S²TEM Centers SC

Solutions in Science, Technology, Engineering & Mathematics Education

Trainer's Guide

What is Disciplinary Literacy?

S²TEM Centers SC

www.s2temsc.org

Session One:

What is Disciplinary Literacy?

Agenda:

- What is Disciplinary Literacy?
- Why is Disciplinary Literacy Important?
- Disciplinary Literacy Enhanced STEM Instruction in Action

Learning Outcomes:

- Develop a shared vision of high quality STEM instruction enhanced by Disciplinary Literacy.

- Recognize purposeful reading, meaningful writing, and productive dialogue as elements of disciplinary literacy instruction.

- Understand data that supports the need for disciplinary literacy enhanced STEM instruction.

Trainer's Agenda (3 hours)

(5 minutes) Welcome, Introductions, Logistics

(20 minutes) Activator—What is Disciplinary Literacy?

(15 minutes) Mini-Lecture—Why Disciplinary Literacy?

(10 minutes) Brainstorming—Vision for High Quality STEM Instruction Enhanced by Disciplinary Literacy

(15 minutes) Triple Track—Strategy Check-in and Analysis

(80 minutes) Immersion—DL-enhanced STEM Lesson

(10 minutes) Table Talk—Disciplinary Literacy

(10 minutes) Reflect and Refine—Vision for High Quality STEM Instruction Enhanced by Disciplinary Literacy

(10 minutes) Triple Track—Strategy Check-in and Analysis

(5 minutes) Reflection and Wrap-Up

Materials Needed:

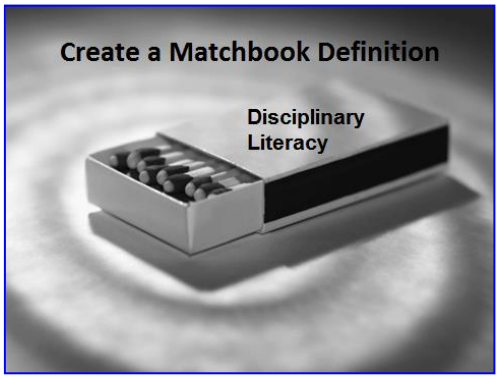
- Chart paper (at least 2 pieces per small group plus 15 pieces for whole group activities)
- Markers (at least 2 per small group)
- Bounce Cards (one per participant)
- Linking Cubes (8 per pair of participants
- Empty Juice Boxes
- Post-It Notes (10-15 per participant)
- Music: "All You Can Eat" by the Fat Boys or some other food related song
- Index Cards (one per participant)
- Sign-in sheet

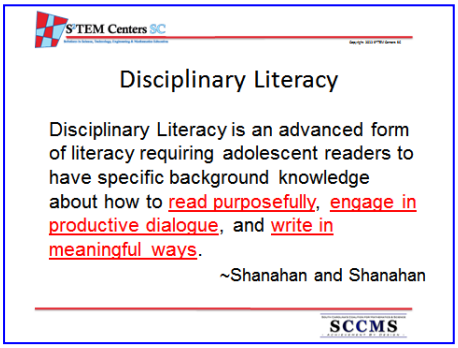
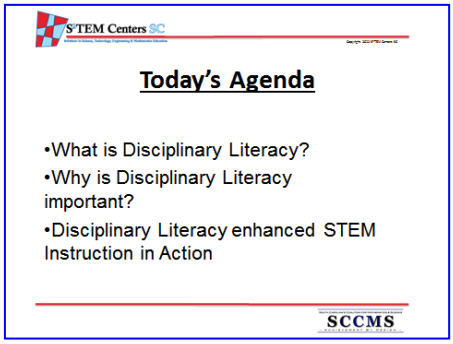
Handouts for Each Participant:

