



Photo courtesy of the CDC.

Measuring and Protecting Skin

The Science of Global Atmospheric Change:
Activity 7

Nancy Moreno, PhD.
Barbara Tharp, MS.

Center for
Educational Outreach
Baylor College of Medicine



BioEd Online

Measuring and Protecting Skin

The objectives of this activity are aligned with the National Science Education Standards, specifically those related to Science as Inquiry and Physical Science. "Measuring and Protecting Skin" uses guided inquiry to build students' awareness of skin by having them compare and contrast the "skin" of an orange to human skin. Students will make observations and predictions, estimate, calculate, graph, and draw conclusions based on their investigation.

The following science concepts are addressed in this activity.

- Skin is a vital part of the body.
- Skin must be protected from sun damage.

Student Worksheets

Student pages in the teacher's guide are provided in English and in Spanish.

Reference

Moreno N., and B. Tharp. (2011). *The Science of Global Atmospheric Change Teacher's Guide*. Third edition. Baylor College of Medicine. ISBN: 978-1-888997-76-7. Development of this student activity was supported, in part, by grant numbers R25 ES06932 and R2510698 from the National Institute of Environmental Health Sciences of the National Institutes of Health to Baylor College of Medicine.

Image Reference

Photo courtesy of the CDC. <http://www.cdc.gov/media/dpk/2013/images/summer-splash/img5.jpg>

Key Words

lesson, experiment, skin, sun, sunscreen, sunburn, ozone, heat,

Measuring and Protecting Skin © Baylor College of Medicine.

Materials



BioEd Online

Materials

Have students conduct the activity in groups of 2-4.

Materials per Student Group

- 2-3 feet of wax paper
- Crayons or colored markers
- Metric tape measure
- Orange or tangerine
- Paper towels
- Plastic knife
- Roll of tape
- Sheet of centimeter ruled graph paper
- Sheet of paper or a notebook for observations
- Copy of “Skin Observations” page

Reference

Moreno N., and B. Tharp. (2011). *The Science of Global Atmospheric Change Teacher’s Guide*. Third edition. Baylor College of Medicine. ISBN: 978-1-888997-76-7. Development of this student activity was supported, in part, by grant numbers R25 ES06932 and R2510698 from the National Institute of Environmental Health Sciences of the National Institutes of Health to Baylor College of Medicine.

Image Reference:

Photo by Christopher Burnett © Baylor College of Medicine.

Key Words

materials list, materials needed,

Measuring and Protecting Skin © Baylor College of Medicine.

Science Safety Considerations

- Follow all instructions.
- Begin investigation only when instructed.
- Do not eat or drink during the experiment.
- Use caution when handling the plastic knife.
- Report accidents or spills.
- Wash hands thoroughly after the investigation.



BioEd Online

Science Safety Considerations

Students always must think about safety when conducting science investigations. This slide may be used to review safety with your class prior to beginning the activity.

Safety first!

- Always follow school district and school science laboratory safety guidelines.
- Have a clear understanding of the investigation in advance.
- Practice any investigation with which you are not familiar before conducting it with the class.
- Make sure appropriate safety equipment and gear, such as safety goggles, fire extinguisher, are available.
- Continually monitor the area where the investigation is being conducted.

References

1. Dean R., M. Dean, and L. Motz. (2003). *Safety in the Elementary Science Classroom*. National Science Teachers Association.
2. Moreno N., and B. Tharp. (2011). *The Science of Global Atmospheric Change Teacher's Guide*. Third edition. Baylor College of Medicine. ISBN: 978-1-888997-76-7. Development of this student activity was supported, in part, by grant numbers R25 ES06932 and R2510698 from the National Institute of Environmental Health Sciences of the National Institutes of Health to Baylor College of Medicine.

Key Words

science, classroom, safety, lab, laboratory, rules, safety signs,

Measuring and Protecting Skin © Baylor College of Medicine.

What Has Skin?

