

Eating Chocolate, a Lesson in Volume Using Candy Bars

Who can resist?

In this lesson students convert a “virtual” piece of candy into units that will be more personally comprehensive. The students measure and calculate the area and volume of a solid chocolate bar using metric rulers. They also compare this information to measurements obtained from the Guinness Book of World Records Website for a record breaking candy bar. Then, after eating one serving of chocolate, students work together to determine the number of bites it would take for a 4th grader to eat the huge candy bar!

This lesson has been created for submission to the Illuminations Summer Institute Program. The following documents represent a small portion of the students’ work involved in this investigation. As the main focus of this lesson is for students to communicate their mathematical thinking, the first two documents that follow are transcripts of the dialogue from two of our discussions. Get ready to enjoy my 4th grades work, but don’t forget your candy bar. You **will** be craving chocolate before you know it!



May12 -- Eating Chocolate Day 1

Whole group information and discussion

Teacher questions in red.

Student consensus in blue

Student Calculations Chart:

Name of candy	Volume	Servings	Bites per serving
HERSHEY'S 43 g	38.5 cu cm	1	12
Big Twix	127.5 cu cm	2	8
HERSHEY'S 43 g	154 cu cm	1	10
HERSHEY'S MINI	1 cu cm	1	1
HERSHEY'S 43 g	90 cu cm	1	6
Star Burst	24 cu cm	12	1
HERSHEY'S 43 g	45 cu cm	1	8
Butterfingers	28 cu cm	1	4
HERSHEY'S 43 g	38.5 cu cm	1	15
Ikea Big Bar	60 cu cm	1	50
HERSHEY'S 43 g	38.5 cu cm	1	4
Mounds	23 cu cm	1	6
HERSHEY'S 43 g	70 cu cm	1	9
Large Hershey's	124 cu cm	2	6
HERSHEY'S 43 g	41.25 cu cm	1	11
Snickers	10 cu cm	1	16
HERSHEY'S 43 g	165 cu cm	1	4
Skor	36 cu cm	1	9
HERSHEY'S 43 g	37.5 cu cm	1	8
Granola Bar	30 cu cm	1	12

Determining the volume of a Hershey's Bar from chart information

HERSHEY'S 43 gram Milk Chocolate Candy Bar.

38.5	154
90	45
38.5	38.5
70	41.25
165	37.5

Why all the differences?

Whole Group Actual Calculation:

Length: 14 cm

Width: 5.5 cm

Depth: 0.5 cm

Area = $14 \times 5.5 = 77$ square centimeters

Volume = Area x Depth 77 square centimeters x 0.5 cm = 38.5 cubic centimeters

Comparing largest and smallest from chart information

Largest Big Twix = 127.5 cu cm **servicing size 1** Smallest: Hershey Mini = 1 cu cm **servicing size 1**

What can we say about serving sizes?

Serving size just depends upon what a company wants it to be. As long as each package has at least 1 serving size than ANYTHING GOES!

Averaging the number of bites it takes a 4th grader to eat a Hershey's Bar

Bites per Hershey's Bar		How should we find the average number of bites?		
Student Experiment Data		Mode	Mean	Median
12	10	4 and 8	8.7	8.5
6	10	The Mean seems like the best idea because the numbers are all over the place. Too many Modes and the Median is not good because there are not lots of 8's and 9's in the data.		
15	4			
9	11			
4	8			

May13 -- Eating Chocolate Day 2

Whole group information and discussion

Teacher questions and comments in red.

Student comments in blue

Student Planning Reporting after Think-Pair-Share

What is your plan for finding out the number of bites in the huge candy bar?

Kate's Plan

1. Measure how long a bite of candy is.
2. Measure how wide a bite of candy is
3. Measure how deep a bite of candy is
4. Divide the length of the huge bar by the measurement for one bite long.
5. Divide the width of the huge bar by the measurement for one bite width.
6. Divide the depth of the huge bar by the measurement for one bite deep.

What will you do with the data get from these calculations?

