

## 6. SkinWise

### Background

Skin protects inner tissues of the body and also provides communication (through the sensory system) with the outside world. The skin also helps maintain a constant temperature within the body by aiding in cooling—through increased blood flow to the surface and perspiration; and heating—by reducing blood flow near the surface.

The skin is comprised of different layers. The outermost layer, the epidermis, consists of an inner layer of living cells and a top layer of compacted dead cells. In fact, most of the skin that is visible on our bodies actually consists of dead cells! Skin color is determined by special cells called melanocytes located near the base of the epidermis. The lower layer, the dermis, is fibrous and gives strength to skin. Most nerve receptors that capture information from the outside world are located at the top of the dermis or the base of the epidermis.

Skin is especially vulnerable to the effects of ozone depletion in the upper atmosphere. Ultraviolet radiation produced by the sun can damage skin—causing premature wrinkling and loss of elasticity, as well as skin cancer. As increased amounts of UV radiation reach the surface of the planet, the risks for skin damage also increase. Sunburns and suntans both are evidence that skin has been exposed to too much damaging radiation. UV radiation also can harm parts of the eye.

This activity builds awareness of skin by having students contrast and compare the “skin” of an orange to human skin. Students also will compare the surface area of an orange to the area of a person’s skin.

### Links

This activity may be taught along with the following components of the My Home Planet Earth unit.

### Adventures:

*Mr. Slaptail’s Curious Contraption*, pages 21–22

Science box, page 20

### Explorations:

*What Is It?*, page 6; *SkinWise*, page 8

### Set-Up

Begin with a discussion involving the entire class. Have students conduct the activity in groups of 2–4.

### Procedure

#### Session 1: Estimating surface area of an orange

1. Generate student interest by brainstorming about things that have a skin. List student ideas on the board. Older students may record the list in their science notebooks.
2. Discuss the purposes of skin and ask for different examples of skin

### CONCEPTS

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

### OVERVIEW

Students will compare and contrast their own skin (including area) with that of an orange.

### SCIENCE & MATH SKILLS

- Predicting
- Estimating
- Calculating
- Graphing
- Drawing conclusions

### TIME

Preparation: 10 minutes

Class: two sessions of

30–60 minutes

### MATERIALS

Each group of students will need:

- orange or tangerine
- plastic knife
- paper towels
- 2–3 feet of wax paper
- tape
- crayons or markers
- tape measure
- sheet of paper or notebook for observations
- copy of *Graph Paper* page (or centimeter ruled graph paper)
- copy of *Skin Observations* page

Students will estimate the surface area covered by the skin of an orange.



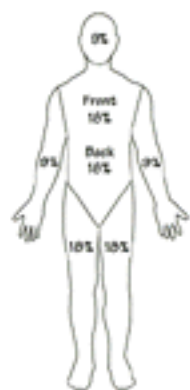
(tree bark, skin on a banana, lizard skin, bird skin, etc.) based on the list of things with skins.

3. Holding an orange, explain to students that they will be examining the skin of an orange and comparing it with their own skin. Ask, *How is the skin of an orange like your skin? How is it different?*
4. Have materials managers collect materials for the groups. Each group will need: an orange, paper towels, plastic knife, tape measure, sheet of writing or notebook paper, and two or more sheets of centimeter square graph paper.
5. Begin the group activity by having one student (recorder) list the group's observations about the skin of the orange. Then place a check next to the observations that would be the same for human skin.
6. Next, ask, *How much skin does an orange have? How could we find out?* Instruct students to estimate the amount of skin on the oranges by coloring similar areas on their graph sheets. 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.
7. Ask, *How could you check your estimates?* Have students peel the oranges and, within each group, trace the peelings onto graph paper. Have them color the traced areas orange. Have students count the number of squares that are colored and decide how much skin their orange really had. Let students devise their own methods for counting partially colored squares, or instruct them to count every other partial square. Ask, *Are you surprised about the area covered by the skin? Why or why not?*
8. Next, have the students examine the peeled oranges. Discuss what might happen if oranges didn't have skin.