- Do trees have skin? What other things have skin?
- What does skin do?
- Is our skin similar to the skin of an orange?



BioEd Online

What Has Skin?

To focus students' attention, begin by asking, *Do trees have skin?* Then ask, *What other things have skin?* Expect a wide range of answers. Some examples might include tree bark, skin on a banana, lizard skin, bird skin, etc. List student ideas on the board. Older students may record the list in their science notebooks.

Discuss the purposes of skin, based on the class list of things with skin. Then ask, *Is our skin similar to the skin of an orange?* Hold up an orange and explain that students will examine the skin of an orange and compare it with their own skin.

Reference

Moreno N., and B. Tharp. (2011). *The Science of Global Atmospheric Change Teacher's Guide*. Third edition. Baylor College of Medicine. ISBN: 978-1-888997-76-7. Development of this student activity was supported, in part, by grant numbers R25 ES06932 and R2510698 from the National Institute of Environmental Health Sciences of the National Institutes of Health to Baylor College of Medicine.

Image Reference:

Photo © Theodore D. Inoue CC-BY-SA 3.0.
http://commons.wikimedia.org/wiki/File:Southern_flying_squirrel_on_tree_closeup_2.jpg

Key Words

lesson, experiment, skin, sun, sunscreen, sunburn, ozone, heat, bark,

Measuring and Protecting Skin © Baylor College of Medicine.

Session 1: Estimating Surface Area

1. Observe the skin of the orange and record your observations.
2. Estimate how much skin the orange has. Record your prediction in square centimeters (cm²).
3. Peel the orange.
4. Flatten and lay the peelings on the graph paper.
5. Trace the peelings onto graph paper.
6. Color the space inside the traced line.
7. Count the number of colored squares. Did the orange have more skin than you estimated? Less?



BioEd Online

Let's Get Started—Session 1: Estimating the Surface Area of an Orange

In this activity, students will compare and contrast their own skin with that of an orange. Students will make observations and predictions, estimate, calculate, graph, and draw conclusions based on their investigation. They will discover that skin protects inner tissues of the body and is a vital organ that must be protected from sun damage.

1. Have Materials Managers collect the materials for their groups. Begin the activity by having one student in each group list the group's observations about the orange skin. Then place a check mark next to any observation that would be the same for human skin.

2. Ask students, *How much skin does an orange have? How could we find out?* Direct students to estimate the amount of skin on their oranges, in cm squared, and then color in the corresponding number of squares on a sheet of graph paper. They may want to measure their oranges using tape measures. With older students, use this opportunity to investigate the relationships among diameter, circumference, and area. Ask, *How could you check your estimates?*

3. Have groups peel their oranges and trace the peelings onto graph paper. Have them color in the traced areas in orange. Then, instruct students to count or measure the number of squares, and the area colored in orange. This will enable them to determine how much skin their orange really has. Allow students to devise their own methods for counting partially colored squares, or instruct them to count every other partial square.

4. Ask, *Are you surprised by the area covered by the skin of your orange? Why or why not?* Next, have the students examine the peeled oranges.

Reference

Moreno N., and B. Tharp. (2011). *The Science of Global Atmospheric Change Teacher's Guide*. Third edition. Baylor College of Medicine. ISBN: 978-1-888997-76-7. Development of this student activity was supported, in part, by grant numbers R25 ES06932 and R2510698 from the National Institute of Environmental Health Sciences of the National Institutes of Health to Baylor College of Medicine.

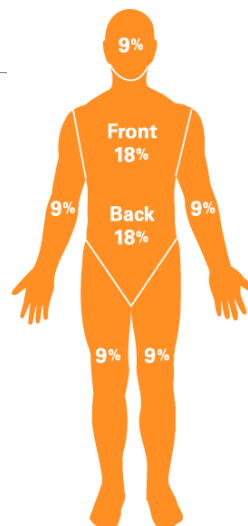
Key Words

lesson, experiment, skin, sun, sunscreen, sunburn, ozone, heat, surface area,

Measuring and Protecting Skin © Baylor College of Medicine.