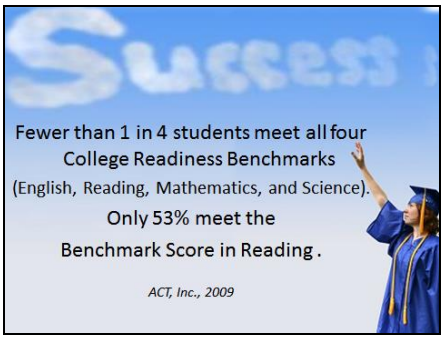
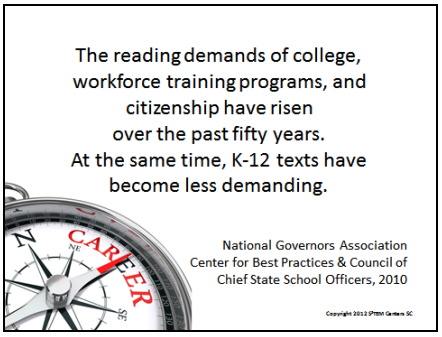
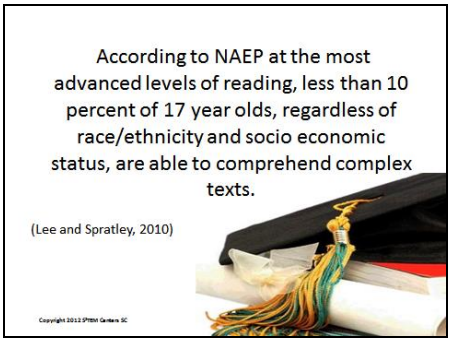
1. Disciplinary Literacy Quotes
2. Agenda (optional)
3. Copies of Triple Track Graphic Organizer
4. KWL: We Think, We Question, We Learned
5. Volume and Surface Area of a Juice Box
6. Article: Chewing and Digestion
7. Scenario: Virtual Medical Care

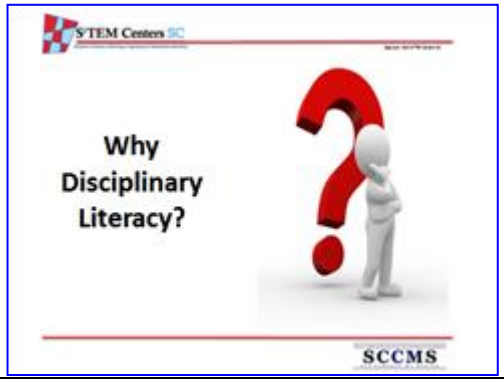
Session One:

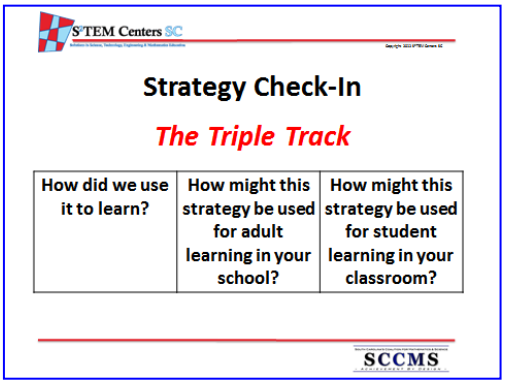
What is Disciplinary Literacy?

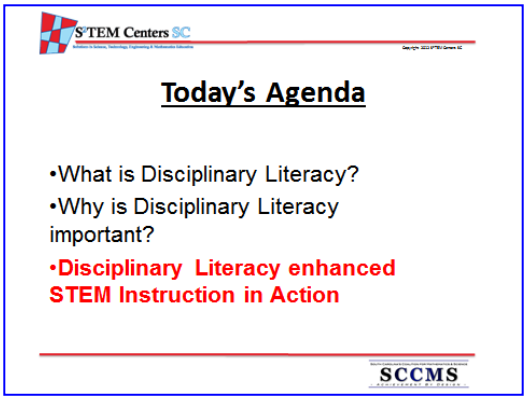
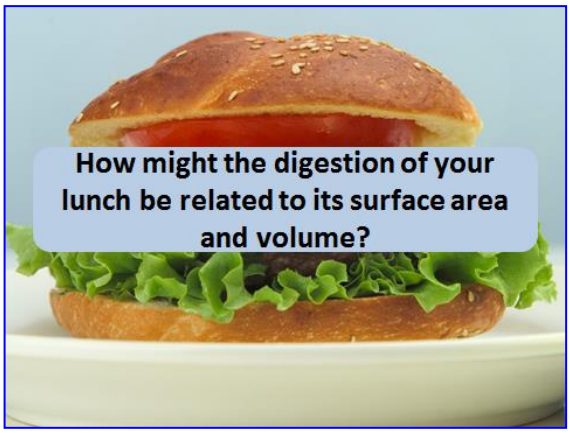
Time (minutes)	Activity (What, Why, How)	Slide
5	What: Welcome and Introductions Why: To introduce and recognize all stakeholders involved in the IQ-MS Research Project. To share important logistics information regarding the IQ-MS Summer Institute How: (1) Welcome Participants (2) Introduce Presenters (3) Share Logistics Information a. Restrooms b. Cell Phones c. Parking Lot	
20	What: Matchbook Definition Why: To introduce the language of disciplinary literacy through quotes by experts in the field and activate participate thinking about disciplinary literacy How: (1) (Highlighting) Individually, participants read the list of quotes about disciplinary literacy. As they read, they should underline or highlight words and phrases that might help them answer the question "What is disciplinary literacy?" (2) (Table Talk) Participants share with their table group the one phrase that resonated most with them in the quotes provided. (3) (Matchbook Definition) Table groups create a Matchbook Definition for Disciplinary Literacy, using their selected words and phrases as starting points. A Matchbook Definition is a concise definition of a concept, one that might fit on a matchbook.	 

