As the Sun Burns

Supplemental science materials

for grades 2 - 4

Stanford SOLAR Center

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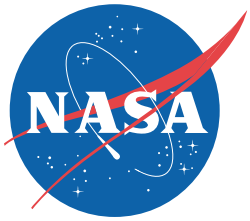

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Table of Contents

Teacher Overview

Objectives
Correlation to National Science Standards
Segment Content/On-line Component Review
Materials List

Explorations

Science Explorations

- UV Rays
- SPF Safe
- Undercover
- UV Reflection
- Got the Sun in my Eyes
- Tip Your Hat to UV

Career Explorations

- Dermatologist
- Ophthalmologist
- Meteorologist
- Solar Astronomer

Answer Keys

- Student Informational Reading: *You Can be UV Safe*
- Student Worksheet: *You Can be UV Safe*
- Student Worksheet: *Reading the UV Chart*

Student Handouts

- Student Informational Reading: *You Can be UV Safe*
- Student Worksheet: *You Can be UV Safe*
- Student Worksheet: *Reading the UV Chart*
- Student Worksheet: *UV Exploration Guidesheet*
- Student Worksheet: *Career Exploration: Dermatologist*
- Student Worksheet: *Career Exploration: Ophthalmologist*
- Student Worksheet: *Career Exploration: Meteorologist*
- Student Worksheet: *Career Exploration: Solar Astronomer*

Appendix

- Solar Glossary
- Web Work

- Objectives
- Correlation to the National Standards
- Segment Content/On-line Component Review
- Materials List

Teacher Overview

Objectives

1. Students will understand that the sun gives us more than just visible light.

2. Students will understand that the sun gives off invisible energy we can't see such as ultraviolet rays.

3. Students will develop an understanding of how to protect their bodies from the harmful effects of sunlight.

4. Students will develop an understanding that the Earth's atmosphere shields the surface of the Earth from most of the ultraviolet rays that come from the sun.

5. Students will explore/demonstrate the effects of ultraviolet radiation on objects that react to ultraviolet rays.

6. Students will become familiar with the work of an ophthalmologist, dermatologist, meteorologist and solar scientist.

Teacher Overview

Correlation to the National Science Standards

This segment of the Webcast *All About the Sun,* "As the Sun Burns", is brought to you by a correlation to the National Science Standards for grades 2 - 4, 5 - 8 and 9 - 12 as delineated below.

Grades 2 - 4

Unifying Concepts and Processes

- Evidence, models, and explanation
- Changes, constancy, and measurement
- Form and function

Science as Inquiry

- Abilities necessary to do scientific inquiry
  - Ask a question about objects, organisms, and events in the environment
  - Plan and conduct a simple investigation
  - Employ simple equipment and tools to gather data and extend the senses
  - Use data to construct a reasonable explanation
  - Communicate investigations and explanations

- Understandings about scientific inquiry

Physical Science

- Properties of objects and materials
- Light and heat

Earth and Space Science

- Properties of earth materials
- Objects in the sky
- Changes in earth and sky

Science and Technology

- Abilities of technological design
  - Identify a simple problem
  - Propose a solution
  - Implementing proposed solutions
  - Evaluate a product or design
  - Communicate a problem, design and solution

- Understandings about science and technology

Correlation to the National Science Standards (continued)

Grades 2 - 4 (continued)

Science in Personal and Social Perspectives

- Personal health
- Changes in environments
- Science and technology in local challenges

History and Nature of Science

- Science as a human endeavor

Teacher Overview

Segment Content/On-line Component Overview

The sun gives off much more than just visible light. Students will learn in this segment that ultraviolet radiation is part of the sun's spectrum of non-visible energy. They will become familiar with the Earth's atmosphere and the ozone layer that surrounds the Earth protecting it from the ultraviolet radiation. They will explore the effects of exposure to these rays on special UV beads. They will become familiar with \ ways to protect themselves from the effects of exposure to ultraviolet rays.

The on-line segment will include interviews with a dermatologist, ophthalmologist and solar scientist about the sun's rays and how to stay safe from their harmful effects. Students will demonstrate proper solar protection behaviors. Students will also perform a demonstration/experiment using special UV beads to determine the amount of exposure to ultraviolet rays from the sun.

Students can visit the Web site and read about the work of an ophthalmologist, dermatologist and solar scientist offered as a text-based interview. Students can also use the Web site to view illustrations of the following concepts: Earth's atmosphere (not specifically stratosphere with the ozone layer) protecting the surface from ultraviolet rays, and protection from the Sun's rays.

The Science Exploration section focuses on explorations with UV beads. These beads can be ordered from the following source:

Educational Innovations, Inc.
151 River Road
Cos Cob, CT 06807

203-629-6049
Catalog: EDI # UV-ast (assorted colors with approximately 240 beads per bag @ $6.95, 1 bag should be enough for a class of 30 students)

The UV explorations can be easily adapted to fit the classroom science pedagogy in use, but are structured in this document as a brief description of a teacher-led activity with an accompanying *UV Exploration Guidesheet* (student guidesheet) . These activities using UV beads should be preceded or followed with scientific content discussion as found in each exploration description.