### Session 2: Estimating the amount of skin on a person

1. Explain that, just like oranges, our bodies need protection. Mention some of the characteristics of skin: skin is the body's largest organ; skin provides strong protection from germs; skin houses our cooling and heating systems; skin contains receptors for our sense of touch, etc. Refer students to the diagram of skin on page 8 of the *Explorations* mini-magazine.
2. Ask, *How much skin do you have and how do you protect it?* Students can record their estimates in their science notebooks and list ways they protect their skin.
3. 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 in people with burns. Roughly, each of the 11 major sections of skin on the body accounts for 9% (or 1/11) of the total. Using this rule, students can estimate the total surface area of skin by measuring the area of one arm.
4. Working in teams of two, have one student wrap another's arm in

### Law of Nines



Each of the major parts of the body represents about 9% or 1/11 of the total amount of skin.

Front of each leg	9%
Back of each leg	9%
Each arm	9%
Head	9%
Each half of front torso	9%
Each half of back torso	9%

Many aspects of circles and spheres are described mathematically using radius ( $r$ ) and  $\pi$ .

$$2r = \text{diameter}$$

$$2\pi r = \text{circumference}$$

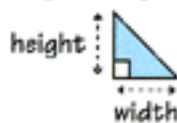
$$4/3\pi r^2 = \text{surface area of a sphere}$$

$$4/3\pi r^3 = \text{volume of a sphere}$$

The area of an irregular geometric shape with straight sides can be estimated by dividing the shape into one or more rectangles and/or triangles. Find the area of each of the smaller shapes and sum the individual areas to find the total area.

To find the area of a rectangle, multiply height times width.

To find the area of a right triangle (a triangle with a  $90^\circ$  angle) multiply height times width and divide the result by two.



Divide other kinds of triangles into two right triangles and calculate the areas as above.



wax paper. Have them mark any areas of overlap, so that they will not be counted for the estimate of surface area.

5. Have them spread the paper out over two or more sheets of centimeter graph paper and count the number of squares (or have older students measure the dimensions of the wax paper and calculate the area as if it were a rectangle, or a rectangle and one or more triangles).
6. Once students have found the surface area of an arm, have them multiply that figure by 11 to obtain the total surface area of skin on the entire body.
7. Ask students to imagine how they might look and feel without their skin—just like the peeled orange. Mention the importance of protecting skin from damaging radiation (ultraviolet) from the sun. Discuss strategies for protecting skin, including wearing clothes with long sleeves, always applying sunscreen, wearing hats, etc.

#### Variations

- 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 only one arm.
- Have students calculate the area covered by a t-shirt, shorts, bathing suit or other clothing. Challenge them to figure out the amounts of skin that are exposed when wearing short sleeves and shorts instead of long sleeves and trousers.

#### Questions for Students to Think About

- Read about ozone depletion and the role of CFCs (chloro-fluorocarbons) on page 3 of the *Explorations* mini-magazine for this unit. What else can you find out about the ozone layer? What is being done to protect this vital part of the atmosphere?

### Sunscreens

Commercial sunscreens protect the skin by shielding it from UV radiation. The most effective products are thick creams, like zinc oxide or titanium oxide, that do not let any radiation pass through to the skin.

Many sunscreens contain a chemical known as PABA (p-aminobenzoic acid). This often is used in tanning lotions, because it lets some of the longer wavelengths of UV light through. The skin reacts to the UV light by creating a protective layer of pigment. Unfortunately, even a tan that is acquired slowly with the benefit of tanning lotion still is evidence of skin damage that eventually could lead to premature aging and/or skin cancer.

Other sunscreens with compounds such as benzophenone and dioxybenzone provide protection against all wavelengths of UV light.

The "Sunscreen Protection Factor" (SPF) of a lotion serves as a measure of its protecting power. A product with an SPF of 10 reduces the amount of radiation reaching the skin by a factor of 10. Most experts recommend that products with an SPF of at least 15 be applied daily. People with fair skin should use sunscreens with an SPF of at least 30.

