***Overview: The Life of a Pickle***

***Within this unit we are going to investigate the industry of pickling cucumbers on a commercial scale while focusing on various aspects of volume within different phases of the pickling process.***

***Activity 1: Capacity of Brine Yard Tanks***

When cucumbers are first delivered to a pickle plant they are unloaded in the brine yard before processing. Within the brine yard, cucumbers can be stored within brine tanks when they are not going to be processed for a long period of time. These tanks are filled with cucumbers and a brine solution to undergo fermentation to produce processed pickles like you eat at ball games, restaurants, or within your own home. Within this investigation you are being tasked with the job to determine how much of the tanks will be filled with cucumbers and brine within the tank yard. The actual tank dimensions are provided below. Make sure to show all of your work below each problem.

 10.5 ft wide ***Needed information for conversions 1ft3 = 7.48 gallons and 1 bushel = 5.5 gallons***

 12 ft tall

1.) As a tank yard employee, one of the jobs is to cushion the tanks before putting in the cucumbers in order to decrease the amount of cucumbers being broken while filling the storage tank. So half the tank is filled with a brine liquid solution, so the tank already has 6 ft of brine within it. Approximately how many bushels of cucumbers are needed in order to fill the tank up? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ bushels

2.) If there are 500 tanks in the yard what is the total capacity of all the tanks in gallons? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ gallons

3.) If all 500 tanks were half full of brine and the other half cucumbers, how many gallons of brine and bushels of cucumbers are needed to fill them all? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ gallons of brine \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ bushels of cucumbers

4.) You need to determine the cost of all the materials that you have in brine stock. If your cucumbers cost approximately $13 per bushel and the brine cost $2.50 per gallon, how much does one tank of pickles cost? \_\_\_\_\_\_\_\_\_

5.) What would the total product cost of all 500 tanks be? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

6.) Why do you feel that performing these jobs well within the tank yard are important for to the business? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_***Overview: The Life of a Pickle***

***Within this unit we are going to investigate the industry of pickling cucumbers on a commercial scale while focusing on various aspects of volume within different phases of the pickling process.***

***Activity 1: Capacity of Brine Yard Tanks - Answer Key***

When cucumbers are first delivered to a pickle plant they are unloaded in the brine yard before processing. Within the brine yard, cucumbers can be stored within brine tanks when they are not going to be processed for a long period of time. These tanks are filled with cucumbers and a brine solution to undergo fermentation to produce processed pickles like you eat at ball games, restaurants, or within your own home. Within this investigation you are being tasked with the job to determine how much of the tanks will be filled with cucumbers and brine within the tank yard. The actual tank dimensions are provided below. Make sure to show all of your work below each problem.

 10.5 ft wide ***Needed information for conversions 1ft3 = 7.48 gallons and 1 bushel = 5.5 gallons***

 12 ft tall

1.) As a tank yard employee, one of the jobs is to cushion the tanks before putting in the cucumbers in order to decrease the amount of cucumbers being broken while filling the storage tank. So half the tank is filled with a brine liquid solution, so the tank already has 6 ft of brine within it. Approximately how many bushels of cucumbers are needed in order to fill the tank up? \_\_\_\_\_\_706\_\_\_\_\_\_\_\_\_ bushels

V=3.14(5.25)2(6) = 519.2775 ft3, then convert to gallons 519.2775(7.48) = 3884.1957 gal, then convert to bushels by 3884.1957 / 5.5 = 706.2174 bushels

2.) If there are 500 tanks in the yard what is the total capacity of all the tanks in gallons? \_\_3,884, 196\_\_\_\_\_ gallons

V=3.14(5.25)2(12) = 1038.555 ft3 (7.48) = 7768.3914 gal(500 tanks) = 3,884,196 gallons

3.) If all 500 tanks were half full of brine and the other half cucumbers, how many gallons of brine and bushels of cucumbers are needed to fill them all? \_\_1,942,098\_\_\_ gallons of brine \_\_\_\_353,000\_\_\_\_ bushels of cucumbers

3884.1957 gal in one tank so 3884.1957(500) = 1942098 gal of brine OR 3884196/2 because it is half the tank = 1942098, then 706 bushels in one tank so 706(500) = 353000 OR 1942098/5.5 = 353109 bushels

4.) You need to determine the cost of all the materials that you have in brine stock. If your cucumbers cost approximately $13 per bushel and the brine cost $2.50 per gallon, how much does one tank of pickles cost? $18,888.49