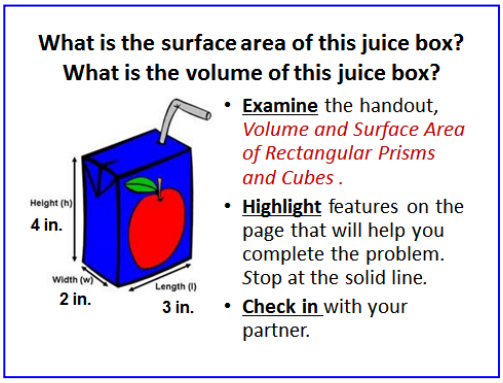
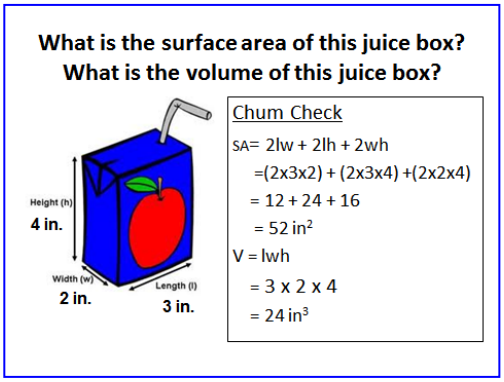
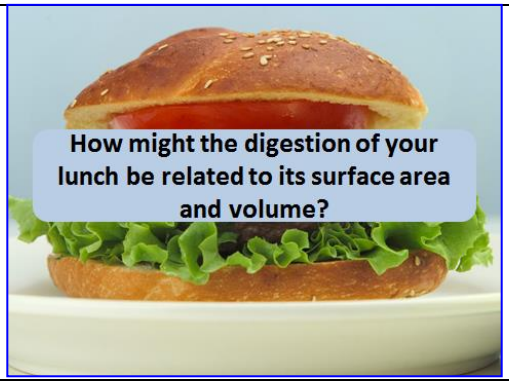
Time (minutes)	Activity (What, Why, How)	Slide
	(4) Each table group shares their Matchbook Definition with the whole group. (5) Presenter shares the definition of Disciplinary Literacy from Shanahan and Shanahan that describes the three elements: purposeful reading, productive dialogue, and meaningful writing.	
5	What: Agenda and Outcomes for the Day Why: To provide a roadmap of the day's learning for participants and identify the learning outcomes. How: Share the agenda and outcomes for the day, making connections between items.	