Session 2: The Law of Nines

1. Predict how much skin a person has.
2. Record your prediction in cm^2 .
3. Wrap your partner's arm in wax paper from the shoulder to the wrist.
4. Lay the wax paper that had wrapped your arm on a sheet of graph paper. Count the number of squares it covers.
5. Record the area of skin on your arm.
6. Multiply the area of skin on your arm by 11 to calculate the total amount of skin on your body.



Each of the 11 major parts of the body represents 9% of the total amount of skin.



BioEd Online

Session 2: The Law of Nines

Explain that, like oranges, our bodies need skin for protection. Mention some of the characteristics of skin: it is the body's largest organ, provides protection from germs, houses the body's "cooling" and "heating" systems, contains receptors for our sense of touch, etc.

1. Refer students to the skin diagram on page 8 of the *Explorations* mini-magazine. Ask, *How much skin do you have, and how do you protect it?* Have students list the ways they protect their skin, and also record their estimates for the amount of skin on their bodies, in cm^2 , in their science notebooks.
2. Tell students that the area of skin on the body can be measured with relative accuracy by applying the Law of Nines. This rule of thumb was developed to help doctors estimate the amount of skin damaged on burn victims. Each of the body's 11 major sections accounts for 9% (or $1/11$) of the total amount of skin.
3. Using this rule, students can estimate the total surface area of skin on their bodies by measuring the area of one arm. Working in teams of two, have one student wrap another's arm in wax paper from the shoulder to the wrist. Have them mark any areas of overlap on the paper, and to avoid including these areas in the estimate of surface area. Then have students switch roles.
4. Have students spread the wax paper "arm wrapping" over two or more sheets of centimeter graph paper and count the number of squares covered. (Or, have older students measure the dimensions of the wax paper and calculate the area as if it were rectangular, or a rectangle and one or more triangles showing area calculations).

5. Once students have calculated the surface area of their arms, have them multiply that figure by 11 to determine the total surface area of skin on their entire bodies.

Reference

Moreno N., and B. Tharp. (2011). *The Science of Global Atmospheric Change Teacher's Guide*. Third edition. Baylor College of Medicine. ISBN: 978-1-888997-76-7. Development of this student activity was supported, in part, by grant numbers R25 ES06932 and R2510698 from the National Institute of Environmental Health Sciences of the National Institutes of Health to Baylor College of Medicine.

Image Reference

Illustration by M.S. Young © Baylor College of Medicine.

Key Words

lesson, experiment, skin, orange, law of nines,

Measuring and Protecting Skin © Baylor College of Medicine.

Let's Talk About It

- Did you or the orange have more skin?
- Why is skin so important?
- What might happen if oranges didn't have skin?
- What might happen if you didn't have skin?
- What do you think you would look and feel like without your skin?
- Is it important to protect our skin from sunlight (UV radiation)? How can we protect our skin?



BioEd Online

Let's Talk About It

During this activity, students learn that skin protects the body's inner tissues and provides information about the outside world.

Ask students, *Did you or the orange have more skin?* and *Why is skin so important?* Discuss what might happen if oranges didn't have skin. (Most likely, the orange would dry up.) Ask students to imagine how they might look and feel without their skin.

Discuss the importance of protecting our skin from UV radiation. Have students devise strategies for protecting skin. Some examples might include wearing clothes with long sleeves, always applying sunscreen, wearing hats, etc.

Reference

Moreno N., and B. Tharp. (2011). *The Science of Global Atmospheric Change Teacher's Guide*. Third edition. Baylor College of Medicine. ISBN: 978-1-888997-76-7. Development of this student activity was supported, in part, by grant numbers R25 ES06932 and R2510698 from the National Institute of Environmental Health Sciences of the National Institutes of Health to Baylor College of Medicine.

