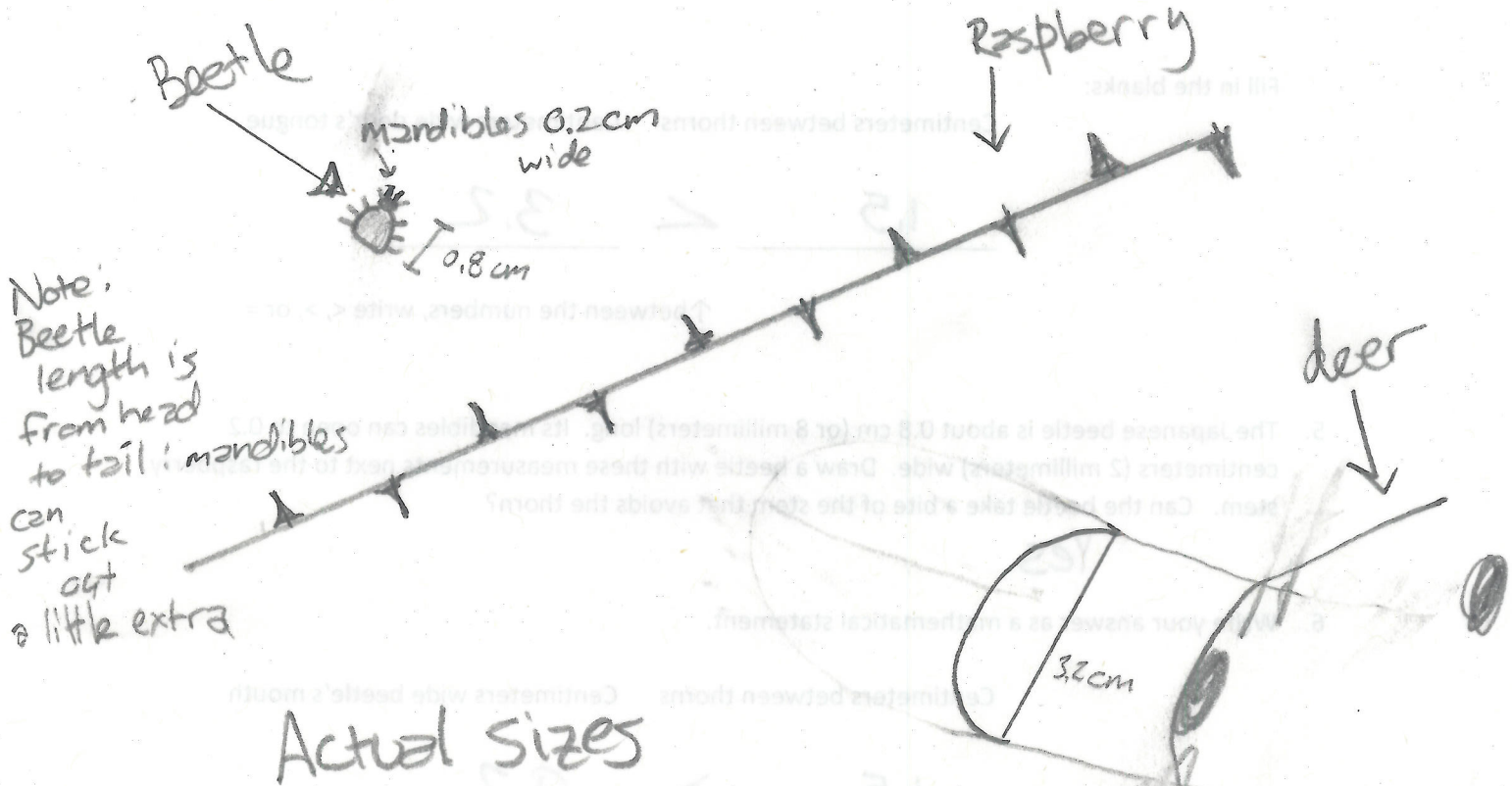


1. In the space below, draw a piece of a raspberry branch:
 - a. The stem is 15 centimeters long.
 - b. Every 1.5 centimeters, there is a thorn which is 0.5 centimeters (or 5 millimeters) long.



2. In the space above, draw a deer's mouth:
 - a. A deer's tongue is 3.2 centimeters wide. Because it doesn't have fingers like we do, a deer uses its tongue to pull leaves, branches, and bark into its jaw to chew with its teeth.

3. Will the deer's tongue be poked by a thorn if it picks up the branch?

YES

4. You can also express your answer to number 3 as a mathematical statement. An example of a mathematical statement is, "My arm, which is 64 cm long, is greater than my hand, which is 18 cm long" OR $64 > 18$.

Fill in the blanks:

Centimeters between thorns Centimeters wide deer's tongue

1.5 < 3.2

↑ between the numbers, write <, >, or =

5. The Japanese beetle is about 0.8 cm (or 8 millimeters) long. Its mandibles can open to 0.2 centimeters (2 millimeters) wide. Draw a beetle with these measurements next to the raspberry stem. Can the beetle take a bite of the stem that avoids the thorn?