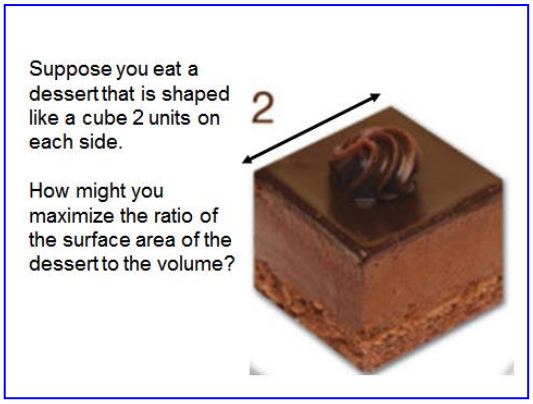
Time (minutes)	Activity (What, Why, How)	Slide
15	<u>What:</u> Mini-Lecture on Data <u>Why:</u> To establish a need for disciplinary literacy instruction in STEM classrooms <u>How:</u> (1) Briefly share data on literacy from provided sources in mini-lecture format. Source information for this data is included in the PowerPoint notes pages for each slide. • Fewer than 1 in 4 students meet all four College Readiness benchmarks. Only 53% meet the benchmark score in reading. • The reading demands of college, workforce training programs, and citizenship have risen over the past fifty yearas. At the same time, K-12 texts have become less demanding. • According to NAEP at the most advanced levels of reading, less than 10 percent of 17 year olds, regardless of race/ethnicity and SES, are able to comprehend complex texts. • Performance of the nation's 12th graders in reading has declined in comparison to 1992. 60% of 12th graders read at basic or below basic. 42% of college students take remedial classes. • Students who experience reading difficulties in the early grades often suffer what has been called the "Matthew Effect", a gap between good and poor readers that widens through the grades.	   

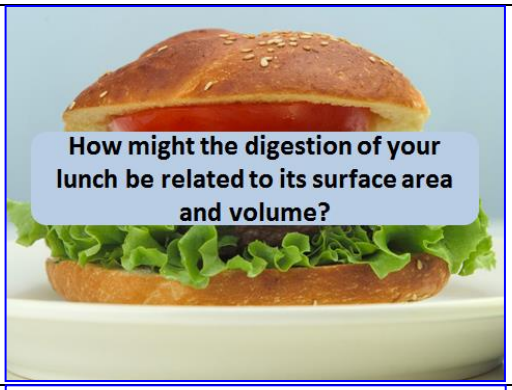
Time (minutes)	Activity (What, Why, How)	Slide
	(2) (Partner Talk) Participants discuss with their partner how the data shared compares to what they knew before.	
10	<u>What:</u> Shared Vision for High Quality STEM Instruction Enhanced by Disciplinary Literacy <u>Why:</u> To establish a shared understanding as school or table groups of baseline expectations for STEM Instruction Enhanced by Disciplinary Literacy <u>How:</u> 1) (Two-Minute Paper) Individually, participants brainstorm what they might see if they looked through the window of a classroom where high quality STEM instruction enhanced by disciplinary literacy was taking place. Provide two minutes of uninterrupted brainstorm/writing time. 2) (Table Talk) Participants share their brainstormed ideas with others at their table. 3) (Focused Listing) Table groups create a consensus list of the top ten (or less) things they would expect to see through the window of a classroom where high quality STEM instruction enhanced by disciplinary literacy was taking place. Groups record their lists on chart paper and post in the room.	

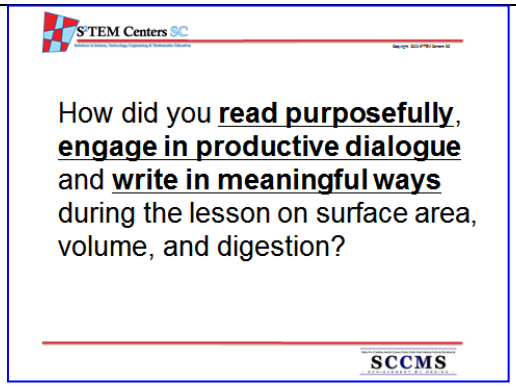
Time (minutes)	Activity (What, Why, How)	Slide
15	What: Triple-track Strategy Check-In Why: To emphasize the disciplinary literacy strategies used in the session and how they might be adapted for adult learning and student learning How: 1) As strategies are used during the session, record them on chart paper on the side of the room. 2) During the strategy check-in, review each strategy and discuss how it was used in the session. 3) (Table Talk) Table groups discuss how they might use the strategy for other types of adult learning in their schools, and how they might use it in the classroom for student learning. Participants record ideas on the Triple-Track graphic organizer.	

