eugene SCIENCE CENTER

3rd Grade Field Trip Guide

Updated 01/03/2024

Table of Contents

Introduction

Welcome and thank you for visiting Eugene Science Center (ESC)! This document will serve as a guide for optimizing your visit to ESC. Featured in this guide are three tracks, with exhibits chosen to align with each track according to the NGSS Framework. These tracks include Engineering Design, Forces and Motion, and Earth and Space Science. Each track has its own guide with exhibit descriptions, possible facilitation questions, an NGSS alignment chart, and a picture of the exhibit. Additionally, there is an NGSS Third Grade DCI Descriptions page at the end of the guide.

In addition to NGSS alignment, many of our exhibits support engagement with data literacy. Learning how to be data literate can influence how we see, understand, and interact with the world. Important aspects on the road to data literacy include: interpreting and communicating data trends; how to identify misinformation; asking questions; and being curious, creative, cautious, and cognizant.

ESC also offers an optional Enrichment Lab that can accompany field trips. Designed according to 3rd grade NGSS standards, our “Bee-Havior” lab explores the structures and behaviors that honeybees use to find food. The activities that accompany the lab include an electrostatic pull challenge, UV light flower displays, and a waggle dance game.

If you have any questions or comments regarding this guide or your field trip experience, please contact our Programs Coordinator, Lena Lamoureux (llamoureux@eugenesciencecenter.org).

Engineering Design

This track has a focus on Engineering Design as defined by the NGSS Framework. Each exhibit supports students in exploring the engineering process to design, build, and test solutions to problems.

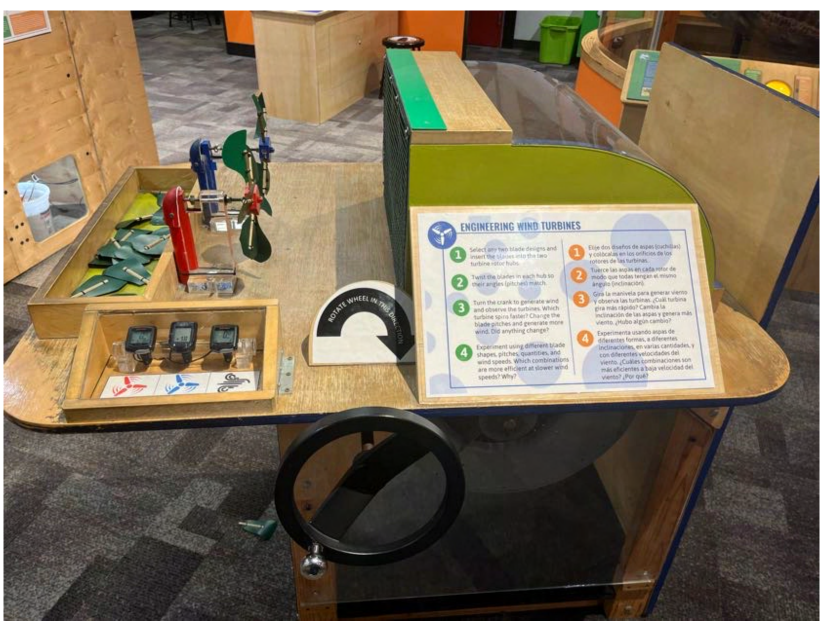
<u>**Exhibit List:**</u> Wind Turbines, Engineering Raceways, Build a Satellite, Resist a Quake, Habitat on Mars, Bowl-A-Graph, Keva Blocks

<u>Wind Turbines</u>

Students engineer their own wind turbines by selecting different blade shapes, number of blades, and position (pitch) of blades in the turbine. They rapidly turn a wheel to create wind. Readouts show speed of the turbine rotation and wind speed. Students can compare turbine designs simultaneously to see which is the most effective.

<u>Facilitation Question:</u> Do you notice which propellers make the turbine move faster? Slower?

SEP	DCI	CCC
Developing and Using Models; Constructing Explanations and Designing Solutions; Analyzing and Interpreting Data	**ETS1.C**	Cause and Effect; Energy and Matter; Structure and Function



Engineering Raceways

Students launch balls into a chaotic maze and then shift magnetic tubes and trays below the maze to catch and move the balls into a basin.

Facilitation Question(s): Can you predict where the ball will end? Choose a basin and try to create a raceway to get a ball to that basin!

SEP	DCI	CCC
Asking Questions and Defining Problems; Constructing Explanations and Designing Solutions	**ETS1.A** **ETS1.B** **ETS1.C**	Cause and Effect; Systems and Systems Modeling; Structure and Function

Build a Satellite

Students use the engineering process to design, build, and test a foam model satellite, attaching a power source, communication tools, navigation equipment, and scientific sensors. Students can then go to the test station to see if their craft has all necessary tools (checklist), can balance in flight (spin test), and can withstand launch (with the shake test) to complete its mission.

Facilitation Question(s): Can you make a satellite using one of each of the categories of tools? If your satellite didn't pass a test, how can you design it differently?

SEP	DCI	CCC
Developing and Using Models; Constructing Explanations and Designing Solutions	**ETS1.A** **ETS1.B** **ETS1.C**	Structure and Function; Systems and Systems Modeling

Resist a Quake

Students learn about earthquake engineering by constructing a structure and seeing how well it withstands earthquakes of various magnitudes on a shake table.

