



## Soybean Math: Fun by the Bushel! [Math]

### Objectives:

1. Students will develop an understanding of what a bushel is and its associated volume.
2. Students will analyze and complete math story problems involving soybeans, bushels, trucks, trains, and grain bins.
3. Students will formulate and complete a variety of addition, subtraction, multiplication, and/or division number sentences in order to complete the math story problems.

### Common Core Standard(s):

- 4.OA.1 Use the four operations with whole numbers to solve problems. Interpret a multiplication equation as a comparison, e.g., interpret  $35 = 5 \times 7$  as a statement that 35 is 5 times as many as 7 and 7 times as many as 5. Represent verbal statements of multiplicative comparisons as multiplication equations.
- 4.OA.2 Use the four operations with whole numbers to solve problems involving multiplicative comparison, e.g., by using drawings and equations with a symbol for the unknown number to represent the problem, distinguishing multiplicative comparison from additive comparison.



## Soybean Ads by the Truckload

[Language Arts & Fine Arts]

### Objectives:

1. Students will develop an understanding of what soybeans are and what they are used for.
2. Students will design and create a colorful drawing to represent an advertisement for soybeans on the side of a semi-truck trailer.

### Illinois Learning Standard:

26.B. 2d Visual Arts: Demonstrate knowledge and skills to create works of visual art using problem solving, observing, designing, sketching, and constructing.

### Common Core Standards:

- RI.4.1 Refer to details and examples in the text when explaining it says explicitly and when drawing inferences from the text.
- RI.4.2 Determine the main idea of a text and explain how it is supported by key details; summarize the text.

### Materials Needed:

- pencils
- various nonfiction picture books about soybeans
- lined paper to record notes
- chart paper
- 12 x 18" pieces of white paper
- rulers
- coloring items (such as markers, crayons, and/or colored pencils)



### **Background:**

This lesson, *Soybean Ads by the Truckload*, will work best after implementation of the related vocabulary lesson, *How to Store a Billion Beans*. After implementing the vocabulary lesson, students should be shown the video “Trucking” (Episode V) found at [www.podtoplate.org/videos](http://www.podtoplate.org/videos). Once students are familiar with the vocabulary and content of the video, this art lesson will build more effectively on students’ understanding.

### **Procedure:**

1. Students should be placed with a partner to read and share a variety of nonfiction soybean picture books. Titles intended for a lower grade reading level are acceptable for the purposes of this lesson. The intention of the reading is for students to glean an understanding of what a soybean is, learn about the life cycle of the soybean plant, and discover what types of food- and non-food products include soybeans or soy by-products.
2. After students have read and discussed a variety of books, have each pair record 15 things they learned about soybeans and their uses. They should record their notes on lined paper.
3. Bring the class together to share what they have learned about soybeans. Invite each student to share two ideas from his/her partner list of 15. Once a fact has been shared by a student, subsequent students should not share the same fact but instead choose a new idea from his or her partner list. Meanwhile, the teacher should record the student-shared facts on chart paper for all to see.
4. Finally, give students the opportunity to make verbal connections with the information listed on the chart paper. This would be a good time for students to ask questions for clarification or to share additional information that relates to details already charted.



[www.podtoplate.org](http://www.podtoplate.org)

Grade Level: 4<sup>th</sup>-5<sup>th</sup> grade

### **Evaluation:**

- Each student should be given a large white sheet of paper (12" x 18" suggested) to use in designing the side profile of a semi-truck and trailer. The illustration can be two, or three-dimensional, but it must be drawn on the page as to maximize the use of space and the rectangle shape on the side of the trailer. Students will then design an advertisement slogan on the side of the trailer promoting soybeans and/or their use. The posters can be put on display to help promote knowledge about soybeans and their use on our planet.

### **Poster Criteria:**

-good use of space

-neatness

-colorful

-creativity/originality

-correct spelling

-message/slogan



## Moving Soybeans Vocabulary Tag [Language Arts]

### Objectives:

1. Students will develop an understanding of how harvested soybeans are moved and stored.
2. Students will be able to define terms related to grain storage and transportation.

### Common Core Standards:

- RI.4.1 Refer to details and examples in the text when explaining what it says explicitly and when drawing inferences from the text.
- RI.4.4 Determine the meaning of general academic and domain-specific words or phrases in a text relevant to a grade 4 topic or subject area.
- RF.4.4 Read with sufficient accuracy and fluency to support comprehension.
- L.4.4 Determine or clarify the meaning of unknown and multiple-meaning words and phrases based on grade 4 reading and content, choosing flexibly from a range of strategies.

### Materials Needed:

- computer and projector to show Pod to Plate Video Episode V – “Trucking” (available online at [www.podtoplate.org](http://www.podtoplate.org))
- vocabulary list Pod to Plate Video Episode #5 – “Trucking”
- vocabulary charts (see Procedure for number of copies of each chart needed)
- large playing area, preferably outdoors
- cones to mark boundaries of playing area
- *Moving Soybeans* matching worksheet

Note: This lesson correlates closely with Pod to Plate video lessons *How to Store a Billion Beans*, *Soybean Math by the Bushel*, and *Soybean Ads by the Truckload*.



