Dear Betty

The same company that makes Fruit Roll Ups® also makes a product called Fruit by the Foot®. Both packages have about the same net weight and cost about the same amount of money. The ingredient lists on both packages list the same items and the nutrition labels are the same, except that a serving of Fruit Roll Ups® is 2 packages instead of 1.

I would like you to compare the 2 products and write a note to the manufacturer telling them which one you find to be the better deal.

Which one provides the greatest number of bites and lasts the longest? In other words, which has the greatest "pleasure measure"?

Which one has the most "environmentally friendly" packaging (has the lowest ratio of packaging material to packed material)?

Give the manufacturer specific, detailed information and make a recommendation to the company based on your findings. Should they continue to offer both products? Should they change their packaging?

Grade Levels 6 - 8

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Give the manufacturer specific, detailed information and make a recommendation to the company based on your findings. Should they continue to offer both products? Should they change their packaging?

Context

We were having a conversation during snack time about the various fruit leather snacks students were eating. I was amazed at the wide variety in presentation of essentially the same food product. On my next trip to the grocery store, I perused the fruit snack aisle and found these two products, manufactured by the same company, with the same unit price. Both seemed to be over packaged and offered only a tiny amount of food beneath all that wrapping. Not one to pass up a teachable moment, I designed this task.

What This Task Accomplishes

On one level I hoped that this task would create more aware consumers. There are also many decision-making and math skills required to complete this task.

What the Student Will Do

The student must first decide on a focus for comparison. Will s/he compare the relative amount of food product in the boxes? The relative amount of wrapping in the boxes? Or both? The student then must decide on the advice to be given to the manufacturer.

Time Required

This task required about two hours of structured class time and additional homework time to complete the written portion of the solution.

Teaching Tips

It would be important to teach students how to find surface area and volume prior to presenting this task. The fruit is rolled so thin that students decided to measure just length and width as the height was slightly less than one millimeter and we did not have precise enough tools to measure the actual thickness of either fruit product.

You might present one product per class and have students measure the amount of food product and wrapping in a package for each separately to avoid confusion in keeping track of data.

I had students work in teams to keep the material expenses down. You might get a grocer to underwrite this project by giving you enough of the products to conduct the investigation.

Suggested Materials

- Have enough packages of the two fruit products to have one individual package for each pair of students (keep the outer boxes available for measuring and for label information).
- Rulers
- Calculators
- A third type of fruit leather product for extension comparisons*

*I had Fruit String Things® by the same manufacturer, they were difficult to measure.

Possible Solutions

Students were surprised to discover that the individual packages for Fruit Roll Ups® represented one-half of a serving. They thought (and I agreed) that there is no reason to use twice as much wrapping when doubling the thickness would be so easy. There appeared to be slightly more product in the Fruit Roll Ups® packages, but more non-recyclable wrapping as well. Both boxes had more cardboard than necessary, so it was possible to pack more servings into a single box than is being done presently. There will be many variations on the solution depending on how and what the student measures. The important point is that students arrive at the ratio of fruit to wrapping, discover that neither of these products is particularly environmentally friendly, and that they are spending more for wrapping than food.

The actual measurements in the Practitioner benchmark are extremely close to my measurements. The Expert benchmark has an error in computation on both cardboard areas, but was still chosen as Expert, as this error does not change the solution. This student did a good job of explaining the process of comparing the two products and then comparing the "String Thing" product as well.

Benchmark Descriptors

Novice
These students either did no measurements or did them poorly and did not compare the two products accurately. They had little or no mathematics in their solutions, used no mathematical representations, and presented weak arguments for their points of view.

The exemplar includes very little measurement and bases the comparison on nutritional labeling, rather than solving the problem as it was presented.

Apprentice
For the most part these students understood what was asked of them in the task. They did take appropriate measurements, but were often inaccurate in their findings. They got confused between the two products and that led them to faulty assumptions. They did attempt to use mathematical language and representations in their presentation and attempted to convince the manufacturer of their point of view.

The exemplar student found the measurements for one individually wrapped portion of the fruit and its wrappers, but did not multiply that figure by the number of packages in the box for either product. The area of cardboard is close to accurate, given the difficulty in measuring the entire area of all the flaps. The student does make some unfounded statements as indicated in the annotations in the exemplar.

Practitioner
These students understood the task, did the measurements - usually with good accuracy - and made some comparisons. They often left out some aspect of the solution, made faulty comparisons or simply stopped too soon.