Facilitation Question(s): How do structures with rods compare to those without?

SEP	DCI	CCC
Asking Questions and Defining Problems; Developing and Using Models; Planning and Carrying Out Investigations	**ETS1.A ETS1.B ETS1.C ESS3.B**	Cause and Effect; Structure and Function

Habitat on Mars

Students create a colony on Mars using a themed lego table. Using cards to guide, students are encouraged to develop life-support systems before eventually adding in leisure activities. The table frames these steps as 'Build/Connect', 'Survive', and 'Thrive'.

Facilitation Question(s): What types of life support systems do you think would be necessary on Mars? What would you need on a mission to Mars to thrive?

SEP	DCI	CCC
Asking Questions and Defining Problems; Developing and Using Models; Constructing Explanations and Designing Solutions	**ETS1.A** **ESS3.B** **LS2.C** **LS2.D**	Cause and Effect; Systems and Systems Modeling; Energy and Matter; Structure and Function

Bowl-A-Graph

Students "bowl" tennis balls into 10 slots while aiming for the center slot. Each time a ball drops into a slot, an LED lights up in a column. When a column is fully lit, students analyze a bar graph to see if they were accurate, precise, or both. They can also do this under the pressure of a 45 second timer.

Facilitation Question(s): Can you make a graph that matches the Accurate and Precise Graph? How does speed influence your accuracy or precision?

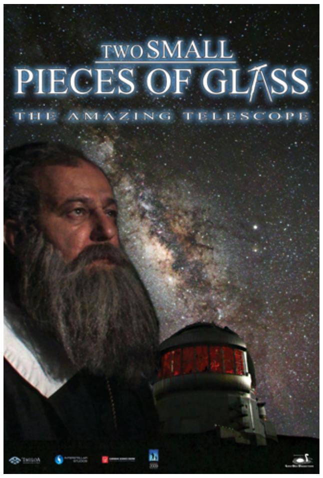
SEP	DCI	CCC
Asking Questions and Defining Problems; Planning and Carrying Out Investigations; Analyzing and Interpreting Data; Engaging in Argument from Evidence	**PS2.A**	Patterns; Cause and Effect

Keva Blocks

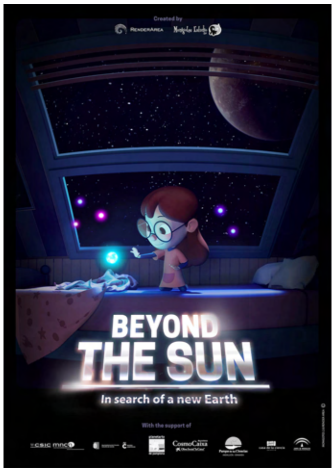
This exhibit consists of hundreds of wooden planks for building structures. Each KEVA plank is ¾ inch wide, ¼ inch thick, and 4 ½ inches long. Planks can be used flat on the width, flat on the narrow side, or on the end. The plank wide side is the same as three times the narrow thickness, and the plank length is four times the wide side width. Therefore, planks can be stacked in multiple ways. Students can design and build structures as they imagine them, by simply stacking the planks.

SEP	DCI	CCC
Asking Questions and Defining Problems; Constructing Explanations and Designing Solutions	**ETS1.A**	Cause and Effect; Scale, Proportion, and Quantity; Structure and Function

Recommended Pre-Recorded Planetarium Shows



***2 Small Pieces of Glass* -** This show breaks down **how telescopes work** on a basic level, and discusses the **origin of the telescope.** It talks about **early astronomical viewing** of planets and the future of astronomy and telescope design. It also introduces a few **historical astronomers** and the contributions they made to the field of astronomy **(ESS1.A, ETS1.A).**



***Beyond the Sun* -** This show explores the topic of **exoplanets**, discussing how to locate them, and what we can learn about them with today's technology. It discusses the ways to locate them, explaining the **doppler effect**, and other important terminology. We think this show does an excellent job of explaining a complex topic in an accessible way **(ESS1.A).**

Forces and Motion

This track explores the physical science concepts of force and motion as outlined in the NGSS Framework. Students participate in and observe different types of interactions between objects and learn more about the physical forces around us.

Exhibit List: Downhill Racers, Cannonball of Air, Nano Exhibition: Ferrofluids, Bowl-A-Graph, Catenary Arch, Fluid Dynamics, Chaotic Pendulum, Bernoulli Blower, Exploring Gravitational Orbits

Downhill Racers

A boxed ramp is the testing arena for investigating which of several rings will move the fastest from the top to the bottom of the incline. Match pairs of rings with different structures and masses and see which ring moves the fastest!

Facilitation Question(s): Why do you think some rings moved faster than others down the ramp?

SEP	DCI	CCC
Asking Questions and Defining Problems; Planning and Carrying Out Investigations; Constructing Explanations and Designing Solutions	**PS2.A**	Structure and Function

<u>Cannonball of Air</u>

This simple exhibit consists of a large cylinder that has one end covered with a heavy plastic sheet and the other open. When the student hits the covered end it creates a “cannonball” of air visualized by movement of a silver covered target area hanging from the ceiling. The air cannon, when hit, creates a “vortex” of air: <u>a swirling motion similar to that seen when water circles a drain</u>. The air coming out of the open end carries enough energy to travel and to hit the target.