Teacher Overview

Materials List

Note: Materials are indicated according to the "Exploration" activity in which it is needed. The amount of materials given is per one group.

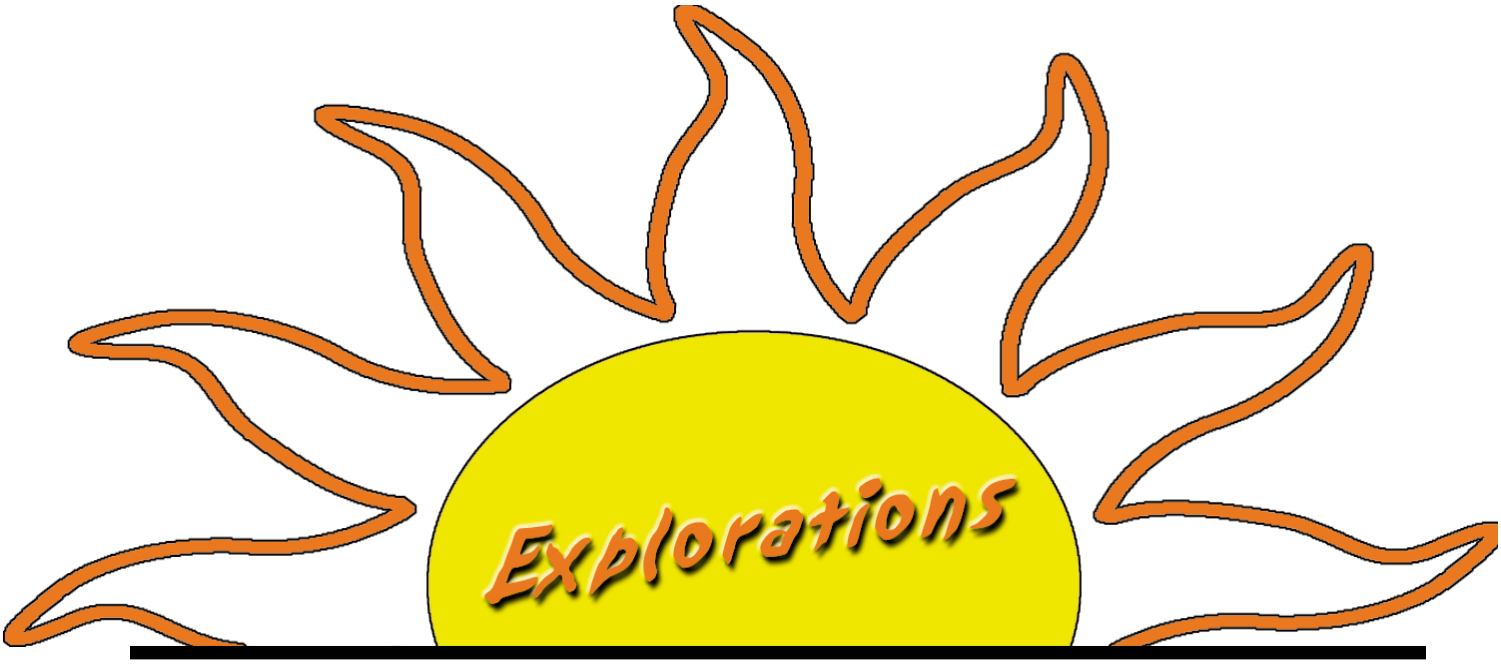
- UV Rays
  - Ultraviolet Beads: About 5 beads per paper plate (Note: Ordering information given in the section "Segment Content/On-line Component Overview")
  - 3 sturdy, white paper plates
  - 3 - 4 dark colored, lightweight hand towels (to serve as temporary coverings)
  - desk lamp

- SPF Safe
  - Ultraviolet Beads: About 5 beads per paper plate (Note: Ordering information given in the section "Segment Content/On-line Component Overview")
  - 4 sturdy, white paper plates
  - 4 dark colored, lightweight hand towels (to serve as temporary coverings)
  - Sunscreen SPF 15+, 30+ and 45+ (1 small bottle of each)

- Undercover
  - Ultraviolet Beads: About 5 beads per paper plate (Note: Ordering information given in the section "Segment Content/On-line Component Overview")
  - 3 sturdy, white paper plates
  - black construction paper
  - 4" x 4" pieces of the following material: blue tarp, light colored cotton or linen, dark colored cotton or linen
  - 12 straight pins (4 per plate)

- Tip Your Hat to UV
  - Ultraviolet Beads: About 5 beads per tester (Note: Ordering information given in the section "Segment Content/On-line Component Overview")
  - Have students bring in their favorite hat or an old hat or a "funny" hat or a hat that they think will afford the most protection from ultraviolet rays.