Find the volume by multiplying the length, width, and depth.

What will the answer represent?

The volume of one bite of the big bar

What was the original question you were trying to find the answer to?

OH, the number of bites in the big one.

How can the information for the size of a bite of candy help you find the number of bites in the big candy?

I could figure out how many of those size bites I could get out of the big bar.

Good job, you are on the right track. Let's see if another group wants to share.

Jared's Plan

1. I figured that there are 12 rectangles of chocolate in the Hershey bar so that must mean that there are 12 bites.

2. I looked at the picture of the big bar and I think that each rectangle of chocolate in that bar would be equal to about 12 Hershey bars. So $12 \text{ (bites)} \times 12 \text{ (bars)} = 144 \text{ bites per rectangle of chocolate in the big bar.}$

3. Then I think there are 36 rectangles of chocolate in the big bar. So $144 \text{ (bites)} \times 36 \text{ (rectangles)} = 5,184 \text{ bites.}$

How can you check your answer to see if it makes sense?

I could check my estimates.

What information do you have to check your estimates?

I could look at the picture again, and use the numbers on the worksheet for the size of the candy bar.

Is there any information that is given on the worksheet that you need to remember to use in your calculations?

I need all the numbers the same amount.

Good. All those numbers will help you. Let's look at the picture again of the huge candy bar. If you were given a big chunk of it how would you go about eating it?

I would just take big bites until it was gone.

Do you think you could get your mouth around it like you did with the Hershey's bar, or would you have to cut it up?

It would be like eating a huge hamburger!

Is that what it was like to eat the Hershey's bar?

No.

If your Hershey's bar was that thick could you eat a whole rectangle in one bite?

No, that would have to be about 10 candy bars stacked on top of each other. I guess I will have to think more about thickness and how that changes the number of bites.

Abhishek and Evan's Plan

1. We thought we could figure out how big one of those rectangles of chocolate in the huge bar was by using the metric numbers on the worksheet.

2. Then we could measure a rectangle in a Hershey's Bar and compare the sizes. We were planning on comparing the areas but we might want to compare volume because that takes in all the numbers on the worksheet. You probably wouldn't give us all those numbers if we didn't need to use them all.

3. So, we could compare the volumes of the rectangles or maybe the whole bars. Or, we could somehow figure out the size of the rectangles in the big bar. What should we do?

Well, let's get through your original plan first and then you two can meet again and decide upon that point.

4. Okay. Then we planned on multiplying the bites by the bigger number. That's it.

I know what you mean by "bites" but I am not sure what you mean by the "bigger number?" Can you explain that idea to me?

Oh, the bigger number is the comparing number when we compare the two things.

Okay, I think you said you were going to compare the areas or the volumes, is that right?

Volume, we thought area but now we think volume.

Okay, how will you use the values for volume to compare the two candy bars?

Well, one might have a volume of like 100 cubic centimeters and the other one might have like 1 billion cubic centimeters.

How about if we use some smaller numbers to demonstrate your idea? Like maybe 4 and 36?

Okay like a volume of 4 cubic centimeters and the other one like 36 cubic centimeters.

How do those numbers compare to each other?

Like there are 9 groups of 4 in 36.

Okay so how does that information help you find the number of bites in the large candy bar?

Well, like we did yesterday, if we have 12 bites in a volume of like 4, then we will have 9 times that many bites in a volume of 36.

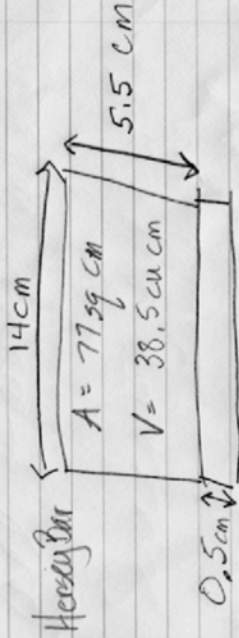
Okay, good thinking. I think you are on the right track.