The exemplar of this group had excellent mathematical language, much of it symbolic, but could have enhanced the solution with diagrams of the measurements written about. This student does have a good table to compare the two products from all aspects.

Expert
The Experts solved the problem efficiently and communicated their solutions clearly. Many included the extension product comparison. All of these students wrote their solution to include the letter to the manufacturer, summarizing their findings as instructed in the task. Their mathematical language was accurate, as were their representations. They may even make informed decisions in the grocery store as well!

The exemplar used diagrams to demonstrate the measurements of the fruit products and the packaging. This student made good comparisons of the ratios of food to waste in these two products, considered a third product made by the same manufacturer, and found it to contain less food per amount of waste. The advice to the manufacturer is accurate and well stated.

Novice

By the foot

3ft long 1" wide

it has a waxy back that is 3 ft long and two strips of sticky staff wich is not needed and their is a realy big raper for it that is aculy filled with mostly air

NUTRITION Facts
serving size 1 roll
Servings Per container
Amount Per Serving
Calories: 80
Total Fat: 1.5g
Sodium: 45mg
Total carbohydrate: 17g
Sugars: 10g
Protein: 0g
Vitamin C: 50%
Net Wt 4.5oz

Macker: Betty Crocker

This information from the box has nothing to do with the task.

Fruit Rollups

the reguler sawar fruit rollups is 4 1/2 with 4 3/4 length

Should have measured "a lot of trash".

their is a lot of trash in it because they cap it is cellophane and a carboards raper.

Should have measured the "really big raper".

Macker: Betty Crocker

How do we know the box would hold 14?

the box could hold 14 but the only put in 10 they wast a lot of car board and paper.

Net Wt 5 oz

Nutrition Facts
serving size 2 rolls (20g)
Servings Per container 5
Amount Per serving
Calories: 110
total fat: 1g
Sodium: 105mg
Carbohydrate: 24g
Protein 0g
Vitamin C: 50%

Dear Betty

Apprentice

Dear Betty

I am going to give you a suggestion on your two products fruit Roll ups and fruit by the foot. On my table below it shows the deferentse between the two. The fruit by the foot lasts the lenget is because of its shape (figure a). You can bit it mor times. Figure B shows fruit roll-up its smaler shape but its taken. I think that you should contine selling bolh tips of fruit esept sell it with less ink on the packing and and more envieromentaly freindly. Using more card bad.

The thickness of the two products was too similar to be able to measure the difference without tools.

Why does this student want more cardboard used?

Figure B

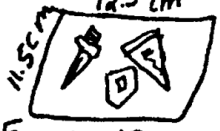
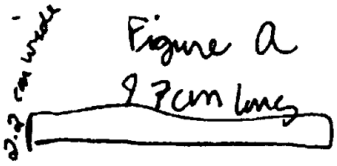


Figure a



	Fruit Roll Up	Fruit by the foot
Box	938 sq cm	138 sq cm
wapper	136 sq cm	168 sq cm
paper	184 sq cm	291 sq cm
fruit	143 sq cm	213 sq cm
servings	6	12
bits	8	10
	more enviromentaly freendly 415	lasts the longest most fruit

Dear Betty

Apprentice

Shows lack of good number sense here. Should have rounded the number of bites to the nearest whole number.

Dear Bedy.
d t would take 19.4 bits to get a fruit rolup because one bite is about five sentameters long and if you devid that into it with is the lengh and it eqels 19.4. But the fruit Roll up only was 8.984375 bits d figured that out by testing how big one bit is that turnd out to be 16 sq cm so my lleta on the back told me the arya of the fruit wich was 143.75 sq cm so d devided 16 into 143.75 and came up with 8.984375. d have also conpard the two fruit maks is table from on the back. Fruit Roll up is more enviromentaly friendly wocking to my table bok it's the back of the paper to find the table. Ever thaw the fruit Roll up shows to be a beta deal d would sugest to keep selling them both but reduce ink on the packaging and double the fruit roll ups thickness and also make the boxes only as big as you need for

It would have been a good extension to determine how small the box could be made.

Apprentice

Fruit Roll up 10/box

Box 18.5 cm x 14.5 cm x 3.5 cm = 938.875

wrapper 17cm x 8 cm = 136

paper 11.5 cm x 16 cm = 184

Fruit 12.5 cm x 11.5 cm = 143.75

There were 10 fruit roll-ups in the box. Student found the volume of only one.