- Student Handouts
  - Student Reading: *You Can Be UV Safe*
  - Student Worksheet: *You Can Be UV Safe*
  - Student Handout: *UV Chart*
  - Student Guidesheet: *UV Exploration Guidesheet*
  - Optional Worksheet: *Reading the UV Chart*



- Science Explorations
- Career Explorations

Explorations

Science Explorations

- UV Rays

Purpose: To demonstrate that the sun gives off energy that we can see (visible light) as well as energy that we cannot see (ultraviolet rays). To observe the effects of ultraviolet rays.

Take the beads (covered) out on a sunny day, expose them to the direct sunlight and have the students observe and record the beads' reaction. Discuss or hypothesize what has caused the beads' color to change.

Take another set of beads (covered) into the shade and expose them. Have the students observe and record the beads' reaction. Discuss or hypothesize what has caused the beads' color to change.

Using another set of beads (covered), hold them beneath lamplight from the classroom (away from any sunlight) and expose them to the artificial light source. Have the students observe and record the beads' reaction. Discuss or hypothesize what has caused the beads' color to change.

On the next overcast or cloudy day, take a set of beads (covered) outside and expose them. Have the students observe and record the beads' reaction. Discuss or hypothesize what has caused the beads' reaction.

This can lead to further exploration of ultraviolet rays and the full spectrum of energy that the sun emits.

- SPF Safe

Purpose: To demonstrate the effectiveness of sunscreen in protecting people from the harmful rays of the sun. To observe the differences in protection from among the different SPF ratings.

Take 3 sets of UV beads and soak one set each in sunscreen SPF 15, SPF 30+, and SPF 45+. Let each dry for about 60 minutes before beginning the exploration. (Note: Drying the beads is optional as the beads will change color when exposed to the sun while they are still wet with lotion.) Take another set of UV beads and do not apply any sunscreen to that set. Place each set of beads on a sturdy paper plate and cover each with a dark cloth as you position them outside. Do not tell students which beads have had which SPF sunscreen applied to them.

Science Explorations

- SPF Safe (continued)

Expose each set to direct sunlight and after 10 seconds have students observe and record the beads' reaction. Have them discuss the effects of sunscreen and try to identify which set of beads had which SPF sunscreen applied.

- Undercover

Purpose: To demonstrate the different amounts of protection from harmful ultraviolet rays that clothing can give humans.

Take 3 sturdy paper plates and cover the top of each plate with black construction paper. Take 3 sets of UV beads and place each set of beads on blackened, sturdy paper plate. Next, cover each set of beads with a 4" x 4" square of each of the following material: blue tarp material, light colored cotton or linen material, and a dark heavy cotton or synthetic material. Using straight pins secure each square no more than 1" above the surface of the paper plate. Take each plate and place outside in direct sunlight. Have the students observe and record the beads' reaction. Discuss or hypothesize what has caused the beads' reaction.

- Tip Your Hat to UV

Purpose: To demonstrate how hats are an effective method of protection from ultraviolet rays. To develop an effective judging criteria and method of testing a theory of which hat would afford the best possible protection from ultraviolet rays.

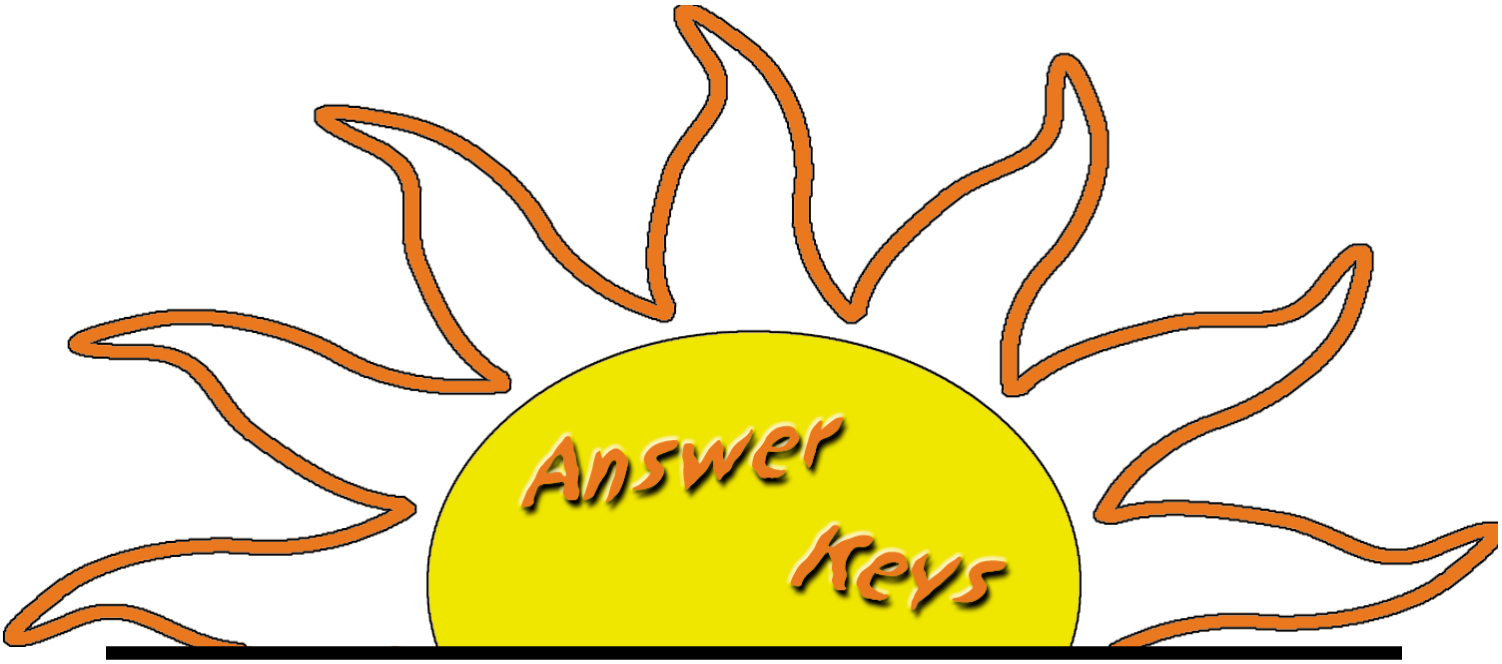
Have students bring in their favorite hat or an old discarded/unwanted hat from home. Have the students in small groups or as a whole class set the criteria for judging which hat will give the best protection from UV rays. The students can judge using the UV beads, or base it upon amount of shadow the hat casts, or the "squint factor" of the wearer's eyes when facing towards the sun or facing away from the sun. Depending upon the criteria the test can be performed on an overcast/cloudy day, a sunny day or both.