706(13) = $9178 for cucumbers + 3884.1957(2.50) = $9710.49 for brine = $18,888.49

5.) What would the total product cost of all 500 tanks be? \_\_\_\_$9,444,245\_\_\_\_\_\_\_\_\_\_\_

$18,888.49(500) = $9444245

6.) Why do you feel that performing these jobs well within the tank yard are important for the business? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

***Activity 2: How many pickles are in the jar?***

Have you ever really thought about packaging on food products such as pickles? How do they determine serving sizes or quantities of pickles per container? Do the companies count the number of pickles in every jar that they produce? How do they determine how much liquid brine solution to put in the jar? Is all of this done by hand or do machines do all of the work? These are some of the questions that I want you think about while completing this activity.

Within an actual pickle plant there are many different roles to be played in order to put the pickles into the jars. There are people who have to sort the pickles looking for damaged cucumbers and size variations, workers who load the jars, caps, labels, and boxes onto the line, people who produce the brine solution, quality control inspectors that make sure there are the right amount of pickles within the jars and that they are safe to eat to simply name a few. All of the various people have to work together in order to not hold up production.

To investigate the production of jarred pickles, you will be investigating the capacity of 2 different pickle jars, as well as their contents within this activity. Please follow these directions for each jar. First I would like for you to estimate the number of pickles within the jar without actually opening the jar and counting them.

***Sample 1:*** ***Part 1*** Company and Product Name: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Jar Size: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ fl oz Pickle Count Estimate: \_\_\_\_\_\_\_\_\_\_ (do not open the jar)

Pickle Count Estimate: \_\_\_\_\_\_\_\_\_\_ (without opening the jar) Explain how you came up with this estimate as well as any methods or strategies that you used and be prepared to share with the class. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

How could we determine the number of pickles that would fit into the jar without actually counting them? Is there any information that we would need to know? Any tools to be used? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Open up the jar to remove only 1 pickle and record the following information and label these on the pictures provided.

Jar Volume Formulas: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Pickle Volume Formulas: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Jar Measurements (cm): \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Pickle Measurements (cm): \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Work Space: Work Space:

 

Use your measurements and formulas in order to determine how many pickles would fit into the jar based on the information you provided above. Make sure to clearly indicate your work above including your calculations.

How many pickles did you calculate should fit within the jar? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ (Hint: Jar Volume / Pickle Volume)

How close were you to the estimate that you made? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Count all of the pickles within each jar. How many pickles are actually in the jar? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

If it was a different amount why do you think it was different? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

***Sample 1:*** ***Part 2 -*** After removing all of the pickles, you need to determine the amount of brine within the jar. What is the best way to determine this mathematically without using a graduated cylinder?

Draw in the brine within the diagram and indicate the measurements needed to calculate the amount of brine solution within the jar. \_\_\_\_\_\_\_\_\_\_\_\_cm

What percentage of the jar was with filled with brine \_\_\_\_\_\_\_\_% and pickles \_\_\_\_\_\_\_\_\_%? (Use the brine volume/total volume to find the brine %, then subtract for pickle %.)

How does this affect the answers that you found in regards to the amount of pickles within the jar above? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

***Sample 2:*** ***Part 1*** Company and Product Name: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Jar Size: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ fl oz Pickle Count Estimate: \_\_\_\_\_\_\_\_\_\_ (do not open the jar)

Open up the jar to remove only 1 pickle and record the following information and label these on the pictures provided.

Jar Volume Formulas: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Pickle Volume Formulas: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Jar Measurements (cm): \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Pickle Measurements (cm): \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Work Space: Work Space:

 

Use your measurements and formulas in order to determine how many pickles would fit into the jar based on the information you provided above. Make sure to clearly indicate your work above including your calculations.

How many pickles did you calculate should fit within the jar? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ (Hint: Jar Volume / Pickle Volume)

How close were you to the estimate that you made? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Count all of the pickles within each jar. How many pickles are actually in the jar? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

If it was a different amount why do you think it was different? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

***Sample 2:*** ***Part 2 -*** After removing all of the pickles, you need to determine the amount of brine within the jar. What is the best way to determine this mathematically without using a graduated cylinder?