SEP	DCI	CCC
Developing and Using Models; Constructing Explanations and Designing Solutions	**PS2.A PS2.B**	Cause and Effect; Energy and Matter; Structure and Function

Nano Exhibition: Ferrofluids

Students explore three different tubes filled with magnetic particles of different sizes and manipulated by adjoining magnets. With the largest particles, students will observe the particles move and clump together, however the particles appear to remain separate. On the smallest 'Nano' level, the particles move as one, like a fluid (ferrofluid).

SEP	DCI	CCC
Asking Questions and Defining Problems; Constructing Explanations and Designing Solutions	**PS2.B**	Cause and Effect; Scale, Proportion, and Quantity; Structure and Function

Bowl-A-Graph

Students "bowl" tennis balls into 10 slots while aiming for the center. Each time a ball drops into a slot, an LED lights up in a column. When a column is fully lit, students analyze a bar graph to see if they were accurate, precise, or both. They can also do this under the pressure of a 45 second timer.

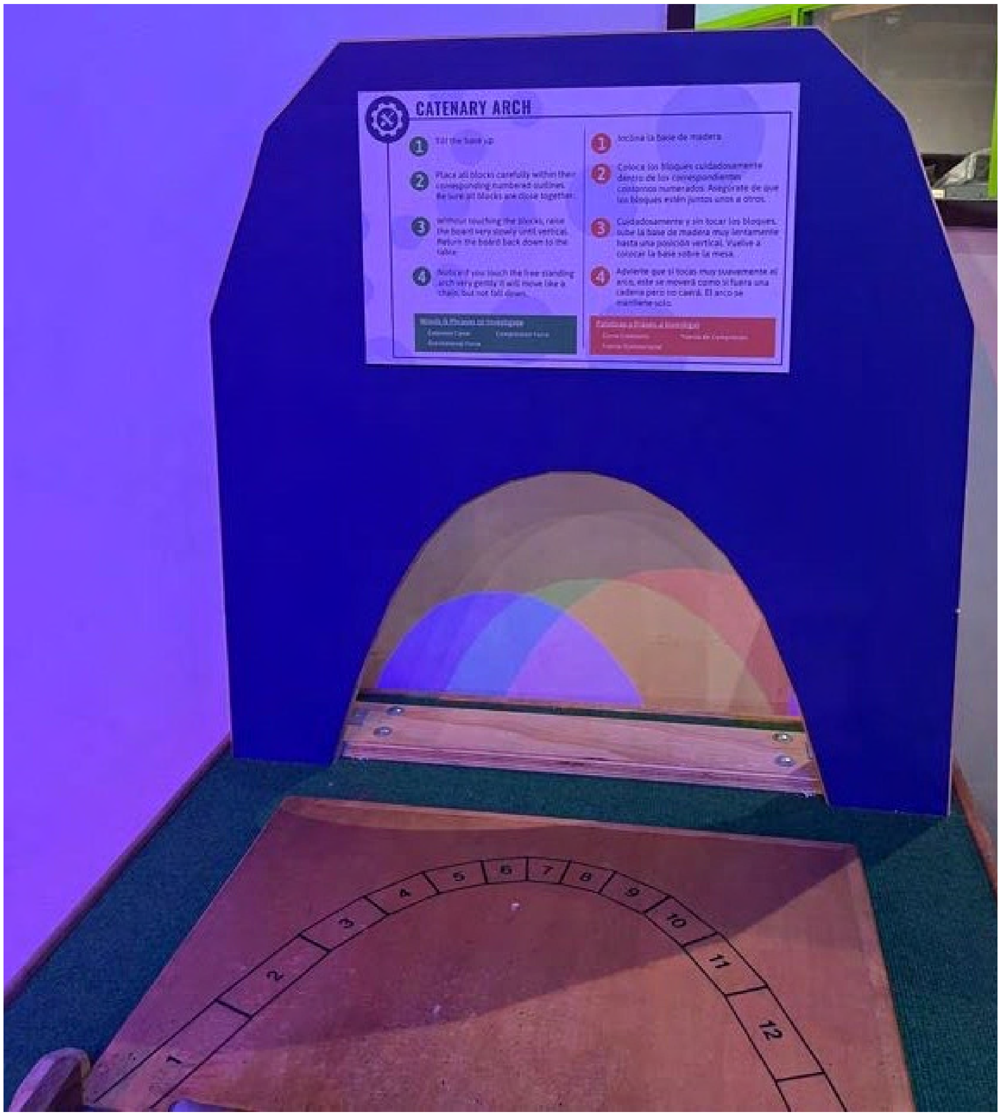
Facilitation Question(s): How did the timer affect your accuracy? How did the timer affect your precision? What is the difference between accuracy and precision?

SEP	DCI	CCC
Analyzing and Interpreting Data; Using Mathematics and Computational Thinking; Engaging in Argument from Evidence	**PS2.A**	Patterns; Cause and Effect

Catenary Arch

The exhibit is a set of numbered wooden blocks that can be used as a simple puzzle. When finished, this puzzle generates a famous structure with the shape of an arch. This is a very strong structure because it redirects the vertical force of gravity into compression forces that press along the curve, holding the arch's building blocks in place.