Fruit by the feet - 12/box

Box - 17 cm x 12.5 cm x 6.5 cm = 1380.25

wrapper 13.5 cm x 12 5 cm = 168 75

paper - 97 cm x 3 cm = 291

candy 2.2 cm x 99 cm = 213.4

Rolled up = 3 cm x cm = 9

	Fruit roll-up	fruit by the feet
Box	938.875 sq cm	1381.25 sq cm
wrapper	136 sq cm	168.75 sq cm
paper	184 sq cm	291 sq cm
Fruit	143.75 sq cm	213.4 sq cm
servings	5	12

This handwriting is different as the students worked in pairs to collect data.

There were 6 in the box, not 12!

Slight errors in measurements result in significant errors in area amounts.

Practitioner

In this task I was asked to compare Fruit Roll Ups and Fruit by the Foot, both made by Betty Crocker. I was asked to consider which has the greatest number of bites and lasts the longest and the environmental side (how much packing material to packed material). I was also told that the boxes of each cost about the same, so price should not matter. With my findings I was also asked to write a note to the manufacturer about my findings and their products.

States a clear understanding of all elements of the task.

First, I measured the area of the fruit things with a meterstick. I decided to use centimeters because there were small things to measure. Since these roll up things have a depth of about one mm, I found and compared the area instead of the volume. To find the area, I used the formula for area, which is: Length x Width=Area. So the Fruit by the Foot were 6(2.5cmx91.5cm)=1372.5 cm square (I multiplied the dimensions by six because there are six servings in a box). The Roll Ups were 5[2(11.5cmx12cm)]=1380 cm square (I multiplied the dimensions by five because there are five servings in a box, and two because there are two rolls in a serving). The total area of fruit in a Fruit Roll Ups box is 1380 cm sq., and for Fruit by the foot it is 1372.5cm sq., so you only get 7.5 cm square more fruit in the Roll Ups than the Fruit by the Foot.

A set of diagrams of the wrappers might have made this paragraph easier to understand.

Next I measured the packaging materials. The fruit by the foot box was (48cmx12cm)+4(16cmx5cm)+4(6cmx4cm)=992 cm square, and each set of parentheses is the measurements for one section or flap. The Roll Ups box was (36cmx18cm)+4(14.5cmx3.5cm)+2(3cmx2.5cm) =806 cm square, again with each set of parentheses a section or flap. Next I measured the wrappers for each. The Fruit by the Foot wrappers had 6(15cmx12cm)=1080 cm square. The Fruit Roll Ups had 10[2(8cmx17cm)]=1360 cm square. Last I measured the wax paper. The Fruit by the Foot had 6(3cmx91.5cm)=1647 cm square. The Fruit Roll Up had 10[2(15cmx11.5cm)]=1725 cm square. I multiplied all of the paper and wrapper dimensions of the Fruit by the Foot by six servings in a box and the Fruit Roll Ups by packages in a box.

Uses formulas and order of operations symbols to explain process followed, clearly and succinctly.

To represent my data I made a chart of the areas of the various things I measured.

	Fruit Roll Ups Area (sq. cm)	Fruit by the Foot Area (sq. cm)
Fruit	1380	1372.5
Cardboard	806	992
Wrapper	1360	1080
Paper	1725	1647
Total Waste	5271	5091.5
Fruit/Waste	26/100	27/100

This table makes comparison easy, by including units in the column headings; the need to repeatedly list them was eliminated.

I got the ratio of fruit to waist by dividing the fruit by the waist and then rounding the decimal to two digits, and then made that into ratio or fraction form.

Practitioner

Here is what I'd write to the manufacturer:

Dear Betty Crocker company,

I am a seventh grade student in Colchester, Vermont. This is concerning the fact that you manufacture two products that are identical, but packaged and cut differently. They are Fruit by the Foot and Fruit Roll Ups. I have measured the area of the fruit and the waste for each of these products. There is only 7.5 cm sq. more fruit in a box of Fruit Roll Ups than the other, and there is more plastic (280 cm sq. more) and wax paper (78 cm sq. more) for Fruit Roll Ups too. On the other hand the Fruit by the Foot has 186cm sq. more cardboard. Since the cardboard is recyclable and it's source is replaceable it is less damaging environmentally than the plastics that go to landfills and are made from a petroleum based product. I also think it is odd to individually wrap half a serving of Fruit Roll Ups, giving it more waste. If you wrapped one serving in one wrapper there would be less waste, as with the Fruit by the Foot. So, I would say that Fruit by the Foot are the better deal because it has about the same amount of fruit and less waste. So I think that you should either package Fruit Roll Ups more efficiently or just make Fruit by the Foot instead of both.

States the findings clearly and briefly to the manufacturer. Summarizes the findings.