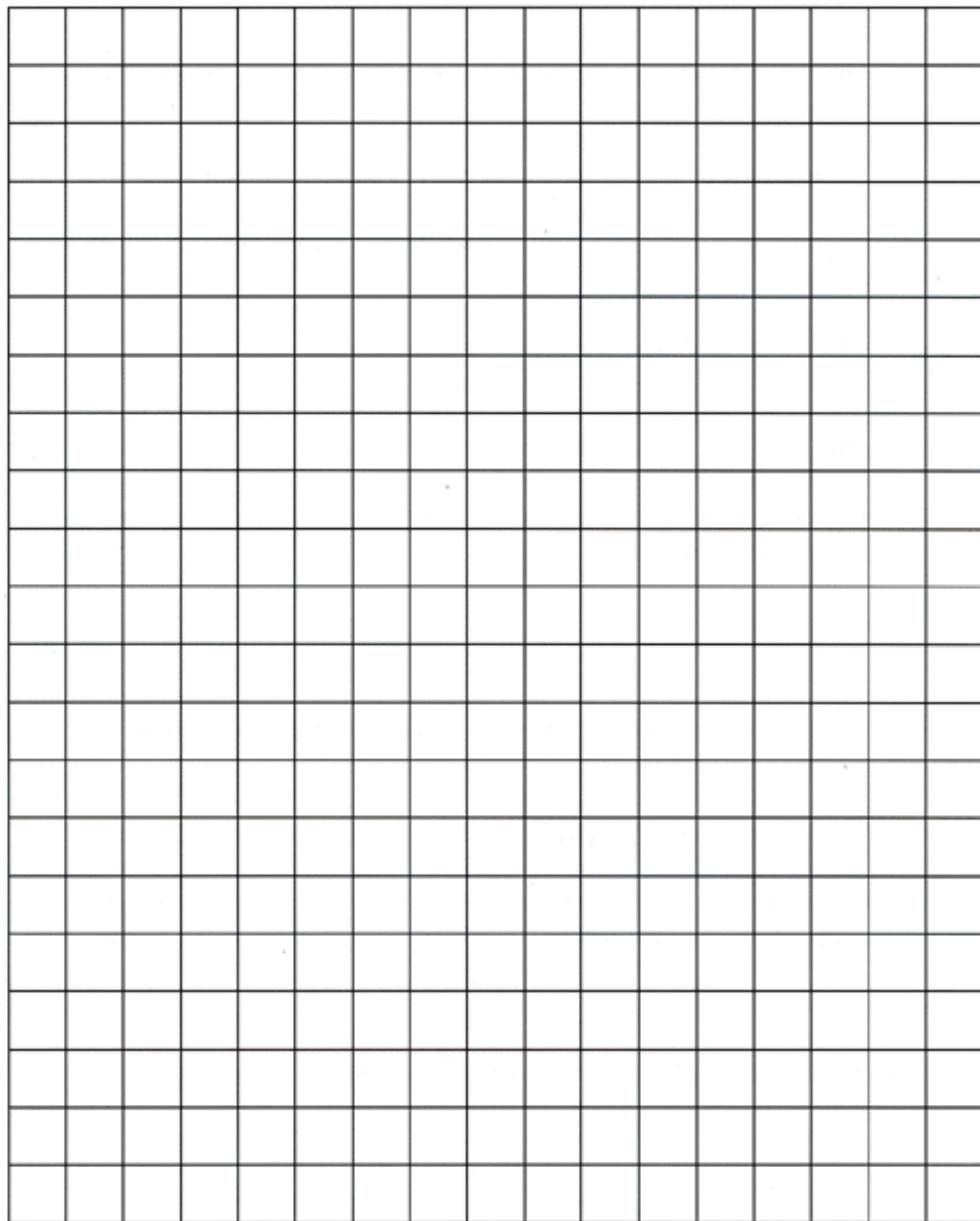
Did you know that hair, feathers, scales, claws, hooves and fingernails all are part of skin?

# Centimeter Graph Paper

## Papel Cuadrulado



Name/Nombre \_\_\_\_\_



## Skin Observations



Name \_\_\_\_\_

### Skin of an Orange

1. Observe the skin of an orange. Write your observations on a separate sheet of paper.
2. Put a check beside the observations that are the same for human skin.
3. How much skin do you think is on an orange? Write your prediction beneath your observations.
4. Now, peel an orange and lay the pieces of skin on graph paper.
5. Trace around the pieces and color in the spaces that were covered by the orange skin.
6. Count the number of squares that are colored. How many centimeter squares did you count? Write the number here.

Area of skin on orange = \_\_\_\_\_  $\text{cm}^2$

### My Skin

1. How much skin do you think is on a person? Write your prediction beneath your predictions for the skin of an orange.
2. Wrap your partner's arm in wax paper — making sure to just cover the arm.
3. Lay the wax paper over graph paper and count the squares that are covered. This is the number of square centimeters of skin on your arm. Write the number here.

Area of skin on arm = \_\_\_\_\_  $\text{cm}^2$

4. Multiply this number by 11 to figure out the total area of skin on the body.

$$\boxed{\phantom{000}} \text{ cm}^2 \times 11 = \boxed{\phantom{000}} \text{ cm}^2$$