E2U1.13 - Analyze and interpret data showing how gravitational forces are influenced by mass, and the distance between objects.<br><br>E2:6.E2U1.9 - Develop and use models to construct an explanation of how eclipses, moon phases, and tides occur within the Sun-Earth-Moon system.<br><br>E2:6.E2U1.7 - Use ratios and proportions to analyze and interpret data related to scale, properties, and relationships among objects in our solar system.<br><br>E2:K.E2U1.5 - Observe and ask questions about patterns of the motion of the sun, moon, and stars in the sky.<br><br>E2:2.E2U1.8 - Observe and explain the Sun's position at different times | Way" in the night sky?<br>Can we travel to the edge of our Milky Way?<br>How is our Sun different from other stars?<br>Will our Sun die?<br>What will Happen to Earth when our Sun dies?<br>Where do we fit the Sun on the Hertzsprung-Russell diagram?<br>Are solar flares dangerous?<br>What is a solar system?<br>How do we know the lighter planets and materials are on the outside of a solar system?<br>Are there other solar systems like ours?<br>Will we be able to travel through our solar system some day?<br>What do we have left to explore in our solar system?<br>Will our solar system continue to grow?<br>What do we know about the other planets in our Solar System?<br>Can we live on our other Planets?<br>Will an Asteroid or Meteor hit Earth and destroy it?<br>Why do more Asteroids not hit Earth?<br>Are Asteroids, Planets?<br>How do we know how old the Earth is?<br>Are there other planets like Earth?<br>How do moons form?<br>Why do moons not float away into space, but rather stay with a planet?<br>Are there moons in other | • Explain Empirical Evidence to identify patterns.<br>• Participate in learning about the past views of Cosmology in different cultures and societies.<br>• Decipher the results of the observations of newly forming stars, Investigate the life cycle of stars, the different types of stars, black holes, and be able to chart them based on the Hertzsprung-Russell (HR) diagram by the Electromagnetic Radiation in which 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.<br>• Explain how heavy elements found on Earth are formed in stars by nucleosynthesis, being produced when certain massive stars achieve a supernova stage and explode.<br>• Explore evidence of nuclear fusion in the sun's core that releases energy that eventually reaches Earth in the form of radiation, focusing on the energy transfer mechanisms and the difference of the masses and lifetimes of other stars, as well as the variation of radiation due to solar flares, the 11-year sunspot cycle, and non-cyclic variations over centuries.<br>• Study how galaxies were formed, and what the different classifications of galaxies are, including our Milky Way.<br>• Compare the size of the solar system to the Milky Way galaxy and compare the size and scale of objects within the solar system, itself.<br>• Evaluate the conditions that currently support life on Earth and compare them to the conditions that exist on other planets and moons in the solar system including atmospheres, hydrosphere, geospheres, the amounts of incoming solar energy, and the habitable zones. | Meteor, Meteor Shower, Meteorite, Meteoroid, Milky Way, Molecular Cloud, Neap Tide, Neutron, Neutron Star, Nodes, Nucleosynthesis, Nucleus, Oort Cloud, Orbit, Ozone, Parabola, Penumbra, Perihelion, Photon, Planet, Planetesimal, Plasma, Polarity, Pressure, Prominence, Proton, Protostar, Quarter Moon, Quasar, Radiant, Radio Galaxy, Radioactivity, Rays, Redshift, Reflection, Refraction, Regolith, Resolution, Rille, Solar Flare, Solar Nebula, Solar Wind, Solstice, Spacetime, Spectrograph, Spectrum, Spicule, Spiral Arm, Spiral Galaxy, Star, Stellar, Summer Solstice, Sunspot, Supergiant, Supernova, T-Tauri Star, Telescope, Terminal Velocity, Terrestrial Planet, Tides, Transverse Velocity, Ultraviolet, Umbra, Universe, Van Allen Belts, Velocity, Vernal Equinox, Waning Crescent, Wavelength, Waxing Crescent, White Dwarf, Zenith, Zodiac |

| Timeline & Resources | AZ College and Career Readiness Standard | Essential Question (HESS Matrix) | Learning Goal | Vocabulary (Content/Academic) |
|---|---|---|---|---|
| • Eclipses,<br>• Space Travel,<br>• Observatories,<br>• Satellites,<br>• Etc.<br><br>Various Websites, including NASA, Star Locators, Telescope, Reading Materials from selected Scientific magazines, news articles related to space exploration and discovery, Various Worksheets, Games, and Films. | during a twenty-four-hour period and changes in the apparent shape of the Moon from one night to another<br><br>E2:HS+E.E2U1.15 - Obtain, evaluate, and communicate information on how the nebular theory explains solar system formation with distinct regions characterized by different types of planetary and other bodies.<br><br>E2:HS.E2U1.16 - Construct an explanation of how gravitational forces impact the evolution of planetary motion, structure, surfaces, atmospheres, moons, and rings.<br><br>E2:HS+E.E2U1.14 - Use mathematics and computational thinking to explain the movement of planets and objects in the solar system.<br><br>E2:5.E2U1.7 - Develop, revise, and use models based on evidence to construct explanations about the movement of | Galaxies?<br>Can humans live on moons?<br>How does the Lunar Cycle affect Earth? Humans?