Draw in the brine within the diagram and indicate the measurements needed to calculate the amount of brine solution within the jar. \_\_\_\_\_\_\_\_\_\_\_\_cm

What percentage of the jar was with filled with brine \_\_\_\_\_\_\_\_% and pickles \_\_\_\_\_\_\_\_\_%? (Use the brine volume/total volume to find the brine %, then subtract for pickle %.)

How does this affect the answers that you found in regards to the amount of pickles within the jar above? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

***Part 3*** – Now I want you to think about other ways in which pickles are packaged other than the whole form. What are various types of pickles that you can buy in the grocery store? List all of the ones you can think of. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_***\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_***

How do you think that the pickle and brine percentages would be different in a spear jar? Why do you think so? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

How do you think that the pickle and brine percentages would be different in a stacker jar? Why do you think so? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

How do you think that the pickle and brine percentages would be different in a chips jar? Why do you think so? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Do you think that the actual volume of these other forms of pickles would be closer or further away from the mathematical volume if calculated then the whole pickles volumes were? Why?

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

The people who perform these types of calculations within the pickle business are called food scientists. Why do you think that it is important for these calculations to be performed?\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

***Activity 2: How many pickles are in the jar?*** *– Answer Key*

*(All answers are going to vary based on the sample jar and pickle sizes within the jars. I would have at least 3 different size jars as your samples. I used the metric system (cm) for this activity because it was easier for my students to compute within the formulas and it made their results more accurate.)*

Have you ever really thought about packaging on food products such as pickles? How do they determine serving sizes or quantities of pickles per container? Do the companies count the number of pickles in every jar that they produce? How do they determine how much liquid brine solution to put in the jar? Is all of this done by hand or do machines do all of the work? These are some of the questions that I want you think about while completing this activity.

Within an actual pickle plant there are many different roles to be played in order to put the pickles into the jars. There are people who have to sort the pickles looking for damaged cucumbers and size variations, workers who load the jars, caps, labels, and boxes onto the line, people who produce the brine solution, quality control inspectors that make sure there are the right amount of pickles within the jars and that they are safe to eat to simply name a few. All of the various people have to work together in order to not hold up production.

To investigate the production of jarred pickles, you will be investigating the capacity of 2 different pickle jars, as well as their contents within this activity. (The gallon jar must be one of the three jars sampled.) Please follow these directions for each jar. First I would like for you to estimate the number of pickles within the jar without actually opening the jar and counting them.

***Sample 1:*** ***Part 1*** Company and Product Name: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Jar Size: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ fl oz Pickle Count Estimate: \_\_\_\_\_\_\_\_\_\_ (do not open the jar)

Pickle Count Estimate: \_\_\_\_\_\_\_\_\_\_ (without opening the jar) Explain how you came up with this estimate as well as any methods or strategies that you used and be prepared to share with the class. The students could try counting the pickles within the jar, look at the number they see at the base of the jar and try multiplying, or look at the serving size on the label.

How could we determine the number of pickles that would fit into the jar without actually counting them? Is there any information that we would need to know? Any tools to be used? Students would probably suggest opening the jar and counting the number of pickles and possibly finding out how much space they take up by using a ruler to make measurements. Lead into the concepts of capacity and volume and how to take the measurements of diameter, radius, and height as well as the actual shape of the pickles to produce the correct formulas needed to find volume. I would suggest that the ends of the pickles would produce two hemi-spheres that could be combined to produce a sphere and the remainder of the pickle would be cylindrical.

Open up the jar to remove only 1 pickle and record the following information and label these on the pictures provided.

Jar Volume Formulas: \_\_\_\_\_\_ V= (3.14)r2h \_\_\_\_\_ Pickle Volume Formulas: V= 4/3(3.14)r3 +V= (3.14)r2h

Jar Measurements (cm): \_\_height, diameter\_\_\_ Pickle Measurements (cm): \_\_ height, diameter \_\_\_

Work Space: Example - Jar h=6.5cm, d=4.5cm Work Space: Example - Cylinder h=4cm, d=1.5cm, Actual length I found first then subtract the diameter to find cylinder height so 6.5-1.5 = 4cm

 

V= (3.14)2.252(6.5) =103.3cm3 Combine Cylinder and Sphere Volumes V= 4/3(3.14)0.753 =1.8cm3 and V= (3.14)0.752(4) =7.1cm3 – Combine for Total Pickle Volume 1.8 + 7.1 = 8.4cm3

Divide jar volume by pickle volume = 103.3/8.4 = 12.3 pickles in the jar

Use your measurements and formulas in order to determine how many pickles would fit into the jar based on the information you provided above. Make sure to clearly indicate your work above including your calculations.