Math Journal May 12

$$A = l \times w \quad A = lw$$

$$V = l \times w \times d \quad V = lwd \quad V = A \cdot d$$

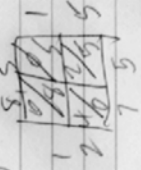
length width depth



$$14 \times 5.5 = 77 \text{ sq. cm}$$

$$\begin{array}{r} 14 \\ \times 5.5 \\ \hline 70 \\ 70 \\ \hline 77.0 \end{array}$$

Largest $14 \times 14 \times 1.5 = 294$

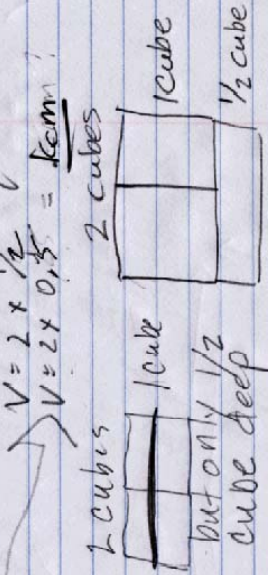


$$127.5$$

Smallest mini hersey

$$\text{area} = 2 \times 2 \text{ sq cm}$$

$$V = 2 \times 2 \times \frac{1}{2} = 2 \text{ cm}^3$$



So if I made it I would cut 2 cubes in $\frac{1}{2}$



but

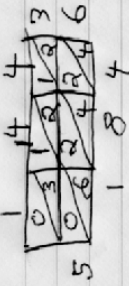
If I cut 1 cube in $\frac{1}{2}$ I could make the whole thing out of 1 cube!

- Hershey min 1 = 1 serv 1
- Hershey big = 1 serv 385
- Twix = 2 serv 127.5 + 2
- Twix small = 1 serv 63.5

1 serv can be 1 cm, 38.5 cm, 3.5 cm anything!

Eating Check 2 Day 2 May 13

12 Squares in a Hershey Bar
12 Bites in a Hershey Bar
1 tile of big bar = 12 Hershey Bars
 $12 \times 12 = 144$
About 36 tiles
 36×144



5184 bites



Thickness
Thick as a brick

Hershey Bar Med 43 grams (H.B.)

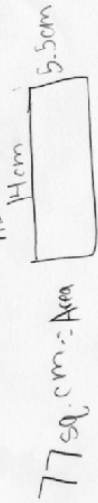
$$\begin{aligned} \text{Area} &= 77 \text{ sq cm} \\ \text{Vol} &= 38.5 \text{ cu cm} \end{aligned}$$

Pre Carol will take ~~2~~ bites to eat her twix

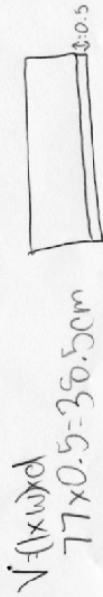
It really took her 8 bites!!
I was close

Investigation #1 - Measurements of your candy bar:

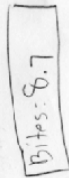
a. Find the surface area of your candy bar. Show your work:



b. Find the volume of your candy bar. Show your work:



c. Calculate the number of bites it would take to eat your candy bar. Eat your work and write the answer here:

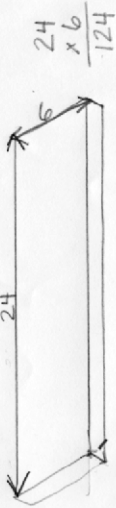


d. Fill in the form below:

It takes 8.7 bites to eat a candy bar with a volume of 38.5 cu. cm.

