USU 4-H Our Magnetic Sun Tote

BIG IDEA:
The Sun provides energy for life on Earth.

UNDERSTANDINGS:
The magnetism of the sun affects the Earth.
Energy from the sun causes damage as well as enables life.

ESSENTIAL QUESSTIONS:
How does the Sun affect our lives?
How can we protect ourselves from ultraviolet energy?

THREE DIMENSIONS, UTAH SCIENCE STANDARDS, AND INTENDED LEARNING OUTCOMES:
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Note: The following activities and information was gathered and adapted from "Our Magnetic Sun Manual" developed by NASA. The complete manual, which includes background information and full lessons for these and additional activities (Explore the Sun Cards, Magnetic Connection, Where Does the Energy Come From? Cards, and Space Weather PowerPoint), can be found at: **http://nightsky.jpl.nasa.gov/download-view.cfm?Doc_ID=496.**

Supplies

The Sun in a Different Light p. 2

- Sun banner
- Bag pipe cleaners: red "prominences" and silver "coronal loops"
- 3D Sun Model attached to banner (optional)
- One small compass (optional)
- Explore the Sun card: "How is the Sun like a boiling Pot of Spaghetti?" (optional)

Protection from Ultraviolet p. 7

- UV beads in an opaque bag
- Materials for testing UV protection. Ex. sunglasses, hat, sunscreen in plastic baggie, clear plastic cup with water, sunny and shady spot, cloth*

*Not included in tote

Activity 1: The Sun in a Different Light

Time: 10-30 min

Grade Level: 4-6

Materials:

- Sun banner
- Bag with a few pipe cleaners: red “prominences” and silver “coronal loops”
- 3D Sun Model attached to banner (optional)
- One small compass (optional)
- Explore the Sun card: “How is the Sun like a boiling Pot of Spaghetti?” (optional)

To Do:

1. Hang the banner or place it on a table where students can easily view it.
2. Ask the students what they observe if the three images of the sun. What is similar? What is different? All of these images were taken on the same day with different detectors.
3. Explain what the different images show.
4. Use the 3-D sun model and pipe cleaners to give the sun some prominences and filaments. Show how a prominence and a filament are the same thing by rotating the sun model.
5. Use the silver pipe cleaners to form a loop over the sun spot.
6. Use a compass to follow the magnetic field lines around the sunspots.
7. Show the interior of the sun model. Use the “How is the Sun Like a Boiling Pot of Spaghetti?” to explain how magnetic fields are generated.

REFLECT:

- What do the different images of the sun show?
- What are filaments and prominences? What are sunspots and loops?
- How are the sun’s magnetic fields different from the Earth’s magnetic fields?
- What is the interior of the sun like? How is it like a boiling part of spaghetti?

APPLY:

The magnetic activity of the sun gives they sun its dynamic features. These different images show features of the sun that would not be visible to the naked eye. The first image uses a light scope and shows sun spots. The second image is what is seen through a hydrogen alpha telescope. Bright areas are called plage, and are like clouds above the sunspots. In this

image you can also see material lifted out from the sun's surface by magnetic activity along the edges called prominences. Darker streaks across the sun's face are called filaments which are just like prominences, only seen from above.

NASA's Solar Dynamic Observatory took the third picture. It detects features that are at much higher temperatures. In this image you can see coronal loops that are caught up in the magnetic fields around sunspots. The last image shows the corona, particles streaming away from the sun.

Unlike the earth that has only one north and south pole, the sun has many different magnetic fields. Each field has its own north and south pole. These magnetic fields are changing all the time. Because of this, features of the sun are not in permanent locations. Sometimes magnetic storms happen that affect the Earth.

The core of the sun is extremely hot and dense. A quart of material from the core would weigh more than a person. That core is what generates the energy in the sun by fusing hydrogen into helium. You can think of the sun like a pot of spaghetti. The bottom of the pot and the burner is dense and generates energy, like the core. The water is like the convective zone in that its density is low enough that the material can move around. The spaghetti is like magnetic field lines that are generated and then get twisted up. The magnetic field lines sometimes pop through the surface and make a sunspot.

Activity 2: Protection from Ultraviolet

Time: 10-30 min

Grade Level: K-12

Materials:

- UV beads in an opaque bag
- Materials for testing UV protection. Ex. sunglasses, hat, sunscreen in plastic baggie, clear plastic cup with water, sunny and shady spot, cloth

To Do:

1. Prepare stations to test different types of UV protection. Be sure to have UV beads stored in a container that will block any exposure to the sunlight.
2. Ask if anyone knows why people can get sunburned. Explain that the sun gives off different types of energy, one of which is ultraviolet light with can damage living things because it has so much energy.
3. Tell students that you have beads that turn color when they are exposed to UV rays. The more Ultraviolet they are exposed to the darker they get.
4. Ask the students what ways they protect themselves from the sun. Have students make predictions of what methods will protect the UV beads from getting exposed to UV light and which ways they think will work best. When using sunscreen, consider using different strengths or expired sunscreen.
5. Talk about what students observed.