SEP	DCI	CCC
Developing and Using Models	**PS2.A PS2.B**	Structure and Function; Stability and Change

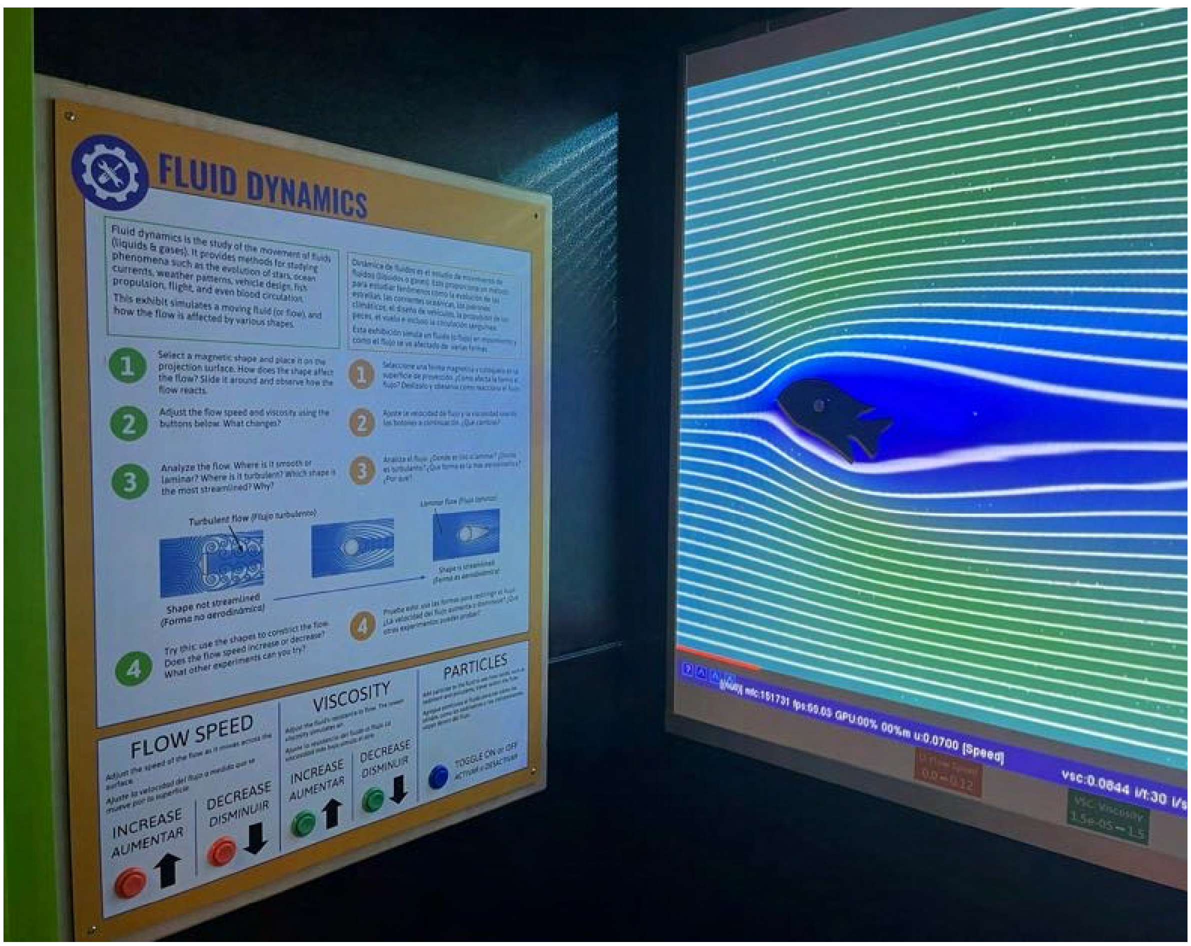


Fluid Dynamics

Students explore an augmented reality flow field projection by adjusting flow speed and viscosity and seeing how the flow reacts when different shapes are placed in its path. Students can also toggle on particles to see how sediment and pollutants travel within a flow.

Facilitation Question(s): Which shapes are more streamlined than others? How does flow change with greater or less viscosity?

SEP	DCI	CCC
Asking Questions and Defining Problems; Developing and Using Models	**PS2.A** **PS2.B**	Patterns; Energy and Matter; Structure and Function



Chaotic Pendulum

Students twist a knob to observe the complex motion of pendulums. Their swing pattern is predictable while swinging gently, but becomes unpredictable and chaotic when moving fast.