Explorations

Career Explorations

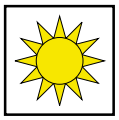
After viewing the Webcast or after reading a brief introduction to each of the careers represented on the Web site http://solar-center.stanford.edu, the students should be able to answer the basic knowledge questions about the following careers represented in the segment: dermatologist, ophthalmologist and solar astronomer.

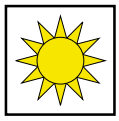
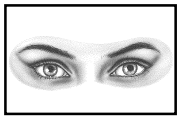
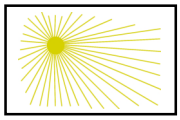
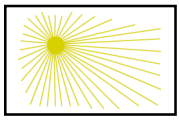
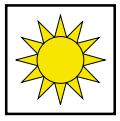
See the "Student Handouts" section for the Career Exploration Student Worksheets. The answer keys are located in the "Answer Keys" section.



- Student Reading: *You Can Be UV Safe*
- Student Worksheet: *You Can Be UV Safe*
- Student Worksheet: *Reading the UV Chart*

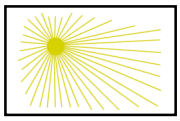
You Can Be UV Safe - Key

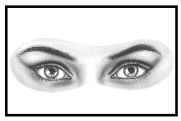
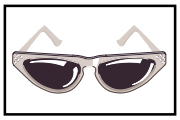
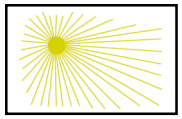
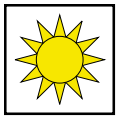
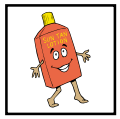
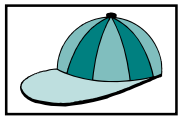
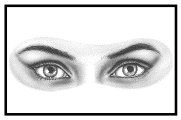
Have you ever been outside in the  S-U-N for a very long time? Did your skin begin to turn red or become painful to touch? You had a sunburn!

The  S-U-N gives us more than L-I-G-H-T. It also gives off E-N-E-R-G-Y that we cannot see with our  E-Y-E-S. Some of this E-N-E-R-G-Y is called  U-L-T-R-A-V-I-O-L-E-T R-A-Y-S. The E-A-R-T-H protects us from the harmful  U-L-T-R-A-V-I-O-L-E-T R-A-Y-S of the  S-U-N.

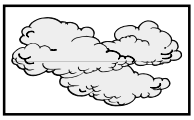
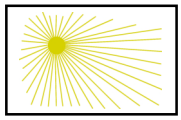
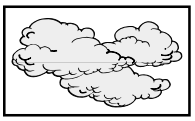
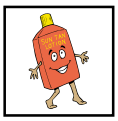
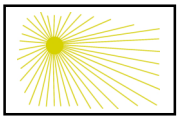
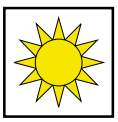
The Earth has an A-T-M-O-S-P-H-E-R-E. It is a thick layer of air that surrounds the Earth.

Student Informational Reading

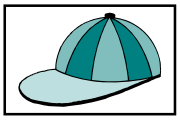
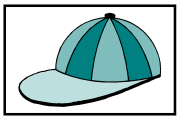
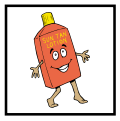
The A-T-M-O-S-P-H-E-R-E keeps most of the  U-L-T-R-A-V-I-O-L-E-T R-A-Y-S from reaching us.