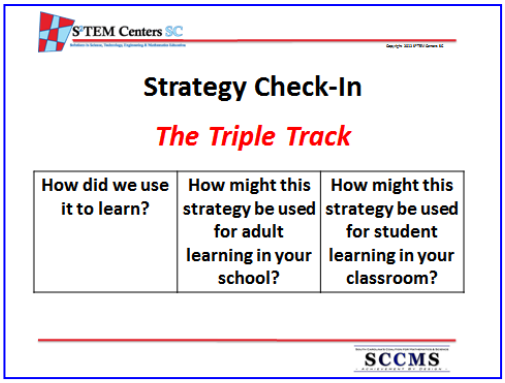
Time (minutes)	Activity (What, Why, How)	Slide
	What: Revisit Agenda Why: To remind participants of the storyline of the day and where they are now in their learning How: Review agenda and share the next step in the learning—experiencing a disciplinary literacy enhanced lesson as a learner.	
10	What: Brainstorm KWL Chart and Knowledge Tour Why: To activate prior knowledge about digestion, surface area, and volume How: 1) (Think-Ink) Individually, participants think about the question: "How might the digestion of your lunch be related to its surface area and volume?" and record their thoughts in writing on post-it notes. One thought per post-it note. (Note: The "ink" part of this strategy requires students to commit to their thoughts before sharing with others.) 2) (Round Robin) Participants share thoughts with their table group and post them on the group chart under "We Think" or "We Question". 3) (Knowledge Tour) Participants walk around the room to visit other charts and read what they have posted under the "We Think" and "We Question" columns. A food related song may be played during the tour, such as "All You Can Eat" by the Fat Boys.	

Time (minutes)	Activity (What, Why, How)	Slide
4	What: Examine Text Features Why: To prepare to learn from a mathematics text How: 1) Suppose we wanted to find the surface area and volume of this juice box. How might this text help us do that? 2) Participants examine the handout "Volume and Surface Area of Rectangular Prisms and Cubes" to identify text features on the handout that might help them solve math problems about surface area and volume. 3) (Chum Check) Participants check in with their partner as a peer coach to identify any features they might have missed.	
4	What: Practice with surface area and volume Why: To review understanding of surface area and volume prior to using it in a more complex problem How: 1) Participants use the directions in the text to compute the surface area and volume of the juice box provided. 2) (Chum Check) Participants check in with their partner as a peer coach to compare their answers and check for mistakes.	
2	What: Revisit our focus question for the lesson Why: To remind students what we hope to investigate today, after the detour to review surface area and volume calculations How: Restate the focus question.	

Time (minutes)	Activity (What, Why, How)	Slide
15	What: Explore the relationship between digestion, surface area, and volume Why: To allow participants to consider what happens to the size of your food when you eat How: 1) Provide groups with "desserts" made of four one inch linking cubes. 2) Suppose you eat a dessert that is originally shaped like this cube, 2 units on each side. How might you maximize the ratio of surface area of the dessert to the volume. 3) In pairs, participants will explore different ways to change the shape of the dessert to change the ratio of the surface area to the volume and record their results to share with their table group. 4) (Popcorn Share) Participants share thoughts on how to maximize the ratio of the surface area to the volume. 5) Key Learning: Why might this be important for digestion? (The greater the surface area, the more exposure to digestive acids.)	

Time (minutes)	Activity (What, Why, How)	Slide
20	What: Read and process article on Chewing and Digestion Why: To provide content support for the assumptions made during the exploration about the dessert How: 1) Participants will read one paragraph at a time from the text on chewing and digestion. 2) (GIST Statement) For each paragraph, participants will write a GIST statement as a summary.	
10	What: Identify New Learning from the Lesson Why: To summarize the learning about digestion How: Table groups revisit the charts made at the beginning of the lesson with "We Think" and "We Question" and add ideas under the third column "We Learned".	
15	What: Virtual Physician Services Why: To apply the new learning in a different situation How: Participant craft tweets as responses to patients who have digestion and chewing related questions for their doctors.	

Time (minutes)	Activity (What, Why, How)	Slide
5	What: Debrief lesson through lens of disciplinary literacy Why: To connect the learning experience with the theoretical ideas in the first part of the session How: (Bounce Cards) Participants will use Bounce Cards to support their dialogue as they discuss the question: "How did you read purposefully, engage in productive dialogue, and write in meaningful ways during the lesson on surface area, volume, and digestion?"	
10	What: Reflect and refine our vision Why: To add new learning to the vision and edit to match current understandings How: Table groups revisit the focused lists created at the beginning of the session and edit them to reflect their current understanding of STEM instruction enhanced by disciplinary literacy.	