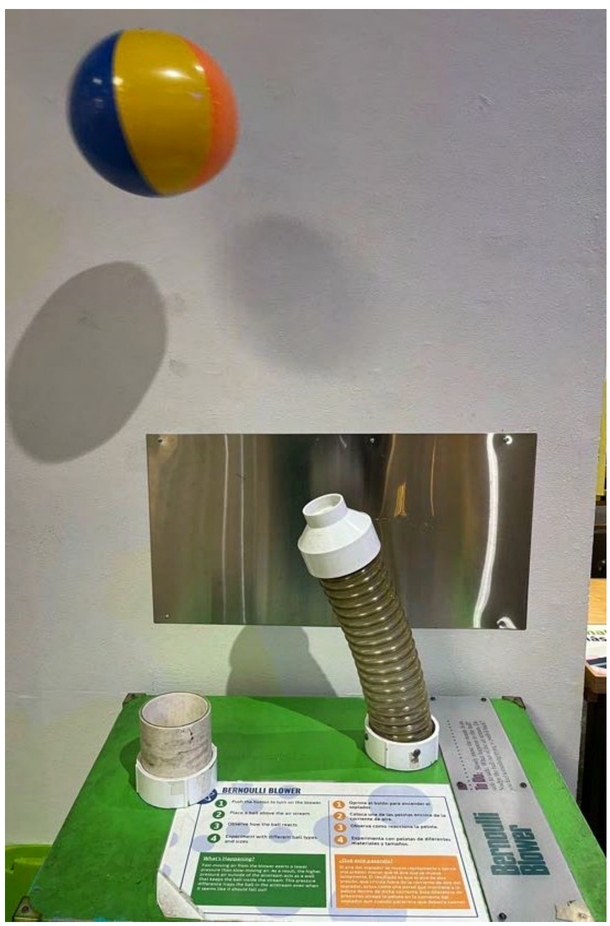
SEP	DCI	CCC
Asking Questions and Defining Problems; Planning and Carrying Out Investigations	**PS2.A PS2.B**	Cause and Effect; Systems and Systems Modeling

Bernouilli Blower

Air pushed from a fan in the base of the exhibit, goes through the tubes on top generating a fast moving stream. The student places a beach ball straight on top of the air flow and watches how the stream pushes it up and keeps the ball suspended in mid air, by creating high and low pressure areas around it. This exhibit illustrates **Bernoulli's Principle.** According to Bernoulli's explanation, air moving at high speed has lower pressure than still air. The ball is kept "floating" by the upward force from the air stream. The fast moving air creates a pocket of low pressure around the ball. The still air surrounding the air stream has a higher pressure and acts like a barrier keeping the ball from falling out.

Facilitation Question(s): Why do you think the ball is staying in the air? What do you think is holding the ball in place?

SEP	DCI	CCC
Asking Questions and Defining Problems; Constructing Explanations and Designing Solutions	**PS2.A PS2.B**	Cause and Effect; Stability and Change



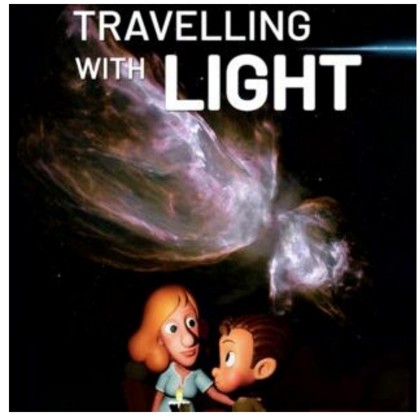
Exploring Gravitational Orbits

Students explore gravitational orbits by launching plastic washers of different sizes at different angles into a gravitational well.

Facilitation Question(s): How does the angle of launch change the shape of the orbit? How do washers with different weights orbit differently?

SEP	DCI	CCC
Developing and Using Models; Planning and Carrying Out Investigations	**PS2.A** **PS2.B**	Patterns; Scale, Proportion, and Quantity; Energy and Matter

Recommended Pre-Recorded Planetarium Shows



Traveling with Light **-** This planetarium show discusses the importance of light in our lives, and how the night sky is obscured with light pollution. It begins by introducing ancient astronomers and how the observation of the stars was essential to their survival. *Traveling with Light* gives examples of constellations used for ancient star navigation, or those used as markers for the time of year. This show also explains briefly how eyes work and how some people perceive light differently through color blindness. Lastly, *Traveling with Light* discusses the source of natural light, talking about stars and the process of nuclear fusion **(PS3.A, PS3.B).**

Sun Struck **-** This planetarium show discusses the sun's creation, lifespan, and the effects the sun has on Earth (photosynthesis, heat, light). *Sun Struck* introduces the concept of light and briefly explains what light is. It also introduces Earth's magnetic field, and how it protects us from the sun's potentially harmful energy. Lastly, *Sun Struck* gives a warning about the potential damage of solar flares, and discusses sun spots and their relations to the sun's magnetic field **(PS2.B, PS3.A, PS3.B, PS3.C).**

Earth and Space Science

This broad track explores topics related to Earth science (e.g., Earth and Human Activity, Earth's Systems) and space science (e.g., Earth's Place in the Universe) as outlined by the NGSS Framework. Students interested in Earth and the universe beyond will benefit from this track.

Exhibit List: Science on a Sphere; Survive a Quake; Make a Quake; Resist a Quake; Habitat on Mars; Sun, Earth, and Universe; Bowl-A-Graph

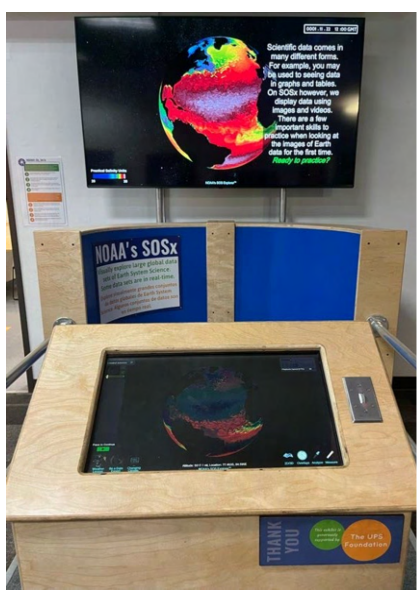
Science on a Sphere

Science On a Sphere allows students to explore visualizations of planetary data to help illustrate Earth systems to people of all ages. The visualizations show information provided by satellites, ground observations, and computer models.