Key Words

lesson, experiment, skin, sun, sunscreen, sunburn, ozone, heat, orange, UV radiation, sunlight, skin cancer,

The Science of Skin

- Skin is a vital part of the body.
- Skin is made up of different layers
 - **Epidermis:** outer skin layer
 - **Dermis:** deep skin layer, gives strength to skin, contains nerve receptors
- Skin must be protected from sun damage (UV radiation).
- UV radiation can cause wrinkling and skin cancer.
- Wearing sunscreen is VERY important!



BioEd Online

The Science of Skin

In this activity, students learned the following points related to global resources.

- **Skin is a vital part of the body.** Skin protects inner body tissues and helps us to communicate (through the sensory system) with the outside world. The skin also helps maintain a constant body temperature by aiding in cooling (through perspiration and increased blood flow to the surface) and heating (by reducing blood flow near the surface). The skin is comprised of different layers. The top layer, the epidermis, consists of an inner layer of living cells and a outer layer of compacted dead cells. Skin color is determined by cells called melanocytes, located near the base of the epidermis. The lower skin layer, the dermis, is fibrous and gives strength to skin. Most nerve receptors, which capture information from the outside world, are located at the top of the dermis or the base of the epidermis.
- **Skin must be protected from sun damage.** Skin requires protection from damaging ultraviolet (UV) radiation from the sun or tanning lights, which can cause premature wrinkling and loss of skin elasticity, as well as skin cancer. Sunburns and suntans both are evidence that skin has been exposed to too much harmful radiation.

Reference

Moreno N., and B. Tharp. (2011). *The Science of Global Atmospheric Change*

Teacher's Guide. Third edition. Baylor College of Medicine. ISBN: 978-1-888997-76-7.
Development of this student activity was supported, in part, by grant numbers R25
ES06932 and R2510698 from the National Institute of Environmental Health Sciences of
the National Institutes of Health to Baylor College of Medicine.

Key Words

skin, sun, sunlight, UV radiation, sun damage, skin cancer, sunscreen,

Measuring and Protecting Skin © Baylor College of Medicine.

Extensions

- Wrap your entire body in wax paper and measure its area. Compare the result to the estimate using only your arm.
- Calculate the area covered by a t-shirt, shorts, bathing suit, or other clothing. Is more skin area exposed when you wear short or long sleeves?
- Read about the ozone layer and how it protects us from dangerous UV rays. What is being done to protect the ozone layer?



Sunscreen helps prevent skin cancer, which often is caused by sunburns.



BioEd Online

Extensions

Wrap the entire body of one or more students in wax paper. Then spread the paper out and measure its area. Compare the result to the estimate using the area of one arm only.

Have students calculate the area covered by a t-shirt, shorts, bathing suit, sweatshirts, or other clothing. Challenge them to calculate how much skin is exposed when they wear short sleeves and shorts instead of long sleeves and trousers.

Have students read about ozone depletion and the role of CFCs (chlorofluorocarbons) on page 3 of the *Explorations* mini-magazine for this unit. Explain that ozone depletion in the upper atmosphere is allowing more UV radiation to reach Earth's surface, which has increased the risk for damage to skin and eyes (particularly the development of cataracts). Ask students, *What else can you find out about the ozone layer?* and *What is being done to protect this vital part of the atmosphere?*

Reference

Moreno N., and B. Tharp. (2011). *The Science of Global Atmospheric Change Teacher's Guide*. Third edition. Baylor College of Medicine. ISBN: 978-1-888997-76-7. Development of this student activity was supported, in part, by grant numbers R25 ES06932 and R2510698 from the National Institute of Environmental Health Sciences of the National Institutes of Health to Baylor College of Medicine.

Image References

Photo courtesy of the National Cancer Institute, Visuals Online. Public domain.
<http://en.wikipedia.org/wiki/File:Melanoma.jpg>

Key Words

lesson, experiment, extension, skin, sun, sunscreen, sunburn, ozone, heat, ozone layer, UV rays, skin damage,

Measuring and Protecting Skin © Baylor College of Medicine.