Ultraviolet rays cause sunburns and can also hurt our  E-Y-E-S. That is why we need to wear S-U-N-S-C-R-E-E-N and  S-U-N-G-L-A-S-S-E-S . These protect us from the harmful  U-L-T-R-A-V-I-O-L-E-T R-A-Y-S of the  S-U-N. We should wear  S-U-N-S-C-R-E-E-N with a sun protection factor of no less than 15. We should wear S-U-N-G-L-A-S-S-E-S that are rated for ultraviolet protection. On sunny days we should wear a  H-A-T to shade our face and  E-Y-E-S.

Student Informational Reading

It is not just on sunny days that we need to be careful. Even on  C-L-O-U-D-Y days about half of the sun's  U-L-T-R-A-V-I-O-L-E-T R-A-Y-S can reach us on E-A-R-T-H. So if you are outside on a  C-L-O-U-D-Y day be sure to wear protective clothing or  S-U-N-S-C-R-E-E-N and S-U-N-G-L-A-S-S-E-S. Solar scientists and meteorologists can predict the amount of  U-L-T-R-A-V-I-O-L-E-T R-A-Y-S will reach the E-A-R-T-H each day. They use a special UV Chart to help people protect themselves from the harsh rays of the  S-U-N . If the UV Chart tells us that the day will be

Student Informational Reading

a T-W-O then we should wear a  H-A-T when outside. If the UV Chart tells that the day will be an E-I-G-H-T then we should wear a  H-A-T,  S-U-N-S-C-R-E-E-N , and stay in shady areas during the middle of the day.

Have your teacher help you read the UV Chart. Then talk about ways you can be UV safe!

You Can Be UV Safe - Key
Grades 2 - 4

Directions: **After reading You Can Be UV Safe, answer the questions below by circling the correct answer.**

1. What kind of energy does the sun give off?

   A. light and ultraviolet rays B. heat and shade

2. What causes sunburns?

   A. heat **B. ultraviolet rays**

3. What can we do to protect us from ultraviolet rays?

   A. wear a hat B. wear sunscreen **C. both A and B**

4. What surrounds the Earth and helps to protect us from ultraviolet rays?

   A. sky B. clouds **C. the atmosphere**

5. Can ultraviolet rays reach you even on a cloudy day?

   A. yes B. no

6. What part of the body can be harmed by ultraviolet rays?

   A. skin only B. eyes only **C. eyes and skin**

Student Worksheet

Reading the UV Chart - Key

Directions: Use the UV Chart to answer the questions below.

1. What is the UV Number for a "Low" Exposure?

   0 to 2

2. What Safety Tip should you take if the Exposure is "Very Low"?

   Wear a hat

3. What are the peak mid-day hours of sunlight?

   10:00 AM to 4:00 PM

4. What is the UV Number for a "High" Exposure?

   7 to 9

5. What Safety Tip should people take if the UV Number is 8?

   Wear a hat and sunscreen (SPF 15+), stay in shady areas stay indoors during mid-day (10:00 AM to 4:00 PM)

6. What does the UV Chart tells the Sun Protection Factor for sunscreen should be?

   SPF 15

7. What kind of clothing does the UV Chart tell us to always wear outside?

   A hat

8. What should you do if the Exposure is "Very High"?

   Stay indoors as much as possible

9. Which two Exposures have a Safety Tip to stay in shady areas?

   5 to 6 and 7 to 9

Career Explorations: Dermatologist - Key

Directions: After watching the Webcast answer these questions below.

1. A dermatologist is a

   A. doctor

   B. scientist

2. A dermatologist helps people who have problems with their

   A. bones

   B. eyes

   C. skin

3. How do ultraviolet rays hurt our skin?

   Ultraviolet rays cause sunburn.

4. Does your family have a dermatologist for a doctor?

Career Explorations: Ophthalmologist - Key

Directions: After watching the Webcast answer these questions below.

1. A ophthalmologist is a

   A. doctor

   B. scientist

2. A ophthalmologist helps people who have problems with their

   A. bones

   B. eyes

   C. skin

3. How do ultraviolet rays hurt our eyes?

   Ultraviolet rays can burn the cornea in our eyes and cause cataracts and blindness.

4. Does your family have a ophthalmologist for a doctor?

Career Explorations: Meteorologist - Key

Directions: After watching the Webcast answer these questions below.

1. A meteorologist is a

   A. doctor

   B. scientist

2. A meteorologist studies the

   A. sun

   B. ocean

   C. weather

3. How does the weather change the amount of ultraviolet rays that reach us?

   The more clouds the less ultraviolet rays reach us.

4. Name a meteorologist who you have seen on television.

Career Explorations: Solar Astronomer - Key

Directions: Afte watching the Webcast answer these questions below.