Facilitation Question(s):

- Start in the bottom left corner and click one of the buttons below: Weather Lesson, Be a Data Expert, or Changing Climate, Changing Ocean Video. As students engage with these visuals, ask: How do you think this data was collected? What patterns do you notice?
- Click "Loaded datasets" and select either: Experience – Tornado Safety, Earthquakes – 2001-2015, or Earthquakes – Realtime.
- To explore more about how scientists collect these data, look at the Satellite (3D) Datasets.

SEP	DCI	CCC
Developing and Using Models; Analyzing and Interpreting Data; Using Mathematics and Computational Thinking	**ESS2.D** **ESS3.B**	Systems and Systems Modeling Patterns



Survive a Quake

Students select a video to learn about what to do during an earthquake and the science behind earthquakes. Accompanying graphics provide preparedness checklists and links to earthquake alert apps.

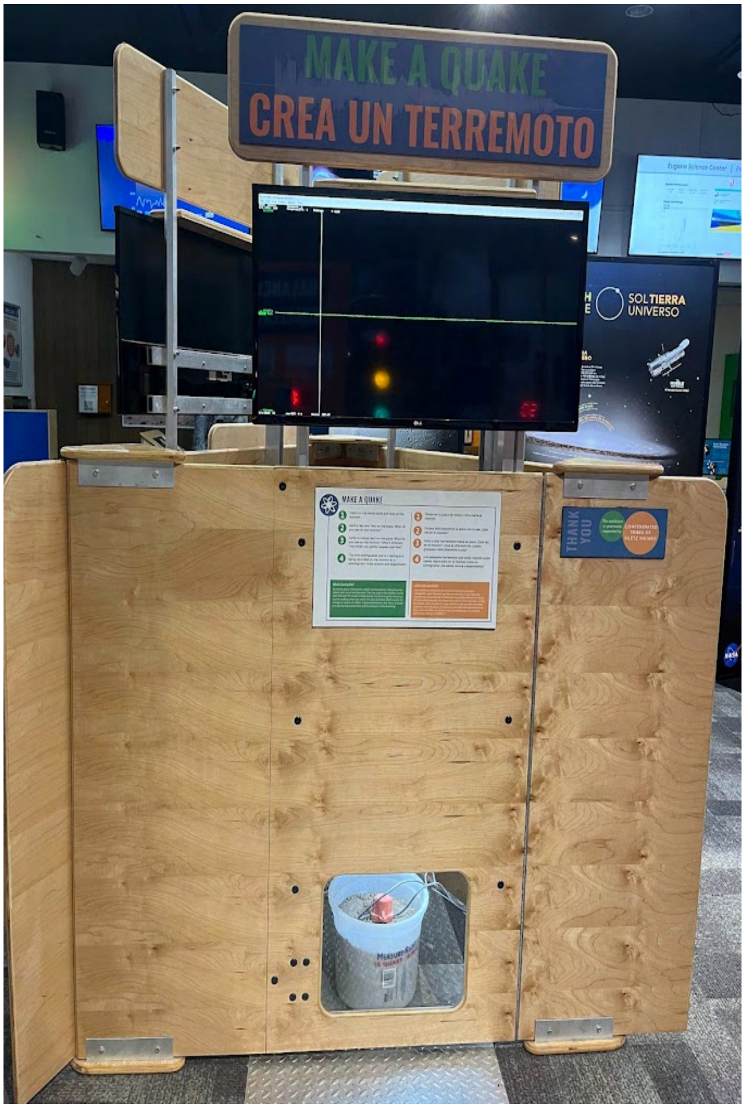
SEP	DCI	CCC
Obtaining, Evaluating, and Communicating information	**ESS3.B**	Patterns; Structure and Function; Stability and Change

Make a Quake

Students learn how scientists monitor and measure earthquakes by jumping on a plate connected to a seismometer. A real-time readout of their "mini-quake" is shown on a video monitor.

Facilitation Question(s): Try jumping with a friend. Can you make your quake bigger? What do you think the seismometer is reading? How can you tell how big your quake is?

SEP	DCI	CCC
Developing and Using Models; Analyzing and Interpreting Data; Using Mathematics and Computational Thinking	**ESS3.B**	Cause and Effect; Energy and Matter



Resist a Quake

Students learn about earthquake engineering by constructing a structure and seeing how well it withstands earthquakes of various magnitudes on a shake table.