<br>What is the future of the Lunar Cycle?<br>Are Eclipse's dangerous?<br>Why can we still see light during an eclipse?<br>How are Eclipses formed?<br>Does an eclipse change anything on Earth?<br>Why are Eclipses revered in some cultures and abhorred in others?<br>How far have we travelled through space?<br>Can movies like Star Trek and Star Wars really happen?<br>What is the largest space ship launched into space so far?<br>What are observatories for?<br>Who owns the observatories?<br>What would have maybe not learned about space if it had not been for observatories?<br>What might observatories look like in the future? How will they be different?<br>Why do satellites just go around Earth over an over?<br>Who owns the satellites that are in orbit around Earth?<br>What happens if there are problems on a Satellite?<br>How do people live on satellites? | • Understand that Energy cannot be created or destroyed only moved between one place and another place, between objects and/or fields, or between systems, and that in nuclear processes, atoms are not conserved, but the total number of protons plus neutrons is conserved.<br>• Analyze Earth as part of the solar system, which is part of the Milky Way galaxy.<br>• Relate the composition of objects in the solar system to their distance from the Sun.<br>• Study the composition and age of meteorites and discover what part asteroids, meteors, and comets play in the Universe.<br>• Explore the Newtonian gravitational laws governing orbital motions, which apply to human-made satellites as well as planets and moons, and Kepler's law that describes common features of the motion of orbiting objects, including their elliptical paths around the sun.<br>• Review past space explorations, what impacts space exploration has had, and what scientists are looking to discover in the future.<br>• Test how 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, are responsible for altering the intensity and distribution of sunlight falling on the earth. Connect how these phenomena cause a cycle of ice ages and other gradual climate changes in conjunction with plate tectonics.<br>• Explain how Observatories enhanced our knowledge of space and our theories of the Evolution of space. | |

| Timeline & Resources | AZ College and Career Readiness Standard | Essential Question (HESS Matrix) | Learning Goal | Vocabulary (Content/Academic) |
|---|---|---|---|---|
| | the Earth and Moon within our solar system.<br><br>E2:HS+E.E2U2.17 - Obtain, evaluate, and communicate the impact of technology on human understanding of the formation, scale, and composition of the universe. | What may future Space Exploration bring to the Human Existence?<br>Can we all travel to space some day?<br>Where have we been in space?<br>Where can we go?<br>What do we need to study if we want to be an astronaut? | | |
| **Second nine weeks: Geology**<br><br>• **Cartography**<br>• **Carbon Cycle**<br>• **Earth's Timeline**<br>• **Earth's Interior, Tectonic Plates, Earth's Interior Energy, Earthquakes, and Volcanos**<br>• **Rock Cycle, Soil Development, and Orogenesis**<br>• **Cryology**<br>• **Ocean Topography**<br><br>**Resources, Materials, and Equipment:** | E1:HS+E.E1U1.4 - Analyze and interpret geoscience data to make the claim that dynamic interactions with Earth's surface can create feedbacks that cause changes to other Earth systems.<br><br>E1:1.E1U1.5 - Obtain, evaluate, and communicate information about the properties of Earth materials and investigate how humans use natural resources in everyday life.<br><br>E1:4.E1U1.7 - Develop and/or revise a model using various rock types, fossils location, and landforms to show evidence that Earth's surface has changed over time. | What are maps used for?<br>What are the different types of maps?<br>What knowledge do I need to read the different types of maps?<br>How are maps created?<br>How has Mapping and Cartography evolved?<br>How might mapping and Cartography evolve in the future?<br>What mechanisms help Carbon cycle throughout Earth's spheres?<br>What significance does the Carbon Cycle play in the life cycle of all species on Earth?<br>What evidence do we have to prove the hypothesis' and theories proposed for the formation of our planet?<br>What evidence proves or disproves the current theory of plate tectonics?<br>How can Relative and Absolute Dating be beneficial to the Future since it relays the Past?<br>What are the essential forces that drive our | **Objectives:**<br><br>**Students will be able to:**<br><br>• Discover the importance of Cartography, and examine its use in Geography and Earth science.<br>• Read, Compare, and Interpret a variety of maps including topographical, road, world maps, and globes<br>• Locate points on Earth's surface by their Latitude and Longitude<br>• Use knowledge to create different types of maps including the use of the 10 Types of Contouring.