Yes

6. Write your answer as a mathematical statement.

Centimeters between thorns Centimeters wide beetle's mouth

1.5 > 0.2

↑ between the numbers, write <, >, or =

7. On the sage plant, leaves are covered in hairs. A sage leaf is 2 centimeters long and only 0.1 cm (or 1 millimeter) thick. This is very small and hard to draw, so let's pretend we have a magnifying glass that makes everything five times bigger. Calculate what the leaf size would look like with this magnifying glass:

Sage leaf length: 2 centimeters x 5 times magnification = $2 \times 5 =$ 10 centimeters

Sage leaf thickness: 1 millimeter x 5 times magnification = $1 \times 5 =$ 5 millimeters

or 0.5
centimeters

8. Sage leaf hairs are spaced every 0.1 centimeter (1 millimeter) along the leaf and are 0.2 centimeters (2 millimeters) long. Calculate how far apart and how long these hairs would look under your magnifying glass:

10 mm = 1 cm

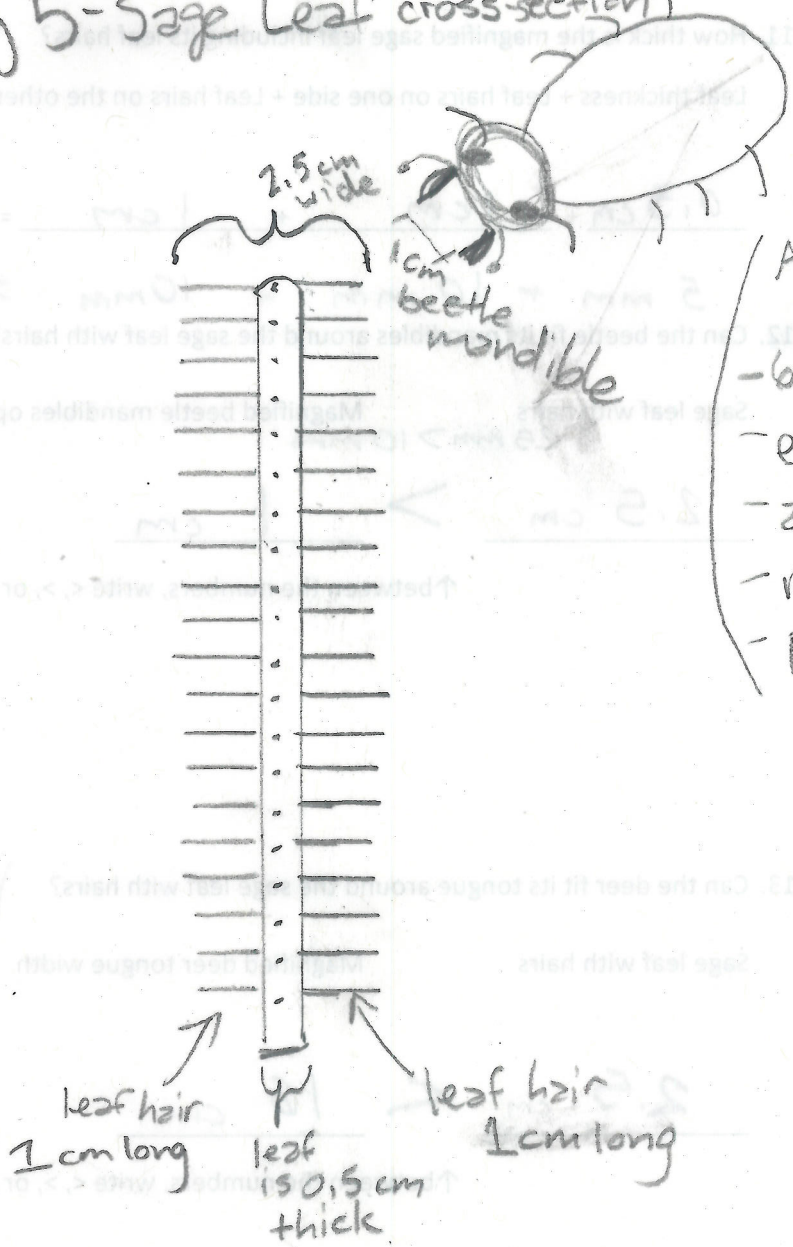
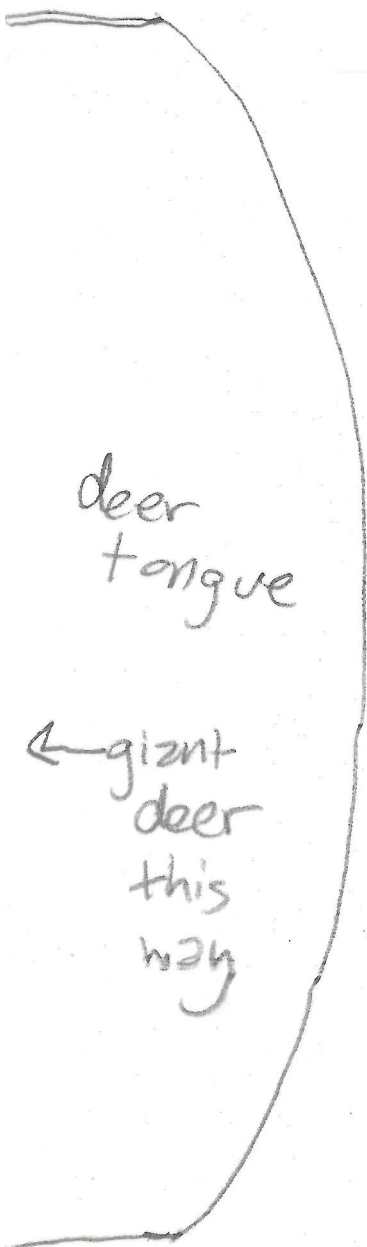
1 mm = 0.1 cm