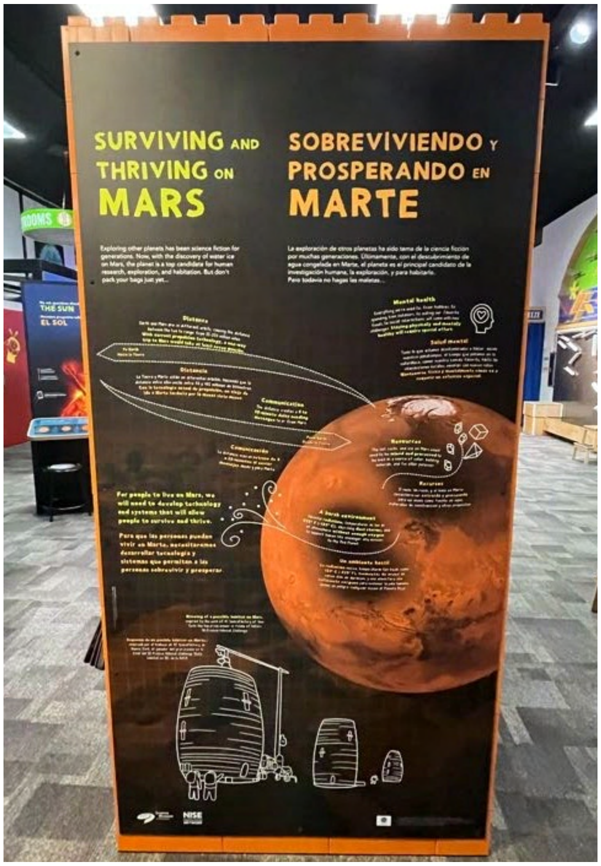
SEP	DCI	CCC
Asking Questions and Defining Problems; Developing and Using Models; Analyzing and Interpreting Data; Constructing Explanations and Designing Solutions	**ESS3.B ETS1.A ETS1.B ETS1.C**	Cause and Effect; Structure and Function; Stability and Change

Habitat on Mars

Students create a colony on Mars using a themed lego table. Using cards to guide, students are encouraged to develop life-support systems before eventually adding in leisure activities. The table frames these steps as 'Build/Connect', 'Survive', and 'Thrive'.

Facilitation Question(s): How is the Mars environment different from Earth? What do you think would be the most important thing to do first on Mars?

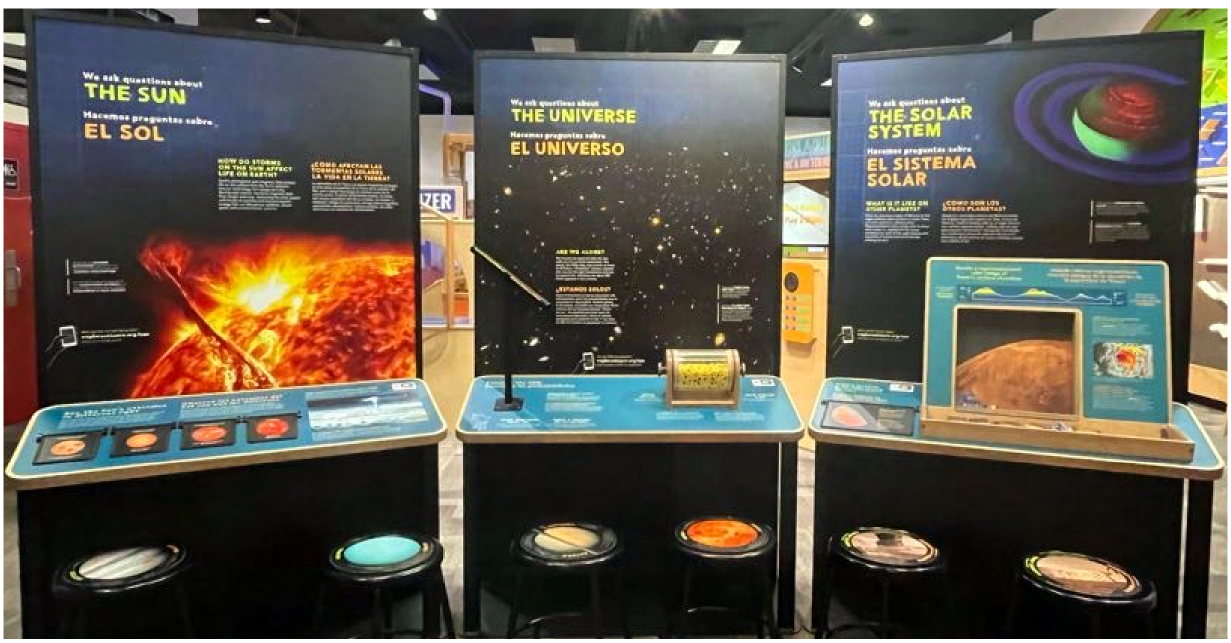
SEP	DCI	CCC
Asking Questions and Defining Problems; Developing and Using Models; Constructing Explanations and Designing Solutions	**ETS1.A** **ESS3.B** **LS2.C** **LS2.D**	Systems and Systems Modeling; Energy and Matter



Sun, Earth, and Universe

This exhibit includes exploration of Earth, the Sun, Our Solar System, and the Universe through flip panels, a spinning wheel filled with beads that describes stars in our universe that might bear life, an elevation model of Venus, and a model of the limited scope of the Hubble telescope.