<br>• Develop a quantitative model to describe the cycling of carbon among the hydrosphere, atmosphere, geosphere, and biosphere. Emphasis is on modeling biogeochemical cycles that include the cycling of carbon through the ocean, atmosphere, soil, and biosphere, providing the foundation for living organisms<br>• Examine Earth's historical Timeline and ascertain how Science finds evidence to prove our knowledge | Azimuth, Boundary, Cartography, Chart, Compass, Contour, Coordinates, Degree, Diagram, Direction, Elevation, Globe, Grid, Habitat, Key, Landforms, Landmark, Latitude, Legend, Level, Line, Longitude, Map, Map scale, Meander, Mercator, Natural Resources, Navigate, Orientation, Parallel, Period, Plat, Prime Meridian, Projection, Relation, Relief, Representational, Rose Compass, Scale, Sea Level, Slope, Structures, Survey, Topography, Atmosphere, Biosphere, Carbon Cycle, Carbon Dioxide, Chemical, Climate, Combustion, Decomposition, Diagram, Direction, Ecosystem, Environment, Equator, Food Chain, Fossil Fuels, Glacial Evidence, Global, Greenhouse Effect, Hydrosphere, Ice Core Samples, Microorganisms, Natural Resources, Nitrogen Cycle, Oxygen, Pangea, Photosynthesis, Respiration, Structures, Warming, Archean, Archeologists, Biodiversity, Cambrian, Cenozoic, Chemical, Cretaceous, Devonian, Diagram, Diverse, Elevation, Environment, Eocene, Eon, Epoch, Equator, Era, Extinction, Fossils, Hadean, Invertebrate, Jurassic, Mesozoic, Microorganisms, Miocene, Mississippian, Oligocene, Ordovician, Organic, Paleocene, |

| Timeline & Resources | AZ College and Career Readiness Standard | Essential Question (HESS Matrix) | Learning Goal | Vocabulary (Content/Academic) |
|---|---|---|---|---|
| Textbook Pearson Earth Science - by Edward J. Tarbuck & Frederick K. Lutgens<br><br>Power Points for:<br>• "Introduction to Mapping,"<br>• Carbon Cycle,<br>• Earth's Timeline,<br>• Intro to Geology,<br>• Earth's Interior, Earthquakes,<br>• Volcanos,<br>• Magnetism,<br>• Mountains,<br>• Ocean Floor,<br>• Caves,<br>• Deserts,<br>• Landforms,<br>• Rocks,<br>• Soil,<br>• Weathering<br>• Erosion,<br>• Glaciers and Ice Caps,<br>• Snowball Earth,<br>• The Ocean Floor,<br><br>Computers, Various Mapping and Data | E1:8.E1U1.6 - Analyze and interpret data about the Earth's geological column to communicate relative ages of rock layers and fossils<br><br>E1:8.E1U3.7 - Obtain, evaluate, and communicate information about data and historical patterns to predict natural hazards and other geological events.<br><br>E1:7.E1U1.6 - Construct a model to explain how the distribution of fossils and rocks, continental shapes, and seafloor structures provides evidence of the past plate motions<br><br>E2:5.E2U1.8 - Obtain, analyze, and communicate evidence to support an explanation that the gravitational force of Earth on objects is directed toward the planet's center.<br><br>E1:4.E1U1.5 - Use models to explain seismic waves and their effect on the Earth. | planet's systems that interact?<br>What will happen to Earth's internal processes as the Planet cools?<br>What might Plate Tectonics evolve into in the future?<br>Where will the Ring of Fire be in half of a million years based on current plate movement?<br>What geologic records may be preserved from 2018 to show evidence from this date?<br>How are other Earth Systems important in the Rock Cycle?<br>What other Sciences are important to the Rock Cycle and how are the different types of Rock affected?<br>Which parts of Erosion and Deposition have had the most influence on the surface of the Earth?<br>How had Deposition influenced Human behavior?<br>How might the area you live in change in the next Era by Erosional and Depositional Changes that might occur? Why might those changes occur?<br>Is Snowball Earth possible again?<br>What will truly happen if all the Glaciers melt and is that possible?<br>What might happen to the polar icecaps if the Earth's Magnetism were to reverse? | • Identify that radioactive decay and heat of formation are the sources of Earth's internal heat.<br>• Learn how scientific evidence such as seismic studies, composition of meteorites, and samples of the crust and mantle led to the inference that Earth's core, mantle, and crust are separated based on composition.<br>• Explore Earth's lithosphere, asthenosphere, mesosphere, outer core, and inner core and how they are separated based on physical properties.<br>• Model how convection currents help distribute heat within the mantle.<br>• Describe the development of the current theory of plate tectonics and the evidence that supports this theory.<br>• Explain Alfred Wegener's continental drift hypothesis, his evidence of fossil record, ancient climates, and the geometric fit of continents, and why it was not accepted in his time but how with the advent of sonar and the discovery of mid-ocean ridges, oceanic trenches, and magnetic reversal striping of the sea floor the development of the modern theory of plate tectonics gained interest.<br>• See how the geologic record preserves evidence of past change.<br>• Show how mantle plumes (hot spots) provide evidence for the rate and direction of tectonic plate motion.<br>• Identify the major tectonic plates of the Earth and describe their motion.