How many pickles did you calculate should fit within the jar? \_12.3 pickles in the jar \_ (Hint: Jar Volume/Pickle Volume)

How close were you to the estimate that you made? \_\_\_\_will vary\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Count all of the pickles within each jar. How many pickles are actually in the jar? \_\_\_\_\_ will vary \_\_\_\_\_\_\_\_\_\_\_

If it was a different amount why do you think it was different? They could discuss that they didn’t take the empty space into account or that all of the pickles really were not the exact same size.

***Sample 1:*** ***Part 2 -*** After removing all of the pickles, you need to determine the amount of brine within the jar. What is the best way to determine this mathematically without using a graduated cylinder? Volume V= (3.14)r2h

Draw in the brine within the diagram and indicate the measurements needed to calculate the amount of brine solution within the jar. \_\_\_\_\_\_\_\_\_\_\_\_cm

V= (3.14)r2h

What percentage of the jar was with filled with brine \_\_\_\_\_\_\_\_% and pickles \_\_\_\_\_\_\_\_\_%? (Use the brine volume/total volume to find the brine %, then subtract for pickle %.)

How does this affect the answers that you found in regards to the amount of pickles within the jar above? The brine is occupying some of the space within the jar, therefore decreasing the space left for the pickles to occupy.

***Sample 2:*** ***Part 1*** Company and Product Name: \_\_\_\_\_Similar responses as sample 1 with different dimensions\_\_\_

Jar Size: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ fl oz Pickle Count Estimate: \_\_\_\_\_\_\_\_\_\_ (do not open the jar)

Open up the jar to remove only 1 pickle and record the following information and label these on the pictures provided.

Jar Volume Formulas: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Pickle Volume Formulas: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Jar Measurements (cm): \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Pickle Measurements (cm): \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Work Space: Work Space:

 

Use your measurements and formulas in order to determine how many pickles would fit into the jar based on the information you provided above. Make sure to clearly indicate your work above including your calculations.

How many pickles did you calculate should fit within the jar? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ (Hint: Jar Volume / Pickle Volume)

How close were you to the estimate that you made? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Count all of the pickles within each jar. How many pickles are actually in the jar? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

If it was a different amount why do you think it was different? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

***Sample 2:*** ***Part 2 -*** After removing all of the pickles, you need to determine the amount of brine within the jar. What is the best way to determine this mathematically without using a graduated cylinder?

Draw in the brine within the diagram and indicate the measurements needed to calculate the amount of brine solution within the jar. \_\_\_\_\_\_\_\_\_\_\_\_cm

What percentage of the jar was with filled with brine \_\_\_\_\_\_\_\_% and pickles \_\_\_\_\_\_\_\_\_%? (Use the brine volume/total volume to find the brine %, then subtract for pickle %.)

How does this affect the answers that you found in regards to the amount of pickles within the jar above? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

***Part 3*** – Now I want you to think about other ways in which pickles are packaged other than the whole form. What are various types of pickles that you can buy in the grocery store? List all of the ones you can think of. Some possibilities include but are not limited to: spears, sandwich stackers, chips, relish

How do you think that the pickle and brine percentages would be different in a spear jar? Why do you think so? I would probably have a jar for the students to view. They should determine that the spears are packaged very tightly so the brine solution percentage should be lower because there is less empty space for it to occupy.

How do you think that the pickle and brine percentages would be different in a stacker jar? Why do you think so? I would probably have a jar for the students to view. They should determine that the stackers are not packaged as tightly as the spears so the brine solution percentage should be higher for them but lower than the whole pickles because there is less empty space for it to occupy.

How do you think that the pickle and brine percentages would be different in a chips jar? Why do you think so? I would probably have a jar for the students to view. They should determine that the chips are not packaged as tightly as the spears so the brine solution percentage should be higher for them probably about the same as the stackers but lower than the whole pickles because there is less empty space for it to occupy.

Do you think that the actual volume of these other forms of pickles would be closer or further away from the mathematical volume if calculated then the whole pickles volumes were? Why?

Answers will vary but they should take into account that there is less empty space for the brine to occupy in these other type jars of pickles, thus they should be able to get closer to the actual capacity of the jar.