1. A solar astronomer is a

   A. doctor

   B. scientist

2. A solar astronomer studies the

   A. sun

   B. ocean

   C. weather

3. What does the sun have to do with ultraviolet rays?

   The sun gives off ultraviolet rays.

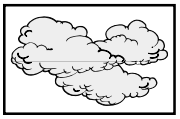
Grades 2 - 4

- Student Informational Reading: *You Can Be UV Safe*
- Student Worksheet: *You Can Be UV Safe*
- Student Worksheet: *Reading the UV Chart*
- *UV Exploration Guide*
- *Career Exploration Guidesheet*

Student Informational Reading

Directions: Use the pictures below to help you write the words in the blank as you read about how you can be UV safe.

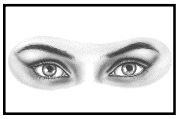
atmosphere



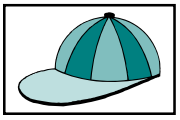
cloudy

Earth

energy

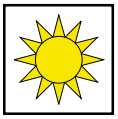


eyes



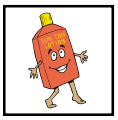
hat

light



sun

sunglasses



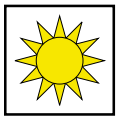
sunscreen

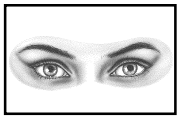
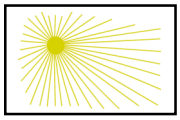
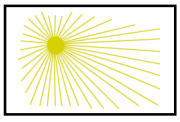
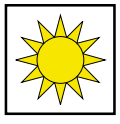
ultraviolet rays

Student Informational Reading

You Can Be UV Safe

Have you ever been outside in the ___ for a very long time? Did your skin begin to turn red or become painful to touch? You had a sunburn!

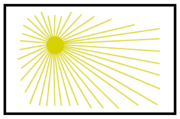
The  ___ gives us more than _____.

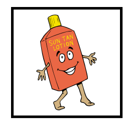
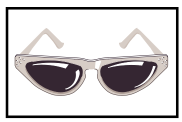
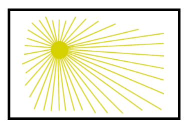
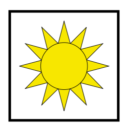
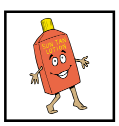
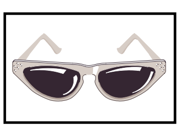
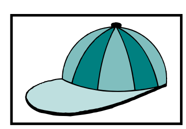
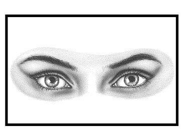
It also gives off _____ that we cannot see with our  ____. Some of this _____ is called  _____ ____. The _____ protects us from the harmful  _____ ____ of the  ___.

The Earth has an _____.

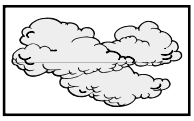
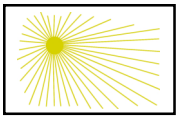
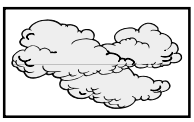
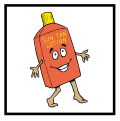
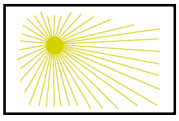
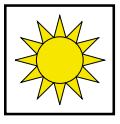
It is a thick layer of air that surrounds the Earth.

Student Informational Reading

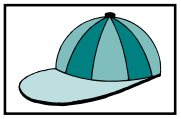
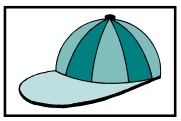
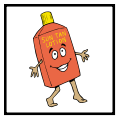
The _ _ _ _ _ _ _ _ _ _ _ _ keeps most of the  _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ from reaching us.

Ultraviolet rays cause sunburns and can also hurt our _ _ _ _. That is why we need to wear  _ _ _ _ _ _ _ _ _ _ _ and  _ _ _ _ _ _ _ _ _ _ _ _. These protect us from the harmful  _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ of the  _ _ _. We should wear  _ _ _ _ _ _ _ _ _ _ _ with a sun protection factor of no less than 15. We should wear  _ _ _ _ _ _ _ _ _ _ _ _ that are rated for ultraviolet protection. On sunny days we should wear a  _ _ _ to shade our face and  _ _ _ _.

Student Informational Reading

It is not just on sunny days that we need to be careful. Even on  _ _ _ _ _ _ _ days about half of the sun's  _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ can reach us on _ _ _ _ _ _. So if you are outside on a  _ _ _ _ _ _ _ day be sure to wear protective clothing or  _ _ _ _ _ _ _ _ _ _ _ and _ _ _ _ _ _ _ _ _ _ _ _ _. Solar scientists and meteorologists can predict the amount of  _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ will reach the _ _ _ _ _ _ each day. They use a special UV Chart to help people protect themselves from the harsh rays of the  _ _ _ _. If the UV Chart tells us that the day will be

Student Informational Reading

a ___ then we should wear a  ___ when outside. If the UV Chart tells that the day will be an _____ then we should wear a  ___,  _____, and stay in shady areas during the middle of the day.