Hairs are this far apart: $\frac{0.1 \text{ cm}}{1 \text{ mm}} \times \text{five times magnification} = \frac{0.1}{1} \times 5 = \frac{0.5 \text{ cm}}{5 \text{ mm}}$

Hairs are this long: $\frac{0.2 \text{ cm}}{2 \text{ mm}} \times \text{five times magnification} = \frac{0.2}{2} \times 5 = \frac{1 \text{ cm}}{10 \text{ mm}}$

9. Draw the magnified leaf length and thickness that you multiplied, and add the hairs that you calculated too!

Magnified by 5 - Sage Leaf cross-section



- A beetle has:
- 6 legs
 - eyes
 - antennae
 - mandibles
 - palps

32
 < 5
 10
 150
 160

10. What would the deer tongue and beetle look like at this magnification? Calculate their sizes and then add them to the drawing of the magnified leaf:

Deer tongue is this wide $\frac{3.2 \text{ cm}}{32 \text{ mm}}$ x five times magnification = $\frac{3.2}{32} \times 5 = \frac{16 \text{ cm}}{160 \text{ mm}}$

Beetle body is this long $\frac{0.8 \text{ cm}}{8 \text{ mm}}$ x five times magnification = $\frac{0.8}{8} \times 5 = \frac{4 \text{ cm}}{40 \text{ mm}}$

Beetle mandibles open this wide $\frac{0.2 \text{ cm}}{2 \text{ mm}}$ x five times magnification = $\frac{0.2}{2} \times 5 = \frac{1 \text{ cm}}{10 \text{ mm}}$

11. How thick is the magnified sage leaf including its leaf hairs?

Leaf thickness + Leaf hairs on one side + Leaf hairs on the other side = Leaf with hairs

$0.5 \text{ cm} + 1 \text{ cm} + 1 \text{ cm} = 2.5$

$5 \text{ mm} + 10 \text{ mm} + 10 \text{ mm} = 25 \text{ mm}$

12. Can the beetle fit its mandibles around the sage leaf with hairs?

NO

Sage leaf with hairs $25 \text{ mm} > 10 \text{ mm}$ Magnified beetle mandibles open this wide

$2.5 \text{ cm} > 1 \text{ cm}$

↑ between the numbers, write <, >, or =

13. Can the deer fit its tongue around the sage leaf with hairs?

YES

Sage leaf with hairs Magnified deer tongue width

$2.5 \text{ cm} < 16 \text{ cm}$

↑ between the numbers, write <, >, or =

14. CIRCLE the animal that can eat a plant with thorns, and put an X through the animal that cannot.

~~Deer~~ Beetle

15. CIRCLE the animal that can eat a plant with leaf hairs, and put an X through the animal that cannot.

Deer ~~Beetle~~

16. CIRCLE the animal that can eat a plant with waxy leaves, and put an X through the animal that cannot (hint: a blueberry has wax).

Deer ~~Beetle~~

↑
see powerpoint slide on wax

KEY

Animals versus Plants

If the plant traits would stop the animal from eating the plant, put an X over the trait.

If the animal could eat a plant with this trait, circle the trait.

O - animal survives

X - plant survives

Deer

Monarch caterpillar

St Johnswort Beetle

~~Thorns~~

Thorns

Thorns

Leaf Hairs

Leaf Hairs

~~Leaf Hairs~~

Wax

~~Wax~~

~~Wax~~

~~Milkweed latex~~

Milkweed latex

~~Milkweed latex~~

Tannins

~~Tannins~~

~~Tannins~~

~~Hypericin~~

~~Hypericin~~

Hypericin

(Count across for plant survival & down for animal survival.)

The deer has a $\frac{3}{6} = 0.5$ chance of survival

The caterpillar has a $\frac{3}{6} = 0.5$ or 50% chance of survival.

The beetle has a $\frac{2}{6} = 0.33$ or 33% chance of survival.

Plants with thorns or leaf hairs have a $\frac{1}{3} = 0.33$ or 33% chance of survival.

Plants with wax, latex, tannins, or hypericin have a $\frac{2}{3} = 0.66$ or 66% chance of survival