<br>• Describe how earthquakes and volcanoes transfer energy from Earth's interior to the surface through seismic waves transferring | Paleozoic, Pangea, Pennsylvanian, Period, Permian, Phanerozoic, Photosynthesis, Pleistocene, Pliocene, Proterozoic, Quaternary, Relation, Silurian, Species, Structures, Tertiary, Toxic, Triassic, Vertebrate, Advection, Aftershock, Alfred Wegener, Asthenosphere, Batholiths, Chemical processes, Coastal Erosion, Composition, Conduction Currents, Constructive Forces, Continental Drift, Convection, Convection Currents, Convergent, Core, Crust, Deep-Ocean Trenches, Density, Density, Destructive Mechanisms, Dikes, Divergent, Dynamic Earth, Earthquake, Energy, Epicenter, Fault Line, Flooding, Focus, Foreshocks, Fossil Record, Geologic Record, Gravity, Half-Life, Heat, Hot Spot, Igneous, Inner Core, Laccoliths, Lava, Lithosphere, Love Wave, Magma, Magnetic Field, Magnetic Reversal, Magnetic Striping, Mantle, Mantle plumes, Mantle, Mass Wasting, Mechanical Energy, Mesosphere, Metamorphic, Metamorphism, Mid-Ocean Ridges, Minerals, Model, Mountain, Mudslides, Oceanic Trenches, Orogenesis, Outer Core, Paleomagnetism, Physical processes, Plate tectonics, Plateau, P-Wave, Radioactive Decay, Radioactive, Ridge-Push, Ridges, Rocks, Sea-Floor Spreading, Sedimentary, Seismic Waves, Seismograph, Sills, Slab-Pull, Subduction, Surface, S-Wave, Systems, Tectonic Plates, Tectonic Uplift, Thermal Convection, Transform boundaries, Trenches, Unstable Isotopes, Valley, Volcanic Ash, Volcanism, Volcano, Weathering, Aa, Abrasion, Abyssal Plain, Algae, Alluvial Fan, Andesite, Angular, Anticline, Ash, Attrition, Basalt, Batholith, Beach, Bedding, Bed-load, Biological Weathering, Clay, Lava |

| Timeline & Resources | AZ College and Career Readiness Standard | Essential Question (HESS Matrix) | Learning Goal | Vocabulary (Content/Academic) |
|---|---|---|---|---|
| Collection Websites, Drafting Supplies, Protractors, Rulers, Compasses, Mapping Paper, Grids, Various Lab Equipment, Topographical Models, Scientific apparatuses for Carbon study, Lab Equipment for Rock Identification, Rock Saw, Rock Cabbing Machine, Various Worksheets, Games, and Films. | E1:4.E1U1.6 - Plan and carry out an investigation to explore and explain the interactions between Earth's major systems and the impact on Earth's surface materials and processes.<br><br>E1:HS+E.E1U1.6 - Obtain, evaluate, and communicate information of the theory of plate tectonics to explain the differences in age, structure, and composition of Earth's crust.<br><br>E1:HS+E.E1U1.8 - Develop and use models to illustrate how Earth's internal and surface processes operate over time to form, modify, and recycle continental and ocean floor features.<br><br>E1:2.E1U1.4 - Observe and investigate how wind and water change the shape of the land resulting in a variety of landforms.<br><br>HS-ESS3-5: (National Standard) Analyze | How does Ocean Floor Topography help us understand Earth's development and Past?<br>Has all of the Ocean floor been discovered?<br>How is the Ocean floor similar to the surface of the Earth? | mechanical energy, and flowing magma transfers heat and mechanical energy.<br>• Demonstrate how Convection currents cause tectonic plates to move.<br>• Model tectonic plate movement to compare the results convergent, divergent, and transform boundaries in mountain building, volcanoes, earthquakes, mid-ocean ridges, and oceanic trenches.<br>• Compare P-Waves, S-Waves, and Love Waves, along with the epicenter and focus of an earthquake. Also Compare and contrast aftershocks and foreshocks and be able to read the measurements of a seismograph. Students will also be able to identify the major hazards associated with earthquakes.<br>• Describe the composition of each layer of Earth<br>• Explain how scientists have determined Earth's structure and composition<br>• List the three main types of volcanos and distinguish how the different types of volcanic landforms form and describe the major intrusive igneous features, such as dikes, sills, laccoliths, and batholiths and their formation.<br>• Define radioactivity and half-life and see how 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.<br>• Make the connection of the different Earth Processes to see how energy drives the cycling of matter within and between systems and is responsible for Plate movement, for most continental and ocean-floor features, and for the distribution of most rocks and minerals within Earth's crust. | Bomb, Calcite, Calcium Carbonate, Cementation, Chalk, Chemical Weathering, Clay, Coal, Cementation, Color, Compaction, Deformation, Delta, Deposition, Desert, Dyke, Deposition, Earthquakes, Effusive eruption, Estuary, Erosion, Eruption, Evaporation, Exfoliation, Expansion, Explosive Eruption, Extrusive, Erosion, Faults, Feldspar, Fine-Grained, Folds, Foliated, Fossil, Fragmental, Freeze-Thaw, Fossil Fuel, Coarse-grained, Coccoliths, Columnar joints, Compaction, Compression, Conglomerate, Continental Shelf, Contraction, Contact Metamorphism, Crater, Creep, Cross-bedding, Crystal, Crystalline, Crystallization, Gabbro, Glacial Erosion, Gneiss, Granite, Groundwater, Gravity, Marble, Meander, Medium-Grained, Metamorphic Aureole, Metamorphic Rock, Metamorphism, Mica, Mineral, Moraine, Mudflow, Mudstone, Hoodoo, Shale, Sill, Slate, Soil creep, Solution, Strata, Strike-slip fault, Suspension, Syncline, Hydrolysis, Ice sheet, Igneous, Interlocking, Intrusion, Invertebrates, Lagoon, Lahar, Landslide, Landslip, Lava, Limestone, Longshore Drift, Lithification, Magma, Mass-Movement, Metamorphism, Normal Fault, Oolith, Oolitic Limestone, Oxidation, Pahoehoe, Pebbles, Petroleum, Physical Weathering, Pillow lava, Plankton, Playa, Plucking, Porous, Pumice, Pyroclastic, Pyroclastic Flow, Pressure, Quartz, Quartzite, Re-Crystallization, Reef, Regional Metamorphism, Reverse Fault, Rhyolite, Rift Valley, Ripple Marks, Rock, Rock Fall, Rock Salt, Rounded, Saltation, Sand, Sandstone, Schist, Sea-stack, Sediment, Sedimentary Rock, Sediment, Streak, |