Investigation #1 - Measurements of your candy bar:

a. Find the surface area of your candy bar. Show your work:



b. Find the volume of your candy bar. Show your work:

Handwritten work: $\frac{124}{1} = 124$

c. Calculate the number of bites it would take to eat your candy bar. Eat your work and write the answer here:

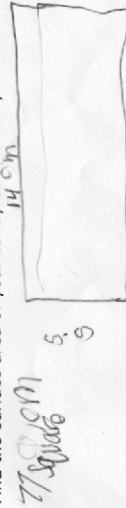
He will take 12 bites,

d. Fill in the form below:

It takes 9 bites to eat a candy bar with a volume of 38.5

Investigation #1 - Measurements of your candy bar:

a. Find the surface area of your candy bar. Show your work:



b. Find the volume of your candy bar. Show your work:



c. Calculate the number of bites it would take to eat your candy bar. Eat your work and write the answer here:

1	4	7	16
2	5	8	11
3	6	9	12

d. Fill in the form below:

It takes 12 bites to eat a candy bar with a volume of 38.5

Investigation #1 - Measurements of your candy bar:

a. Find the surface area of your candy bar. Show your work:



b. Find the volume of your candy bar. Show your work:

Handwritten work: $23 \times 1 = 23$

c. Calculate the number of bites it would take to eat your candy bar. Eat your work and write the answer here:



d. Fill in the form below:

It takes 4 bites to eat a candy bar with a volume of 38.5

The Largest Candy Bar in the World!



Make a prediction:

How many ~~serving sizes~~ do you think are in this candy bar?: 69.8 billion

Make a prediction:

How many ^{bites} ~~serving sizes~~ do you think are in this candy bar?: 18,000

Make a prediction:

How many ^{bites} ~~serving sizes~~ do you think are in this candy bar?: 40,000

Make a prediction:

How many ~~serving sizes~~ do you think are in this candy bar?: 27,374

Make a prediction:

How many ~~serving sizes~~ do you think are in this candy bar?: 5 googleplex

Project investigation: About how many ~~average~~ bites would it take to eat the whole thing? 24,655,104 ÷ 38.5 =

Make a prediction:

How many ^{bites} ~~serving sizes~~ do you think are in this candy bar?: 180,000

Make a prediction:

How many ^{bites} ~~serving sizes~~ do you think are in this candy bar?: ~~654,400~~

Make a prediction:

How many ^{bites} ~~serving sizes~~ do you think are in this candy bar?: 50,000

Make a prediction:

How many ~~serving sizes~~ do you think are in this candy bar?: 3,000,000

Make a prediction:

How many ^{bites} ~~serving sizes~~ do you think are in this candy bar?: 36500

Make a prediction:

How many ~~serving sizes~~ do you think are in this candy bar?: 3000

Make a prediction:

How many ^{bites} ~~serving sizes~~ do you think are in this candy bar?: 252

Make a prediction:

How many ^{bites} ~~serving sizes~~ do you think are in this candy bar?: ~~5720~~ 10,250

1. Using the proper metric conversions, find the surface area of the candy bar below:

$$\begin{array}{r} 1152 \\ \times 123 \\ \hline 3456 \\ 24040 \\ \hline 115200 \end{array}$$

115200

$$\begin{array}{r} 3456 \\ \cdot 24040 \\ \hline 15200 \\ 141696 \\ \hline 2833920 \end{array}$$

2. Using the proper metric conversions, find the volume of the candy bar below:

$$2640,392,3$$

$$2833920$$

volume

3. Based on the information you have gathered, determine the number of regular size Hershey candy bars you would need to make up the longest candy bar in the world. Show your work:

$$73608,3$$

4. Now calculate the approximate number of bites it would take a fourth grader to eat the whole candy bar!

$$73608,3$$

5. Check to see if your answer makes sense. Explain your reasons why it makes sense below:

it makes sense because $hb = 11$
in my case it was 12×12 because
12 hershey bars can fit in one sq. ft.

6. Tell how you used problem solving strategies to calculate your answer:

$12 \times 12 = 144 \times 36$ because 11.52 is about 36 ft.
 $144 \times 36 = 5184 \times 3$ ft. because 1 meter is about 3 ft.
 $5184 \times 3 = 15552 \times 200$ cm because that's the depth = 311040.

7. How close was your prediction? Tell why you think that your prediction was not exactly accurate? What information would have helped you be more accurate in your prediction?

I was close I might have been closer if I took a survey of bites.

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