LESSON MAKER PRO

Plant Surface Lab

Use simple models to compare leaves and roots.

HIGH SCHOOL · BOT.1

BOT.1 "Students will investigate the morphology, anatomy, and physiology of plants. Analyze models (3-D, paper, and/or computer-based) to distinguish the basic morphology of the plant kingdom..."

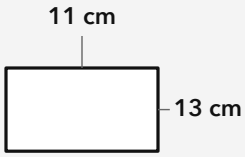
NAME _____ DATE _____

MODEL THE SURFACE

To estimate the area of one side of a leaf, model it as a rectangle and multiply length by width. To estimate the absorbing side area of a cylindrical root or root hair, calculate 2 × 3 × radius × length, using π = 3 and leaving out the ends. Multiply by the number of matching leaves, roots, or root hairs.

WORKED EXAMPLE

A plant has 7 leaves. Model one side of each leaf as an 11 cm by 13 cm rectangle. Estimate the total one-sided leaf area.

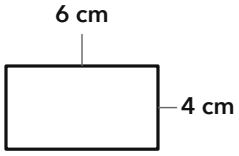


1. Area of one modeled leaf: 11 × 13 = 143 cm^2.
2. Area of 7 leaves: 7 × 143 = 1001 cm^2.

Answer: 1001 cm^2

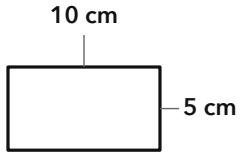
PRACTICE 6 problems

1 Estimate the area of one side of this leaf using the rectangular model.



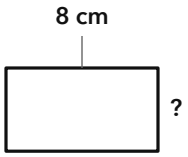
ANSWER _____

2 A plant has 3 leaves with these modeled dimensions. Estimate their total one-sided area.



ANSWER _____

3 The modeled area of one side of this leaf is 48 cm^2. Find its missing width.



ANSWER _____

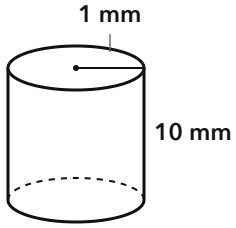
4 Use the rectangular models to find the one-sided area of each leaf. Which leaf has more area, and by how much?

LEAF MODELS

Leaf	Length	Width
A	12 cm	4 cm
B	10 cm	5 cm

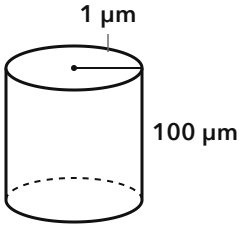
ANSWER _____

5 Model a root section as this cylinder. Using π = 3, estimate its absorbing side area. Do not include the ends.



ANSWER _____

6 A root has 4 hairs modeled by this cylinder. Using π = 3, estimate their combined side area. Do not include the ends.



ANSWER _____

APPLY IT Show your work

1 You are choosing plants for a sunny balcony. Use the models to estimate each plant's total one-sided leaf area. Which plant has more, and by how much?

BALCONY PLANT MODELS

Plant	Leaves	Length per leaf	Width per leaf
A	8	6 cm	5 cm
B	12	5 cm	3 cm

ANSWER _____

2 A class compares root hair models while planning a school garden. Each hair is a cylinder with the dimensions shown. Using π = 3, how much more absorbing side area do the root hairs of plant B have than those of plant A?

ROOT HAIR MODELS

Plant	Root hairs	Radius of each	Length of each
A	10	1 µm	80 µm
B	20	1 µm	80 µm

ANSWER _____

CHALLENGE One step up

Two plants have leaves modeled as rectangles. How many leaves must plant B have to match plant A's total one-sided leaf area? Explain why equal modeled leaf area would not prove that the plants lose water at the same rate.

LEAF AREA CHALLENGE

Plant	Leaves	Length per leaf	Width per leaf
A	8	9 cm	5 cm
B	?	6 cm	4 cm

WORK SPACE AND ANSWER

Plant Surface Lab

PART 1 · PRACTICE

#	PROBLEM	ANSWER
1	Estimate the area of one side of this leaf using the rectangular model.	**24 cm^2**
2	A plant has 3 leaves with these modeled dimensions. Estimate their total one-sided area.	**150 cm^2**
3	The modeled area of one side of this leaf is 48 cm^2. Find its missing width.	**6 cm**
4	Use the rectangular models to find the one-sided area of each leaf. Which leaf has more area, and by how much?	**A: 48 cm^2; B: 50 cm^2. B has 2 cm^2 more.**
5	Model a root section as this cylinder. Using π = 3, estimate its absorbing side area. Do not include the ends.	**60 mm^2**
6	A root has 4 hairs modeled by this cylinder. Using π = 3, estimate their combined side area. Do not include the ends.	**2400 μm^2**

PART 2 · APPLY IT

1. **Plant A has 240 cm^2; plant B has 180 cm^2. Plant A has 60 cm^2 more.** Multiply the length, width, and leaf count for each plant: 8 × 6 × 5 = 240 and 12 × 5 × 3 = 180. Subtract 180 from 240.
2. **4800 μm^2 more** Each hair has 2 × 3 × 1 × 80 = 480 μm^2 of side area. Plant B has 10 more hairs, so its modeled area is greater by 10 × 480 = 4800 μm^2.

CHALLENGE

Plant B needs 15 leaves: plant A has 8 × 9 × 5 = 360 cm^2, and each B leaf has 6 × 4 = 24 cm^2, so 360 ÷ 24 = 15. Equal modeled area does not prove equal water loss because traits such as stomatal density or cuticle thickness can differ.

All areas are estimates from simplified models. For the challenge explanation, accept another specific factor that affects water loss, such as differences in stomatal opening.