| Timeline & Resources | AZ College and Career Readiness Standard | Essential Question (HESS Matrix) | Learning Goal | Vocabulary (Content/Academic) |
|---|---|---|---|---|
| | 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's systems. [Clarification Statement: Examples of evidence, for both data and climate model outputs, are for climate changes (such as precipitation and temperature) and their associated impacts (such as on sea level, glacial ice volumes, or atmosphere and ocean composition).] | | • Learn the classification process of minerals, rocks, and other Earth resources based on their properties and origins, including igneous rocks, sedimentary rocks, and metamorphic rocks.<br>• Understand the formation of intrusive and extrusive rocks and be able to differentiate.<br>• Focus on weathering, erosion, and deposition, along with the surface features formed by them.<br>• Describe and demonstrate by modeling how landforms are created through geologic processes.<br>• Understand and explore landform development<br>• Practice mechanical investigations including stream transportation and deposition using a stream table, erosion using variations in soil moisture content, or frost wedging by the expansion of water as it freezes.<br>• Investigate chemical weathering and recrystallization by testing the solubility of different materials.<br>• Design, build, and test a model that investigates geological processes such as mudslides, earthquakes, flooding, and erosion, with the possible effects on human-engineered structures like dams, homes, bridges, roads.<br>• Demonstrate how system interactions, such as the loss of ground vegetation, causes an increase in water runoff and soil erosion, and how dammed rivers increase groundwater recharge, decrease sediment transport, and increase coastal erosion.<br>• Exhibit models to establish how the resulting land features of mountains, valleys, and plateaus, and the sea-floor features such as trenches, ridges, and seamounts, are a result of both constructive forces such as volcanism, tectonic uplift, and orogeny, and destructive | Tension, Texture, Thrust Fault, Traction, Transport, Turbidity, speed Transportation, Unconformity, Uplift, Vent, Vesicles, Viscosity, Volcano, Volcanic Ash, Wave-Cut Platform, Weathering, Ablation, Ablation Moraine, Abrasion, Accumulation, Accumulation Area, Advance, Arête, Barren Zone, Bergschrund, Bergy Seltzer, Braided Stream, Calving, Calving Glacier, Chatter Marks, Cirque, Corrie, Crescentic Gouge, Crevasse, Debris Cone, Dendrochronology, Disarticulation, Distributary, Downwasting, Drift, Drumlin, Erratic, Esker, Eustacy, Firn, Fjord, Foliation, Fountain, Freeze-Thaw Weathering, Glacial Furrow, Glacial Groove, Glacial Lake, Glacial Stream, Glacial Trough, Glacier, Glacier Cave, Glacier Flow, Glacier Ice, Glacier Table, Ground Moraine, Hanging Glacier, Hanging Valley, Holocene, Horn, Ice Cap, Ice Field, Ice Rafting, Ice Sheet, Ice Shelf, Iceberg, Ice-Cored Moraine, Ice-Dammed Lake, Icefall, Ice-Marginal Lake, Isostasy, Jökulhlaup, Kame, Kettle, Lateral Moraine, Little Ice Age, Mass Balance, Medial Moraine, Moraine, Moulin, Neve, Nunatak, Ogive, Outwash Plain, Piedmont Glacier, Pit Pond, Plucking, Polar Glacier, Push Moraine, Recessional Moraine, Reconstituted Glacier, Remnant, Retreat, Roche Moutonnee, Rock Flour, Rock Glacier, Rockslide, Sérac, Snowbridge, Stagnation, Striations, Suncups, Surge, Tarn, Temperate Glacier, Terminal Moraine, Terminus, Tidewater Glacier, Till, Trimline, Truncated Spur, U-Shaped Valley, Valley Glacier, Varve. |

| Timeline & Resources | AZ College and Career Readiness Standard | Essential Question (HESS Matrix) | Learning Goal | Vocabulary (Content/Academic) |
|---|---|---|---|---|
| | | | mechanisms such as weathering, mass wasting, and coastal erosion.<br>• Discuss the different erosional features formed by alpine glaciers.<br>• Describe the processes by which glaciers change the underlying rocks.<br>• Discuss the sorting and types of particles deposited by glaciers as they advance and recede.<br>• Describe the landforms created by glacial deposits.<br>• Diagram glacier anatomy, movement, deposits, landforms, and climate<br>• Understand effects of growth and retreat of Glaciers and Ice Caps.<br>• (No testing will take place for Cryology, only introduction to the topic and all processes, and landforms created by so as to introduce the effect on Geology.)<br>• Learn how scientific evidence such as seismic studies, composition of meteorites, and samples of the crust and mantle led to the inference that Earth's core, mantle, and crust are separated based on composition.<br>• Explore Earth's lithosphere and physical properties evident on the Ocean Floor.<br>• Describe the development of the current theory of plate tectonics and the evidence on the Ocean Floor that supports this theory.<br>• Explain Alfred Wegener's continental drift hypothesis, his evidence of fossil record, ancient climates, and the geometric fit of continents, and why it was not accepted in his time but how with the advent of sonar and the discovery of mid-ocean ridges, oceanic trenches, and magnetic reversal striping of the sea floor the development of the modern theory of plate tectonics gained interest. | |