Time (minutes)	Activity (What, Why, How)	Slide
10	What: Triple-track Strategy Check-In Why: To emphasize the disciplinary literacy strategies used in the session and how they might be adapted for adult learning and student learning How: 1) As strategies are used during the session, record them on chart paper on the side of the room. 2) During the strategy check-in, review each strategy and discuss how it was used in the session. 3) (Table Talk) Table groups discuss how they might use the strategy for other types of adult learning in their schools, and how they might use it in the classroom for student learning. Participants record ideas on the Triple-Track graphic organizer.	
5	What: Reflection and Wrap Up Why: To provide feedback on the learning of the day to the facilitator How: (Most Important Point) Participants write the most important point of the day on an index card to submit for feedback to the presenter on what they have learned. Additional feedback about logistics and other concerns should be placed on the Parking Lot for consideration.	

Disciplinary Literacy Quotes to Consider

Read each of the following quotes. Highlight or underline words and phrases that help you answer: "What is disciplinary literacy?"

- Disciplinary literacy is based on the premise that students can develop deep conceptual knowledge in a discipline only by using the habits of reading, writing, talking, and thinking which that discipline values and uses. (McConachie, et.al., 2006)

- Disciplinary literacy is distinct from "content area" reading. Disciplinary literacy is more aimed at what we teach (which would include how to read and use information like a scientist [or mathematician]), than how we teach (such as how can students read the history book well enough to pass the test). The idea of disciplinary literacy is that students not only have to learn the essential content of a field, but how reading and writing are used in that field." (Shanahan and Shanahan, 2008)

- Disciplinary literacy is built on the premise that each subject area or discipline has a discourse community with its own language, texts, and ways of knowing, doing, and communicating within a discipline (O'Brien, Moje, & Stewart, 2001). It moves beyond the notion of "every teacher is a reading teacher" and literacy as an "add-on" set of generic strategies used to improve the reading and writing of subject area texts. Rather, it situates literacy as an integral part of content (Moje, 2008) so that "literacy within the discipline" becomes the goal of disciplinary literacy." (Zygouris-Coe, 2012)

- Knowledge production in the disciplines operates according to particular norms for everyday practice, conventions for communicating and representing knowledge and ideas, and ways of interacting, defending ideas, and challenging the deeply held ideas of others in the discipline. (Moje, 2008)

- [E]very science or engineering lesson is in part a language lesson…Students should be able to interpret meaning from text, to produce text in which written language and diagrams are used to express scientific ideas, and to engage in extended discussion about those ideas. (National Research Council, 2012)

- "Rich language environments that promote reading, writing, and speaking help students develop deep understanding of content while supporting their development of literacy skills." (Pugalee, 2007)

Strategy Triple Track

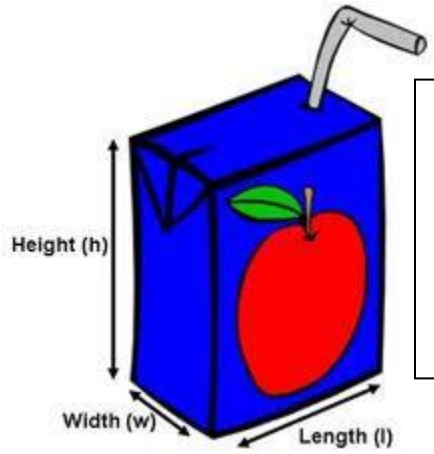
Strategy	How did we use it to learn?	How might this strategy be used for adult learning in your school?	How might this strategy be used for student learning in your classroom?

We Think-We Question-We Learned Chart

We Think	*We Question*	*We Learned*

Volume and Surface Area of Rectangular Prisms and Cubes

Adapted from www.sciencebuddies.org, www.instructables.com, and Math on Call, 1998. Great Source Education Group. Houghton-Mifflin Company.

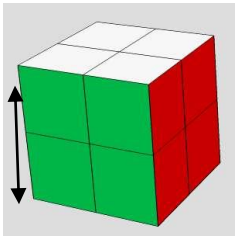


Rectangular Prism Formulas

Surface area: SA = 2lw + 2lh + 2wh
The surface area of a solid is the sum of the areas of its outside surfaces. Surface area is measured in square units such as square feet (ft^2).