The people who perform these types of calculations within the pickle business are called food scientists. Why do you think that it is important for these calculations to be performed? They need to be able to project how much brine and pickles would be needed to produce a certain amount of jars to save the company money on products that are wasted.

***Activity 3: Case Up –*** After producing the individual jars of pickles you would then need to package the product for shipping. You have been tasked with the job of determining an efficient way to package your pickle jars in the least expensive manner possible. Choose one of your sample jars to determine the dimensions needed to pack your jars in cases of 6 or 12 packs. Make sure to draw a picture of your rectangular boxes showing how you will arrange the jars for each sample and you cannot stack the jars.

(Example shown below for jars that are 10cm tall and have a diameter 5cm wide) length = 30cm

***Sample # :*** height=10cm

Company and Product Name: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ 5cm

Jar Size: \_\_\_\_\_\_\_\_ fl oz h=\_\_\_\_\_\_ d=\_\_\_\_\_\_ Create all possible boxes below. = width

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| 1. | 2. | 3. | 4. | 5. |

Which one of the boxes do you feel would be the best to use and why? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Check the volume of the jars and the volume of the boxes to make sure that all the jars will fit within the box. If they will not then determine your mistake in order to make them fit. Also determine the surface area of the box then find the cost of each box if the cardboard used to create the boxes cost $0.0006 per square inch. Show all of your work below.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Box Design  | Volume of All Jars (cm3) V=πr2h (number of jars) | Volume of Box (cm3) V = lwh | Surface Area of Box (cm2) SA = 2lw+2wh+2lh | Cardboard cost per box  |
| 1 |  |  |  |  |
| 2 |  |  |  |  |
| 3 |  |  |  |  |
| 4 |  |  |  |  |
| 5 |  |  |  |  |

Now that your jars of pickles are cased up, do you still feel like the box that you chose in the previous question is the best option? Why? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

If Pickles Plus Company placed an order for 381,000 jars of pickles, how many cases would you need of each box design that you created? Also, find the total cost of the boxes.

|  |  |  |  |
| --- | --- | --- | --- |
| Box Design  | Cardboard cost per box | Number of cases needed | Total Cost of Order |
| 1 |  |  |  |
| 2 |  |  |  |
| 3 |  |  |  |
| 4 |  |  |  |
| 5 |  |  |  |

Based on these results, do you still feel like the box that you chose for casing up the jars in the previous question is the best option for the company based on the cardboard cost? Why? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Based on the 381,000 jar order above, choose the cheapest case option then determine the final cost of the product using the following information per case.

Cucumbers/Brine $5.18, Jar/Lid $2.55, Labor/Overhead Costs/Warehouse $2.95, Box(your choice)\_\_\_\_\_\_\_\_\_\_

How much would it cost for you to produce this 381,000 jar order for a customer? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Show your work below.

Why would this information be important within a business? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

***Activity 3: Case Up – Answer Key (This is only a sample solution all answers will vary based on jar sizes. – If you have a lower group of students only do 12 pack cases.)*** After producing the individual jars of pickles you would then need to package the product for shipping. You have been tasked with the job of determining an efficient way to package your pickle jars in the least expensive manner possible. Choose one of your sample jars to determine the dimensions needed to pack your jars in cases of 6 or 12 packs. Make sure to draw a picture of your rectangular boxes showing how you will arrange the jars for each sample and you cannot stack the jars.

(Example shown below for jars that are 10cm tall and have a diameter 5cm wide) length = 30cm

***Sample # :*** height=10cm

Company and Product Name: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ 5cm

Jar Size: \_\_\_\_\_\_\_\_ fl oz h=\_\_\_\_\_\_ d=\_\_\_\_\_\_ Create all possible boxes below. = width

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| 1. Sample ResponseJar h=9.5cm, d=6cm6-pack Dimensions:L=36cm, W=6cm, H=9.5cm | 2. Sample ResponseJar h=9.5cm, d=6cm6-pack Dimensions:L=18cm, W=12cm, H=9.5cm | 3. Sample ResponseJar h=9.5cm, d=6cm12-pack Dimensions:L=72cm, W=6cm, H=9.5cm | 4. Sample ResponseJar h=9.5cm, d=6cm12-pack Dimensions:L=36cm, W=12cm H=9.5cm | 5. Sample ResponseJar h=9.5cm, d=6cm12-pack Dimensions:L=24cm, W=18cm H=9.5cm |

Which one of the boxes do you feel would be the best to use and why? Answers will vary.