| Timeline & Resources | AZ College and Career Readiness Standard | Essential Question (HESS Matrix) | Learning Goal | Vocabulary (Content/Academic) |
|---|---|---|---|---|
| | | | • Make the connection of the different Earth Processes to see how energy drives the cycling of matter within and between systems and is responsible for Plate movement, for most continental and ocean-floor features. | |
| **Third nine weeks: Meteorology**<br><br>• **Atmosphere**<br>• **Atmospheric Phenomenon**<br>• **Climate**<br>• **Seasons**<br>• **Clouds**<br>• **Wind**<br>• **Weather**<br>• **Weather Prediction**<br>• **Weather Phenomenon**<br><br>**Resources, Materials, and Equipment:**<br><br>Textbook Pearson Earth Science - by Edward J. Tarbuck & Frederick K. Lutgens<br><br>Computers, Atmosphere apparatuses, and Various Geologic and | E1:6.E1U1.6 - Investigate and construct an explanation demonstrating that radiation from the Sun provides energy and is absorbed to warm the Earth's surface and atmosphere.<br>E1:4.E1U1.8 - Collect, analyze, and interpret data to explain weather and climate patterns.<br>E1:HS.E1U1.11 - Analyze and interpret data to determine how energy from the Sun affects weather patterns and climate.<br>E1:HS+E.E1U1.2 - Develop and use models to describe how variations in the flow of energy into and out of Earth's systems result in changes in climate.<br>E2:6.E2U1.10 - Use a model to show how the tilt of Earth's axis causes variations in the length of the day and gives rise to seasons. | How do Scientists determine the composition, structure and properties that make up Earth's atmosphere?<br>What causes Phenomenon?<br>What were the reactions of the population before their were Scientific explanations?<br>Why does Climate Change?<br>What are Factors that affect Climate?<br>What difference can Humans make in future Climate on Earth?<br>Are seasons the same everywhere?<br>What determines a Season?<br>How are Season different in different climates?<br>What are clouds?<br>How do clouds form? | **Objectives:**<br><br>**Students will be able to:**<br><br>• describe the formation of Earth's early atmosphere and key gases<br>• identify methods of transferring energy through the atmosphere<br>• describe the various properties of the atmosphere including temperature, air pressure and density<br>• Determine the difference between Weather and Phenomenon.<br>• Explain the causes of Phenomenon in the Atmosphere.<br>• Predict where Phenomenon are most likely to occur.<br>• describe different types of climate data.<br>• explain why climates vary.<br>• describe the criteria used to classify climates.<br>• distinguish among different types of climatic changes and why they occur.<br>• identify how humans impact the global climate<br>• compare and contrast natural and human impact on climate change<br>• describe seasonal changes on Earth.<br>• Explain how the tilt of Earth causes those changes.<br>• Predict Seasonal changes that may develop in the future if climates change. | Above Average, Absorption, Acid Rain, Adiabatic process, Aeolian, Air current, Air density, Air mass, Altocumulus, Altostratus, Anemometer, Anomaly, Anticyclone, Atmosphere, Atmospheric radiation, Autumn, Barometer, Barometric Pressure, Below Average, Blizzard, Ceiling, Charged Particles, Cirrocumulus, Cirrostratus, Cirrus, Clear, Climate Change, Climate, Climatology, Cloud, Cold Front, Cold Front, Condensation, Convection, Coriolis Effect, Cumulonimbus, Cumulus, Cyclone, Depression, Dew Point, Dew, Dewpoint, Doppler, Downburst, Drift, Drizzle, Drought, El Niño, Evapotranspiration, Fair, Flash Flood, Flood, Flurry, Fog, Forecast, Freezing, Front, Frost, Frostbite, Funnel Cloud, Gale, Global Warming, Greenhouse Effect, |

| Timeline & Resources | AZ College and Career Readiness Standard | Essential Question (HESS Matrix) | Learning Goal | Vocabulary (Content/Academic) |
|---|---|---|---|---|
| Meteorological Data Collection Websites. Various Worksheets, Games, and Films<br><br>Power Points for:<br>• Atmosphere<br>• Atmospheric Phenomenon<br>• Climate<br>• Seasons<br>• Clouds<br>• Wind and Movement in the Atmosphere<br>• Weather<br>• Predicting the Weather<br>• Weather Phenomenon | E1:K.E1U1.3 - Observe, record, and ask questions about temperature, precipitation, and other weather data to identify patterns or changes in local weather.<br>E1:HS.E1U1.11 - Analyze and interpret data to determine how energy from the Sun affects weather patterns and climate.<br>E1:HS+E.E1U1.2 - Develop and use models to describe how variations in the flow of energy into and out of Earth's systems result in changes in climate.<br>E1:K.E1U1.3 - Observe, record, and ask questions about temperature, precipitation, and other weather data to identify patterns or changes in local weather.<br>E1:K.E1U1.4 - Observe, describe, ask questions, and predict seasonal weather patterns; and how those patterns impact plants and animals (including humans).<br>E1:7.E1U2.7 - Analyze and interpret data to construct an explanation | Why is it important to understand the development of clouds?<br>How do changes in the temperature of Earth's atmosphere affect the growth or change of clouds?<br>What IS Wind?<br>How is Wind controlled?