Have your teacher help you read the UV Chart. Then talk about ways you can be UV safe!

Student Worksheet

You Can Be UV Safe
Grades 2 - 4

Directions: **After reading *You Can Be UV Safe*, answer the questions below by circling the correct answer.**

1. What kind of energy does the sun give off?

   A. light and ultraviolet rays B. heat and shade

2. What causes sunburns?

   A. heat B. ultraviolet rays

3. What can we do to protect us from ultraviolet rays?

   A. wear a hat B. wear sunscreen C. both A and B

4. What surrounds the Earth and helps to protect us from ultraviolet rays?

   A. sky B. clouds C. the atmosphere

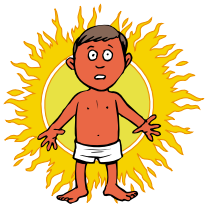
5. Can ultraviolet rays reach you even on a cloudy day?

   A. yes B. no

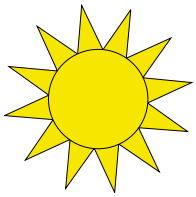
6. What part of the body can be harmed by ultraviolet rays?

   A. skin only B. eyes only C. eyes and skin

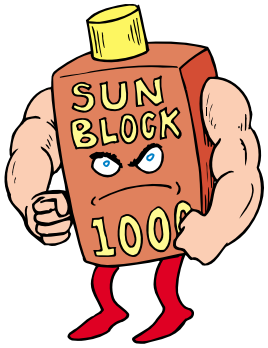
Student Worksheet

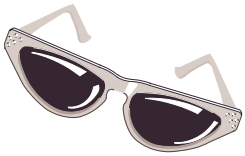


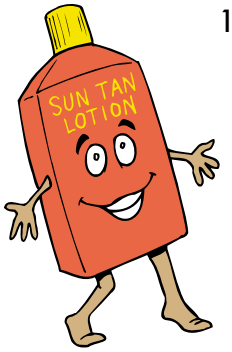
UV Chart

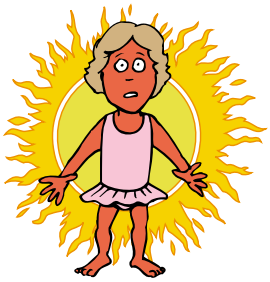


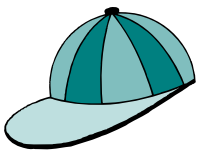
UV Number	Exposure	Safety Tip
0 to 2	Very Low	Wear a hat
3 to 4	Low	Wear a hat and sunscreen (SPF 15+)
5 to 6	Medium	Wear a hat and sunscreen (SPF 15+) Stay in shady areas
7 to 9	High	Wear a hat and sunscreen (SPF 15+) Stay in shady areas Stay indoors during mid-day (10:00 AM to 4:00 PM)
10+	Very High	Stay indoors as much as possible











Student Worksheet

Reading the UV Chart

Directions: Use the UV Chart to answer the questions below.

1. What is the UV Number for a "Low" Exposure?

2. What Safety Tip should you take if the Exposure is "Very Low"?

3. What are the peak mid-day hours of sunlight?

4. What is the UV Number for a "High" Exposure?

5. What Safety Tip should people take if the UV Number is 8?

6. What does the UV Chart tell us the Sun Protection Factor for sunscreen should be?

7. What kind of clothing does the UV Chart tell us to always wear outside?

8. What should you do if the Exposure is "Very High"?

9. Which two Exposure categories have a Safety Tip to stay in shady areas?

Exploration Guidesheet

Directions: **In your group, decide how you will explore the science ideas you have talked about in class.**

1. What is it that you want to explore?

2. How will you explore this science idea?

3. List the materials you will need.

4. List step-by-step how you will do your exploration.

5. After you follow your steps, write down what you observed.

6. What did you learn from this exploration?

7. Does this lead you to have other questions? Write down your question.

Career Explorations: Dermatologist

Directions: After watching the Webcast answer these questions below.

1. A dermatologist is a

   A. doctor

   B. scientist

2. A dermatologist helps people who have problems with their

   A. bones

   B. eyes

   C. skin

3. How do ultraviolet rays hurt our skin?

4. Does your family have a dermatologist for a doctor?

Career Explorations: Ophthalmologist

Directions: After watching the Webcast answer these questions below.

1. A ophthalmologist is a

   A. doctor

   B. scientist

2. A ophthalmologist helps people who have problemsnwith their

   A. bones

   B. eyes

   C. skin

3. How do ultraviolet rays hurt our eyes?

4. Does your family have a ophthalmologist for a doctor?

Career Explorations: Meteorologist

Directions: After watching the Webcast answer these questions below.