Check the volume of the jars and the volume of the boxes to make sure that all the jars will fit within the box. If they will not then determine your mistake in order to make them fit. Also determine the surface area of the box then find the cost of each box if the cardboard used to create the boxes cost $0.0006 per square inch. Show all of your work below.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Box Design  | Volume of All Jars (cm3) V=πr2h (number of jars) | Volume of Box (cm3) V = lwh | Surface Area of Box (cm2) SA = 2lw+2wh+2lh | Cardboard cost per box  |
| 1 | V = 3.14(3)2 9.5 = 268.5(6 jars) = 1611cm3 | V = 36(6)(9.5) = 2052cm3 | SA = 2(36)(6)+2(6)(9.5)+ 2(36)(9.5) = 1230cm2 | 1230cm2(0.0006) = $0.74 |
| 2 | V = 3.14(3)2 9.5 = 268.5(6 jars) = 1611cm3 | V = 18(12)(9.5)= 2052cm3 | SA = 2(18)(12)+2(12)(9.5)+ 2(18)(9.5) = 1002cm2 | 1002cm2(0.0006) = $0.60 |
| 3 | V = 3.14(3)2 9.5 = 268.5(12 jars)=3222cm3 | V = 72(6)(9.5) = 4104cm3 | SA = 2(72)(6)+2(6)(9.5) +2(72)(9.5)=2346cm2 | 2346cm2(0.0006) = $1.41 |
| 4 | V = 3.14(3)2 9.5 = 268.5(12 jars)=3222cm3 | V = 36(12)(9.5)= 4104cm3 | SA = 2(36)(12)+2(12)(9.5) +2(36)(9.5)=1776cm2 | 1776cm2(0.0006) = $1.07 |
| 5 | V = 3.14(3)2 9.5 = 268.5(12 jars)=3222cm3 | V = 24(18)(9.5) = 4104cm3 | SA = 2(24)(18)+2(18)(9.5) +2(24)(9.5)=1662cm2 | 1662cm2(0.0006) = $1.00 |

Now that your jars of pickles are cased up, do you still feel like the box that you chose in the previous question is the best option? Why? \_\_\_\_They should be able to recognize at this point that options 2 and 5 are the best because they are the cheapest based on the number of jars within the box.\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

If Pickles Plus Company placed an order for 381,000 jars of pickles, how many cases would you need of each box design that you created? Also, find the total cost of the boxes.

|  |  |  |  |
| --- | --- | --- | --- |
| Box Design  | Cardboard cost per box | Number of cases needed | Total Cost of Order |
| 1 | 1230cm2(0.0006) = $0.74 | 381,000/6 jars per case = 63,500 | 63,500(0.74) = $46,990 |
| 2 | 1002cm2(0.0006) = $0.60 | 381,000/6 jars per case = 63,500 | 63,500(0.60) = $38,100 |
| 3 | 2346cm2(0.0006) = $1.41 | 381,000/12 jars per case = 31,750 | 31,750(1.41) = $44,767.50 |
| 4 | 1776cm2(0.0006) = $1.07 | 381,000/12 jars per case = 31,750 | 31,750(1.07) = $39,972.50 |
| 5 | 1662cm2(0.0006) = $1.00 | 381,000/12 jars per case = 31,750 | 31,750(1.00) = $31,750 |

Based on these results, do you still feel like the box that you chose for casing up the jars in the previous question is the best option for the company based on the cardboard cost? Why? \_\_\_\_\_\_The 5th design is the most cost efficient because it is the cheapest overall. – You may want to discuss is because this design has the smallest surface area because it is closer to a perfect cube which is the reason it is the cheapest.\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Based on the 381,000 jar order above, choose the cheapest case option then determine the final cost of the product using the following information per case.

Cucumbers/Brine $5.18, Jar/Lid $2.55, Labor/Overhead Costs/Warehouse $2.95, Box(your choice)\_\_\_\_5\_\_\_\_\_\_

How much would it cost for you to produce this 381,000 jar order for a customer? \_\_$370,840\_\_\_\_\_\_\_ Show your work below.

Cucumbers/Brine $5.18 + Jar/Lid $2.55 + Labor/Overhead Costs/Warehouse $2.95 + Box $1.00= $11.68 per case

$11.68 per case (31,750 cases) = $370,840

Why would this information be important within a business? It would be important because of the amount of money that you could save by choosing the correct materials needed to be the most cost effective to maximize profit.