<br>What is wind made of?<br>What are the factors that affect weather?<br>How are weather patterns formed?<br>Can weather be predicted?<br>What is needed to change weather?<br>What were early methods of predicting the weather?<br>How often are Meteorologists correct in their weather predictions?<br>What weather patterns are the same as 100 years ago? 1000 years ago? Do we use this evidence in predictions for the future? | • describe cloud formation and the different types of cloud groups<br>• Understand the development of clouds<br>• Determine the causes of smog and how it relates to water in the atmosphere.<br>• Explain how wind is created.<br>• Predict patterns of wind.<br>• relate the Coriolis Effect to weather patterns.<br>• explain how warm, cold, stationary and occluded fronts affect weather patterns.<br>• analyze weather data to predict weather patterns.<br>• describe and interpret weather maps and reports.<br>• Understand the use of Weather Data Collection Apparatuses to Predict future weather.<br>• Understand how weather patterns create unpredictability and instability.<br>• Read measurements for events such as tornados and hurricanes.<br>• Discuss the hazards created by Weather Phenomenon. | Gust, Haboob, Hail, Haze, Heat Index, Heat Wave, High Pressure, Humidity, Hurricane, Indian Summer, Ion, Isobar, Jet Stream, La Niña, Lake Effect, Land Fall, Lightning, Low Pressure, Maritime, Mesosphere, Meteorology, Nor' Easter, Occluded Front, Overcast, Paroemieology, Precipitation, Pressure, Prevailing Wind, Radar, Rain Shadow, Rain, Ridge, Sea Surface Temperature, Shower, Sleet, Snow, Southern Oscillation, Spring, Squall, Stationary Front, Storm, Stratosphere, Stratus, Subtropical, Summer, Surf, Surge, Temperature, Thermosphere, Thunder, Thunderstorm, Tornado, Trade Winds, Tropical Air Mass, Tropical Cyclone, Tropical, Tropopause, Troposphere, Trough, Tsunami, Turbulence, Unstable, Vertical Wind Shear, Visibility, Warm Front, Warning, Watch, Water Spout, Wavelength, Weather, Westerlies, Wind Chill, Wind Shear, Wind, Winter |

| Timeline & Resources | AZ College and Career Readiness Standard | Essential Question (HESS Matrix) | Learning Goal | Vocabulary (Content/Academic) |
|---|---|---|---|---|
| | for how advances in technology has improved weather prediction. E1:2.E1U2.6 - Analyze patterns in weather conditions of various regions of the world and design, test, and refine solutions to protect humans from severe weather conditions. | What creates Weather Phenomenon? Can Weather Phenomenon be predicted? How are weather phenomenon events dangerous? What are safety measures we can take to ensure life and human property is not risked? | | |
| **Fourth nine weeks: Hydrology**<br>• **Water Cycle**<br>• **Oceans**<br>• **Lakes (and Ponds)**<br>• **Rivers**<br>• **Creeks and Streams**<br>• **Groundwater**<br>• **Aquafers**<br>• **Frozen Water**<br>• **Water as a solvent**<br>• **Water in the Atmosphere**<br>• **Human Use and Interaction**<br>• **Viability of Water** | **E1:HS+E.E1U1.5 -** Obtain, evaluate, and communicate information on the effect of water on Earth's materials, surface processes, and groundwater systems.<br><br>**E1:2.E1U1.5 -** Develop and use models to represent that water can exist in different states and is found in oceans, glaciers, lakes, rivers, ponds, and the atmosphere.<br><br>**E1:4.E1U3.9 -** Construct and support an evidence-based argument about the availability of water and its impact on life. | How does water work to break down almost everything on Earth?<br><br>Why is the entire planet not solid water if it breaks everything down?<br><br>If there is water in the air, why can we breathe it in?<br><br>How much water can the air hold and what happens when it reaches capacity?<br><br>Is another Dust Bowl possible? Where? And Why? | **Objectives:**<br><br>**Students will be able to:**<br>• Characterize how water has been recycled throughout time.<br>• Identify oceans, lakes, running water, frozen water, ground water, and atmospheric moisture as the reservoirs of Earth's water cycle, and graph or chart the relative amounts of water in each.<br>• Diagram how the processes of evaporation, condensation, precipitation, surface runoff, ground infiltration and transpiration contribute to the cycling of water through<br>• Earth's reservoirs.<br>• Model the natural purification of water as it moves through the water cycle.<br>• Relay how research shows the oceans formed from outgassing by volcanoes and ice from comets. | Abiotic, Ablation, Absorb, Adhesion, Alluvial, Alluvium, Aquiclude, Aquifer, Aquifuge, Arroyo, Artesian Well, Atmospheric Moisture, Backflow, Bed, Biotic, Canal, Capillary, Channel, Cohesion, Condensation, Creek, Crest, Current, Dam, Delta, Depths, Dike, Dissolve, Drainage, Dry Wash, Ecosystem, El Niño, Estuary, Evaporation, Filter, Flash Flood, Floe, Flood, Flood Plain, Freeze, Freezing Point, Freshwater, Frozen water, Glacier, Ground Infiltration, Groundwater, Headwater, Hydrosphere, Ice, Ice Jam, Impermeable, Impervious, Irrigation, |

| Timeline & Resources | AZ College and Career Readiness Standard | Essential Question (HESS Matrix) | Learning Goal | Vocabulary (Content/Academic) |
|---|---|---|---|---|