1. A meteorologist is a

   A. doctor

   B. scientist

2. A meteorologist studies the

   A. sun

   B. ocean

   C. weather

3. How does the weather change the amount of ultraviolet rays that reach us?

4. Name a meteorologist who you have seen on television.

Career Explorations: Solar Astronomer

Directions: After watching the Webcast answer these questions below.

1. A solar astronomer is a

   A. doctor

   B. scientist

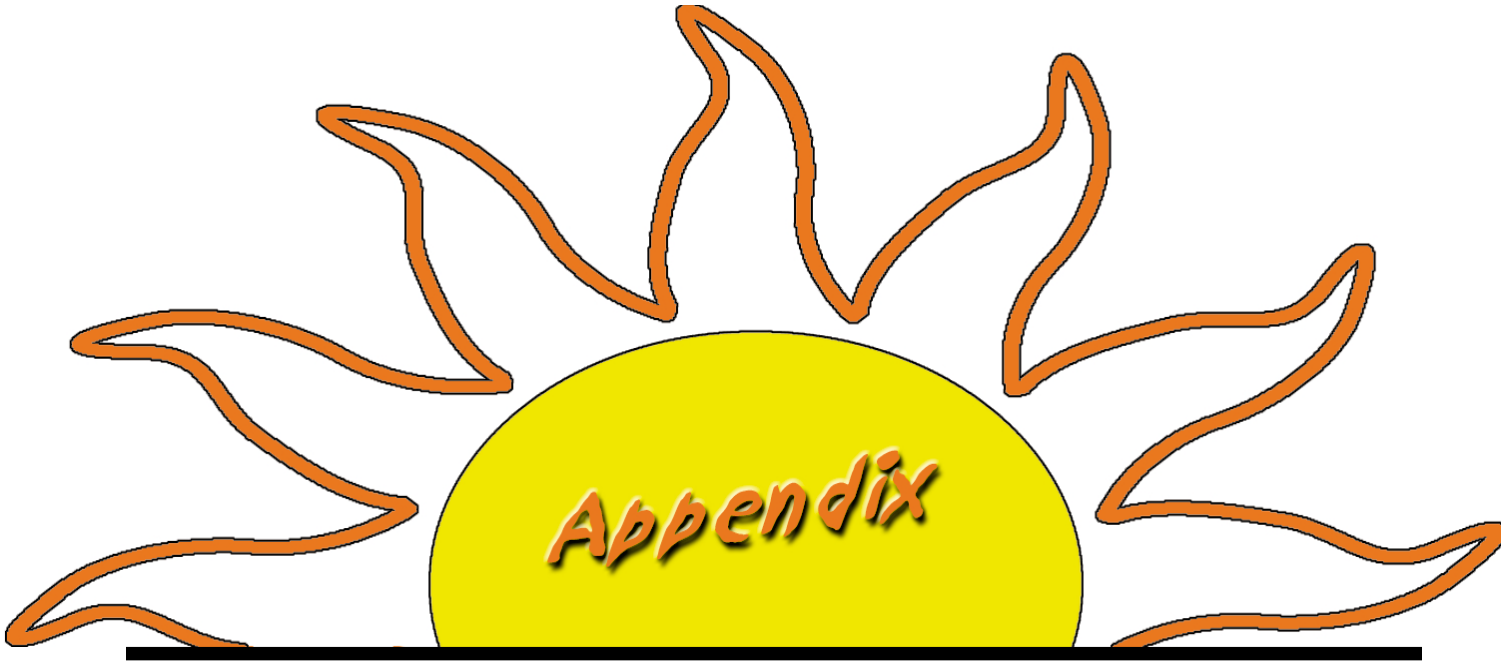
2. A solar astronomer studies the

   A. sun

   B. ocean

   C. weather

3. What does the sun have to do with ultraviolet rays?



- Solar Glossary
- Web Work

Solar Glossary

Directions: **An interactive vocabulary crossword puzzle and word search can be found on the Web site (http://solar-center.stanford.edu), using the following words and their definitions.**

atmosphere	A thick blanket of air that surrounds the Earth.
cloudy	Many clouds in the sky.
dermatologist	A doctor who helps people with skin problems.
energy	Giving off power like heat or light.
meteorologist	A scientist who studies weather.
ophthalmologist	A doctor who helps people with eye problems.
solar	Having to do with the sun.
solar astronomer	A scientist who studies the sun.
SPF (Sun Protection Factor)	The number o a sunscreen bottle that tells how much protection from ultraviolet rays the sunscreen gives.
sun	The star closest to earth that gives the Earth heat and light and other kinds of energy.
sunburn	A burn of the skin caused by ultraviolet rays.

Solar Glossary (continued)

sunglasses	Special eye glasses with dark lenses to keep out harmful ultraviolet rays and to let in less sunlight to the eyes.
sunscreen	Special cream or lotion that protects skin from sunburn caused by ultraviolet rays.
UV	Ultraviolet rays of energy given off by the sun that can cause sunburns.

Web Work

http://solar-center.stanford.edu

This site contains an interactive vocabulary crossword puzzle and word search using the solar glossary words.