Volume: V = *lwh*
The volume *V* of a rectangular prism is the product of the length, width, and height. Volume is measured in cubic units such as cubic feet (ft^3).
Think about how many cubes will fit inside the box.

A **rectangular prism** is a solid with six rectangular faces. Juice boxes, are in the shape of **rectangular prisms.** You can measure the **height**, **width**, and **length** of the box, and then, use that information in a **formula** to calculate how much the box can hold (**volume**) and how much packaging material (**surface area**) was required to make or cover the box.

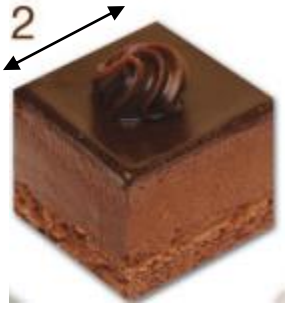


Cube Formulas

Surface area: $6s^2$ (the sum of the areas of each face)
Volume: V = *s x s x s*

A **cube** is a solid with 6 congruent square faces.

Increasing Surface Area to Volume Ratio



You have a cube on your table that is about the size of this dessert.
What is the volume of the cube? _____

What is the cube's surface area? _____

What is the surface area to volume ratio? _____

Work with your partner to get the **largest possible** surface area from the cube without changing its volume.

In your notebook: Defend your answer with a diagram and by showing your calculations. Compare your answer with the original surface area to volume ratio.

What would happen if you could cut the cubes into smaller and smaller pieces?

Directions: Use the blanks below each paragraph to write a summarizing sentence for the information in the paragraph. Use one word per blank.

Chewing Initiates Digestion

Chewing is an extremely important, yet oftentimes overlooked, part of healthy digestion. Most people put food in their mouth, chew a few times and swallow their food, as if their sole focus was how quickly they could get their foods to their stomachs. Proper, health-promoting digestion begins in the mouth. The process of chewing is a vital component of the digestive activities that occur in the mouth, inextricably linked to good digestion, and therefore, good health.

_____ _____ _____ _____ _____ _____ _____

_____ _____ _____ _____ _____ _____ _____

The Mechanical Process of Digestion Begins with Chewing

The action of chewing mechanically breaks down very large aggregates of food molecules into smaller particles. This results in the food having an increased surface area. Raising the surface area-to-volume ratio of the total mass of food is an important contributing factor to good digestion. In addition to the obvious benefit of reduced esophageal stress that accompanies swallowing smaller, versus larger, pieces of food, there is another very important benefit to chewing your food well that comes with its ability to be exposed to saliva for a longer period of time.

_____ _____ _____ _____ _____ _____ _____

_____ _____ _____ _____ _____ _____ _____

The Chemical Process of Digestion Begins with Chewing

Food's contact with saliva is not just important because it helps to lubricate the food, making it easier for foods to pass through the esophagus, but because saliva contains enzymes that contribute to the chemical process of digestion. The enzymes work only on surfaces presented to them, the larger the available surface area of food, the more enzymes that can be functioning simultaneously. This leads to more efficient digestion.

_____ _____ _____ _____ _____ _____ _____

_____ _____ _____ _____ _____ _____ _____

Excerpt from http://www.whfoods.com/genpage.php?tname=george&dbid=36

Virtual Physician Services: A 21st Century Option

Due to the rising cost of fuel and the advances in technology, one affordable alternative for consumers is online physician services. As the demand for affordable health care in the United States increases, so will there be an increase in the acceptance of virtual care from doctors. Virtual care from doctors saves money for the doctors and the patients. The potential for an increase in the quality of care is present due to physicians having less of their time wasted. Many doctors report that a large number of office visits are for things that could easily be treated with an online consultation.

You are a doctor for an online medical company called i-Doc.com. Your company advertises: "We offer on-demand, real-time health services by licensed physicians via video conference, phone or secure email."

You are thinking about saving even more time by offering to provide quick responses with a Tweet. Craft your responses to two patients and remember a Tweet is 140 characters or less.

Patient 1: A patient e-mails your company and states that they cannot tolerate the taste of the chewable medication their primary doctor prescribed them and wants to know if it would be safe for them to swallow the medication instead. Without knowing their medical history, how would you respond?

Patient 2: Another patient writes in and asks if their grandmother could chew her timed released pills because she is having difficulty swallowing. Write your response.