REFLECT:

- Where do you think the beads will turn the darkest?
- Do sunglasses protect our eyes from UV? How about regular glasses?
- What will happen if we put some beads in this cup of water?
- Are we protected from UV in the shade?
- What other conditions or material might protect us from UV?

APPLY:

Ultraviolet light, also known as UV rays, is a type of non-visible light that the sun gives off. Earth's atmosphere shields the earth from most of the UV light from the sun. Astronauts have to take extra measures to protect themselves from UV rays. UV radiation can cause damage to living things, an example of which is getting a sunburn. People use and have developed many different methods of protecting themselves from UV radiation.

OUR MAGNETIC SUN TOTE CONTENTS:

- Magnetic Sun Banner
- Sun Cross Section
- White Plastic Box
    - Velcro Dots
    - 4 Compasses
    - Rod Magnets
    - 2 Cards
    - Plastic Arc
    - Flashlight
    - 10 Rings of UV Beads
    - 2 Sun Information Cards
- Explore the Sun Cards
- Where Does Energy Come From Cards
- Sun information cards
    - Solar Eclipses
    - Northern Lights
    - Real-Time Sun Images
- Magnetic Sun Poster
- *Traditions of the Sun* (book about Chaco culture)
- (5) paper solar glasses

Three Dimensions, Utah Science Standards, and Intended Learning Outcomes

Note: These applications of National and State Science Standards are not comprehensive. They are meant to serve as suggestions. While only standards for K-6 have been listed, standards for more advanced grade levels can also be applied. Additionally, this tote is an excellent tool to facilitate inquiry for any age group.

THREE DIMENSIONS

K-PS3-1. Weather and Climate

Make observations to determine the effect of sunlight on Earth's surface.

Science and Engineering Practices:

- Make observations (firsthand or from media) to collect data that can be used to make comparisons.
- Scientist look for patterns and order when making observations about the world.

Disciplinary Core Ideas:

- Sunlight warms Earth's surface.

Crosscutting Concepts:

- Events have causes that generate observable patterns.

1-ESS1-1. Space Systems: Patterns and Cycles

Use observations of the sun, moon, and stars to describe patterns that can be predicted.

Science and Engineering Practices:

- Use observations (firsthand or from media) to describe patterns in the natural world in order to answer scientific questions.

Disciplinary Core Ideas:

- Patterns of the motion of the sun, moon, and stars in the sky can be observed, described, and predicted.

Crosscutting Concepts:

- Patterns in the natural world can be observed, used to describe phenomena, and used as evidence.
- Science assumes natural events happen today as they happened in the past.
- Many events are repeated.

3-PS2-3. Forces and Interactions

Ask questions to determine cause and effect relationships of electric or magnetic interactions between two object no in contact with each other.

Science and Engineering Practices:

- Ask questions that can be investigated based on patterns such as cause and effect relationships.

Disciplinary Core Ideas:

- Electric and magnetic forces between a pair of objects do not require that the objects be in contact. The sizes of the forces in each situation depend on the properties of the objects and their distances apart and, for forces between two magnets, on their orientation relative to each other.

Crosscutting Concepts:

- Cause and effect relationships are routinely identified, tested, and used to explain change.

5-PS3-1. Matter and Energy in Organisms and Ecosystems

Use models to describe that energy in animals' food (used for body repair, growth, motion, and to maintain body warmth) was once energy from the sun.

Science and Engineering Practices:

- Use models to describe phenomena.

Disciplinary Core Ideas:

- The energy released from food was once energy from the sun that was captured by plants in the chemical process that forms plant matter (from air and water).
- Food provides animals with the materials they need for body repair and growth and the energy they need to maintain body warmth and for motion.

Crosscutting Concepts:

- Energy can be transferred in various ways and between objects.

5-ESS1-1. Space Systems: Stars and the Solar System

Support an argument that differences in the apparent brightness of the sun compared to other stars is due to their relative distances from the Earth.

Science and Engineering Practices:

- Support an argument with evidence, data, or a model.

Disciplinary Core Ideas:

- The sun is a star that appears larger and brighter than other stars because it is closer. Stars range greatly in their distance from Earth.

Crosscutting Concepts:

- Natural objects exist from the very small to the immensely large.

UTAH SCIENCE STANDARDS

K-Grade 2

Standard 1:

The Processes of Science, Communication of Science, and the Nature of Science. Students will be able to apply scientific processes, communicate scientific ideas effectively, and understand the nature of science.
Standard 2:
Earth and Space Science. Students will gain an understanding of Earth and Space Science through the study of earth materials, celestial movement, and weather.

Grade 3

Standard 5:
Students will understand that the sun is the main source of heat and light for things living on Earth. They will also understand that the motion of rubbing objects together may produce heat.

Grade 5

Standard 3:
Students will understand that magnetism can be observed when there is an interaction between the magnetic field of magnets or between a magnet and materials made of iron.

Grade 6

Standard 3:
Students will understand the relationship and attributes of objects in the solar system.

INTENDED LEARNING OUTCOMES (ILO'S):

1. Use science process and thinking skills.
2. Manifest science interests and attitudes.
3. Understand important science concepts and principles.
4. Communicate effectively using science language and reasoning.
5. Demonstrate awareness of the social and historical aspects of science.
6. Understand the nature of science.