Expert

I have been looking into two of your products (Fruit by the Foot and Fruit Roll-Ups). Now I have tried both a Fruit Roll-up and a Fruit By the Foot . In the fruit Roll-up you get 43 bites per serving. Assuming that a bite was 1" x 1" I calculated the length x width.

Fruit Roll-Up # of bites

1) 5" = width
5/16" = height

2) 5 x 4 5/16 = 21 1/2 = area of one fruit roll-up . Two fruit roll-ups equal one serving.

3) 21 1/2 x 2 = 43 bites per serving

For the fruit by the foot there is 38 bites per serving. The bite is still 1" x 1"

Fruit By the Boot # of Bites

1) 38" = length
1" width

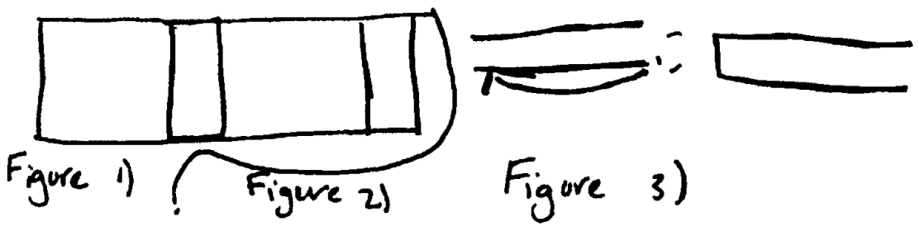
2) 38" x 1" = 38" sq.

3) 38" sq. = 38 bites

Another concept I looked into is the way you package your two products.

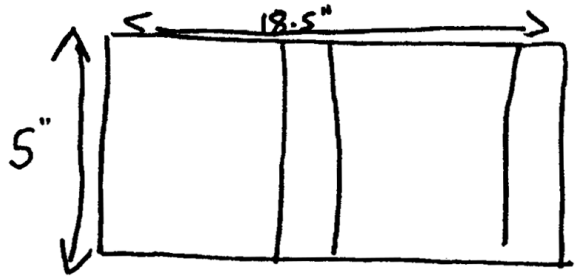
Fruit by the food packaging:

1) In the first step divided the box up in to three parts

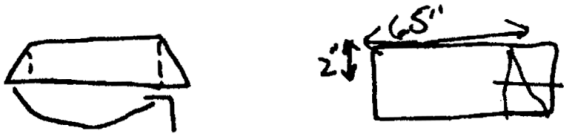


Expert

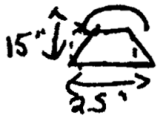
2)18.5" x 5" = 92.5 square inches which is the area for figure one.



3) 2" x 6.5" = 13 square inches for the second figure.

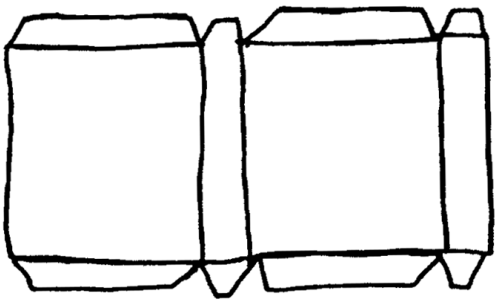


4) 1.5" x 2.5" = 3.75" square inches for figure three



There is a computational error in finding total area of the cardboard box.

5) Add them all up and your area for the whole box which is 109.25 square inches.



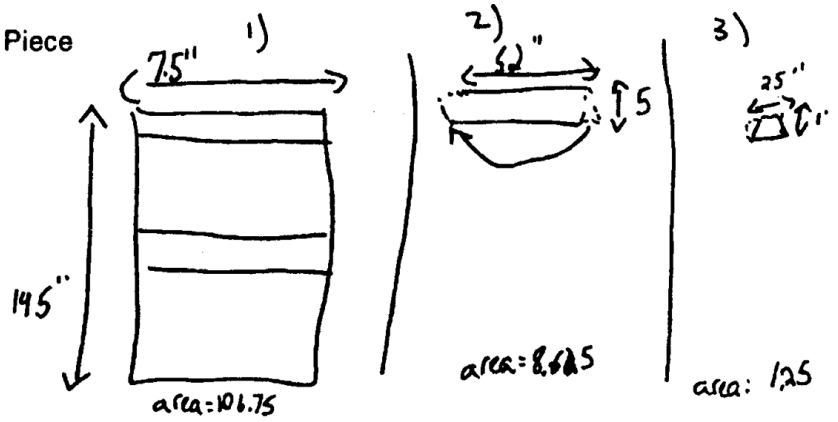
Expert

But then you need the wrapper. the outside of the wrapper is 6" x 5". That is an area of 30" sq. Since there are six wrappers then the total area of wrappers is 180" sq. Then there is a piece of paper that is as big as the Fruit By the Foot itself. Then it must be 38". Since there are six Fruit By the Foot in one box there's 228 sq. inches. So if you add up all of the sq. inches of wrapping. The ratio of food to wrapper for the fruit by the foot is:

228 sq. inches (food)
---------- = .44
517.25 sq. inches (wrapping)

Should be 30 sq. in., not 30″ square and 180 sq. in. or 180 in^2 , not 180″sq.

Fruit roll-up box structure:



Total area of the Box = 118.625

Wrapping: The main wrapper is 7.25" x 3.25". The area of the wrapper is 23.5625" sq. Since there are 10 fruit roll-ups in a box the area is 235.625" sq. Then there is a piece of foil that is as big as the fruit roll-up so it is 6" x 4.5". But I still have to multiply it by 10 so the area is 270" sq. So if you add up all the boxing and other waste you get 624.25 sq. inches. The tactic of food to wrapper is:

270 sq. inches (food)
---------- = .43
629.25 sq. inches (wrapping)

Expert

So with this information there is at least twice as much wrapping in each package. The thing I find most interesting is that the fruit roll-up has more food and more wrapping and yet it had a slightly lower ratio of food to wrapping by .43 to .44. I have a few suggestions to make about your two products. I figured out that since 2 rolls equal one serving size you can just make a fruit roll-up twice as thick. How would this help you? Well you would only need to have 5 fruit roll-up in a box so that you can make a smaller box. Also you would only need to have half as many wrappers. This would cut down on waste. Another thing is that since they are both practically the same you should make one of them with less expensive products and less nutritional value for less money so people with a lower income can buy them. Then you should make one that is made out of higher quality product and that has more nutritional value for people that have a higher income or want a healthier snack.

For an extra task I decided to look into your product, String Think. The fruit itself was 2.25" x 6". That is 13 1/2 bites.

String thing bites:

1) Height = 2.25"
Length = 6"

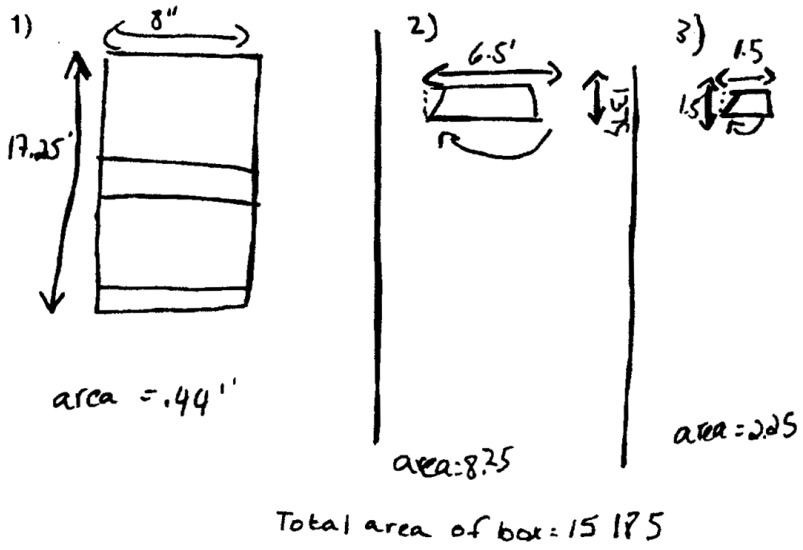
2) 2.25 x 6 = 13.5 bites

Makes good observations about the solution in this paragraph.

There is a computational error in finding the total area of the cardboard box.

String thing waste:

Parts:



Expert

Wrapping: The outside wrapper is 8" x 7". That is 56 square inches. Since there 6 string thing in a box all the area of them all is 336 sq. inches. The inner wrapper that hold it together is 3.5' x 6.25". The area of that is 21.875 sq. inches. So the ratio of food to wrapping is

81 sq inches (food)
622.187) sq inches (all of wrappings added up)

Now that is truly amazing. The other products have almost THREE times as much fruit and they all have about the same amount of waste. That is ane thing you need to work.

To sum it up, the fruit roll-up has more bites but also more trash, and the Fruit by the foot has less bites and less trash. On the other hand String Thing has less bites and MORE trash. I hope you take what I said into concideration.