| **Resources, Materials, and Equipment:**<br><br>Textbook Pearson Earth Science - by Edward J. Tarbuck & Frederick K. Lutgens<br><br>Computers, Scientific apparatuses for Water study and Various Data Collection Websites. Worksheets, Games, and Films.<br><br>Power Point for:<br><br>• Water Cycle<br>• Waters of the Ocean<br>• for Fresh Water Lakes<br>• Rivers – Life Lines on Earth<br>• Creeks and Streams<br>• Groundwater<br>• Aquafers<br>• Water in Cryology<br>• Water – The Strongest Force on Our Planet | | What does the future of fresh water for humans look like? How do you determine that?<br><br>What can you do to keep water fresh for human use on this planet?<br><br>Why is water valuable?<br><br>What can be done to preserve our water resources?<br><br>What would life on our planet be like if fresh water resources were scarcer than they are now?<br><br>How is fresh water being wasted on our planet right now? | • Investigate how salinity, temperature, and pressure at different depths and locations in oceans and lakes affect saltwater ecosystems through experimentation.<br>• Model energy flow in the physical dynamics of oceans such as wave action, deep-ocean tides circulation, surface currents, land and sea breezes, El Niño, and upwelling's.<br>• Comprehend the vastness of Earth's lakes as reservoirs yet understand their minimum in the Earth's total Water.<br>• Explore how Lakes are Groundwater Discharge Points<br>• Discuss the uses of Lakes as Freshwater and understand their growth and destruction<br>• Explain the Reasons for Flooding<br>• Understand the Structure of Dams and their uses<br>• Comprehend how Rivers are considered a Life Source<br>• Follow the paths of Collection for Runoff to the Rivers<br>• Understand the capacity and water flow to and from Rivers.<br>• Explore various fresh water systems, such as streams and drainage systems, groundwater, and caves.<br>• Recreate the action of streams on the landscape.<br>• Understand the different sources of water for streams and creeks.<br>• Understand Ground water as one of Earth's reservoirs.<br>• Model the natural purification of water as it moves through the ground.<br>• Comprehend how water is stored in the ground.<br>• Explore groundwater systems and how they contribute to the formation of natural landforms. | Lake, Levee, Liquid, Meander, Natural Purification, Ocean, Ogee, Percolation, Perennial Stream, Permeable, Pool, Porosity, Precipitation, Pressure, Puddle, Rain Gage, Rainfall, Reservoir, River, Running water, Runoff, Salinity, Saltwater, Saturation, Spring, Stream, Surface Runoff, Surface Water, Tank, Tide, Transpiration, Transport, Turbidity, Upwelling, Viscosity, Wash, Water Quality, Water Table, Waterline, Watershed, Wave, Well, Wetland |

| Timeline & Resources | AZ College and Career Readiness Standard | Essential Question (HESS Matrix) | Learning Goal | Vocabulary (Content/Academic) |
|---|---|---|---|---|
| • Atmospheric Water<br>• Human Position in the Water Cycle on Earth<br>• Free Water | | | • Characterize the traits of an aquifer.<br>• Model the natural purification of water as it moves through aquifers.<br>• Discuss the amount of time to build substantial aquifers.<br>• Reason how aquifers have been depleted in the recent past and discuss what they have been used for.<br>• Understand effects of growth and retreat of Glaciers and Ice Caps and how they affect fresh and available water.<br>• Comprehend what this means for the Human system on Earth.<br>• Model how water creates caves.<br>• Design landforms are mostly created by water.<br>• Explore how water acts and reacts upon different substances in a laboratory setting.<br>• Observe these solvent actions in nature and comment on Scientific Evaluations using Logic.<br>• Explain how atmospheric moisture is a reservoir of Earth's water.<br>• Chart the quantities of water in our Atmosphere at any time.<br>• Explain how heat and greenhouse gasses affect the concentration of water in the Atmosphere.<br>• Point our Earth's main Water reservoirs.<br>• Using data collected from local water systems, evaluate water quality and conclude how current pollution practices can make water unavailable for human and animal use or unsuitable for life.<br>• Explain how water is used for Travel and Transportation<br>• Discuss how Water is used in Industry | |

| Timeline & Resources | AZ College and Career Readiness Standard | Essential Question (HESS Matrix) | Learning Goal | Vocabulary (Content/Academic) |
|---|---|---|---|---|
| | | | • Comprehend the vastness of the Human effect on Pollution in Earth's water systems.<br>• Track the Civilization of Man by following the waterways.<br>• Understand how Building Dams changed the way human's live.<br>• Explore how Annual Flooding Impacts Agriculture both positively and negatively.<br>• Discover how Life in the Desert is possible with a short water supply.<br>• Research Navajo's and their History with Water and the importance it has on their culture.<br>• Using data collected from local water systems, evaluate water quality and conclude how current pollution practices can make water unavailable for human and animal use or unsuitable for life.<br>• Research the practices of industry and how they use water.<br>• Discover how fresh water is wasted.<br>• Find alternative means that do not waste Fresh water in industry.<br>• Create ways to save Fresh Water in their own lives and in their communities. | |