SEP	DCI	CCC
Developing and Using Models; Analyzing and Interpreting Data; Obtaining, Evaluating, and Communicating Information	—	Scale, Proportions, and Quantity; Energy and Matter



Bowl-A-Graph

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Facilitation Question(s): How did the timer affect your accuracy? How did the timer affect your precision? What is the difference between accuracy and precision?

SEP	DCI	CCC
Analyzing and Interpreting Data; Using Mathematics and Computational Thinking; Engaging in Argument from Evidence	**PS2.A**	Patterns; Cause and Effect

Recommended Pre-Recorded Planetarium Shows

Earth, Moon, and Sun **-** This planetarium show discusses misconceptions in astronomy, such as "the flat earth" and other misunderstandings of how the moon and sun function in our solar system. *Earth, Moon, and Sun* tells a few Native American creation stories about the sun, the moon, and the constellations. This show explores entry level astronomy topics in a comedic way. Topics include eclipses (lunar and solar), the Earth's orbit around the sun, the moon's orbit around the Earth **(ESS1.A).**

Our Violent Planet - This planetarium show discusses the violent potential of our planet, covering earthquakes and volcanic eruptions that have occurred throughout human history. *Our Violent Planet* explores introductory concepts of geology, such as plate tectonics, that explain how some of these volcanic events occurred and why they caused so much damage **(ESS3.B).**

Recommended Live Shows

Our Cosmic Neighborhood - This live show focuses on our solar system, and the planets, moons, and other celestial bodies that inhabit it. *Our Cosmic Neighborhood* breaks down what a solar system, galaxy, and planet/moon are and their relationships with each other on a cosmic scale. This show encourages students' active engagement and asking/answering questions about our night sky **(ESS1.A).**

Stargazing Tonight **-** This live show reviews the night sky in Oregon, looking at constellations and planets visible during the given time of year. *Stargazing Tonight* introduces constellations of importance, including the big and little dipper, their relationship with the North star, and why the North star is important. This show explores 1 - 2 planets such as Saturn or Jupiter. This show encourages students' active engagement and asking/answering questions about our night sky **(ESS1.A).**

NGSS - 3rd Grade DCI Descriptions

Engineering Design

ETS1.A - Defining and Delimiting Engineering Problems: Possible solutions to a problem are limited by constraints, success determined by criteria **(3-5ETS1-1).**

ETS1.B - Developing Possible Solutions: Research before designing a solution; testing involves investigating how well a solution performs under a range of likely conditions and can identify areas of improvement; communicating with peers is an important part of the design process (can lead to improved designs) **(3-5ETS1-2; 3-5ETS1-3).**

ETS1.C - Optimizing the Design Solution: Different solutions need to be tested in order to determine which best solves the problem, given criteria and constraints **(3-5ETS1-3).**

Motion and Stability: Forces and Interactions

PS2.A - Forces and Motion: Each force acts on one particular object and has both strength and direction **(3-PS2-1; 3-PS2-2).**

PS2.B - Types of Interactions: Objects in contact exert forces on each other **(3-PS2-1)**; electric and magnetic forces between a pair of objects do not require that the objects be in contact **(3-PS2-3; 3-PS2-4).**

Earth's Place in the Universe

ESS1.A: The Universe and its Stars: Patterns of the motion of the sun, moon, and stars in the sky can be observed, described, and predicted **(1-ESS1-1).**

Earth's Systems

ESS2.D - Weather and Climate: Scientists record patterns of the weather across different times and areas so that they can make predictions about what kind of weather might happen next **(3-ESS2-1)**; climate describes a range of an area's typical weather conditions and the extent to which those conditions vary over years **(3-ESS2-2).**

Earth and Human Activity

ESS3.B - Natural Hazards: A variety of natural hazards result from natural processes. Humans cannot eliminate natural hazards but can take steps to reduce their impacts **(3-ESS3-1).**

Ecosystems: Interactions, Energy, and Dynamics

LS2.C - Ecosystem Dynamics, Functioning, and Resilience: When the environment changes in ways that affect a place's physical characteristics, temperature, or availability of resources, some organisms survive and reproduce, others move to new locations, yet others move into the transformed environment, and some die **(3-LS4-4).**

LS2.D - Social Interactions and Group Behavior: Being part of a group helps animals obtain food, defend themselves, and cope with changes. Groups may serve different functions and vary dramatically in size **(3-LS2-1).**

Energy

PS3.A - Definitions of Energy: The faster a given object is moving, the more energy it possesses **(4-PS3-1).** Energy can be moved from place to place by moving objects or through sound, light, or electric currents **(4-PS3-2; 4-PS3-3)**.

PS3.B - Conservation of Energy and EnergyTransfer: Energy is present whenever there are moving objects, sound, light, or heat. When objects collide, energy can be transferred from one object to another, thereby changing their motion. In such collisions, some energy is typically also transferred to the surrounding air; as a result, the air gets heated and sound is produced. **(4-PS3-2; 4-PS3-3).** Light also transfers energy from place to place **(4-PS3-2).** Energy can also be transferred from place to place by electric currents, which can then be used locally to produce motion, sound, heat, or light. The currents may have been produced to begin with by transforming the energy of motion into electrical energy **(4-PS3-2; 4-PS3-4).**

PS3.C - Relationship Between Energy and Forces: When objects collide, the contact forces transfer energy so as to change the objects' motions **(4-PS3-3).**