**Procedure:**

1. Show and discuss Pod to Plate Video Episode V - "Trucking." Review key vocabulary heard in the video and defined in the vocabulary list.
2. Explain Vocabulary Tag game to students: Half of the students in the class will be "it." Students who are "it" will carry a vocabulary list including eight terms and their definitions. As there are 15 total vocabulary terms, there are two different charts with one word repeated. For example, if there are 24 students in the class, six students will have one chart, six more will have another, and the remaining 12 will not have a chart.
  - a. The object of the game is to not become "it." The better you remember the vocabulary words, the less likely you are to become "it."
  - b. If playing outdoors: Students who are "it" run to try to tag students who are not "it." A student is tagged if a student who is "it" comes within ten feet of a student who is not "it" and calls that child's name. When tagged, the student must stop so the child who is "it" can read aloud a definition from his or her chart. If the tagged student can say the vocabulary term the definition describes correctly, he or she continues on without becoming "it." If the student is incorrect or cannot come up with an answer, he or she is told the correct answer and then must take the vocabulary chart and becomes "it."
  - c. If playing indoors: Students who are "it" walk quickly to try to tag students who are not "it." A student is tagged if a student who is "it" lightly touches (no hitting) a student who is not "it" on the upper arm or shoulder. When tagged, the student must stop so the child who is "it" can read a definition from his or her chart. If the tagged student can say the vocabulary term that the definition describes correctly, he or she continues on without becoming "it." If the student is incorrect or cannot come up with an answer, he or she is told the correct answer and then must take the vocabulary chart and becomes "it."
  - d. Students who do not stop to read a definition after being tagged can be sent to "jail" by the teacher. While in jail, students may review the vocabulary chart until being released by the teacher. (Students who cannot run due to injuries or health issues can be assigned the duty of "sheriff" and sit next to the jail to quiz inmates on the vocabulary terms.)



[www.podtoplate.org](http://www.podtoplate.org)

Grade Level: 4<sup>th</sup>-5<sup>th</sup> grade

- e. The game may continue as long as time allows. Proficiency with the terms will increase as the game progresses.

**Evaluation:**

- Have students complete the *Moving Soybeans* matching activity worksheet.





## Vocabulary List for Pod to Plate Video Episode #5 – Trucking

**auger** – a large screw within a cylinder or pipe, used to force material such as grain from one end of the pipe to the other

**bin** – large, cylindrical steel building in which grain crops such as corn or soybeans are stored; also known as a grain bin

**bucket elevator** – mechanism found within an elevating or grain leg; a series of connected rectangular buckets which scoop grain out of an underground pit and lift it up to be dumped into pipes leading to storage bins

**conveyor** – machine or mechanism with a moving belt on which material is moved from one place to another; conveyor belt

**dump** – to unload material using gravity, as from the bottom of a grain truck or wagon

**fuel** – materials such as wood, coal, or gas which are burned to produce heat or power

**hopper** – container with a tapered opening at the bottom which allows contents to be emptied out using gravity

**storage** – place to hold or store a product until it is needed

**tarp** – short for “tarpaulin,” a heavy cloth or vinyl cover used to cover and protect items from rain or sun

**truck** – term used to describe a tractor and trailer used to haul products such as harvested crops; also known as a semi-trailer or tractor-trailer

**truck scale** – a large scale mounted on a cement foundation allowing trucks to drive onto a platform to be weighed

**yield** – amount of something produced; used to describe the amount of crops produced, i.e., “soybean yield”

### **Bonus terms**

**market** – place where a product such as crops might be bought or sold

**processing** – a series of actions meant to change and/or preserve a material, i.e., processing soybeans to make vegetable oil

**scale ticket** – a written document or paper filled out at the grain elevator and provided to the farmer who has delivered the grain; a receipt which proves how much grain was delivered



### Moving Soybeans Vocabulary Chart #1

<b>auger</b>	a large screw within a cylinder or pipe, used to force material such as grain from one end of the pipe to the other
<b>bin</b>	large, cylindrical steel building in which grain crops such as corn or soybeans are stored; also known as a grain bin
<b>bucket elevator</b>	mechanism found within an elevating or grain leg; a series of connected rectangular buckets which scoop grain out of an underground pit and lift it up to be dumped into pipes leading to storage bins
<b>conveyor</b>	machine or mechanism with a moving belt on which material is moved from one place to another; conveyor belt
<b>dump</b>	to unload material using gravity, as from the bottom of a grain truck or wagon
<b>fuel</b>	materials such as wood, coal, or gas which are burned to produce heat or power
<b>hopper</b>	container with a tapered opening at the bottom which allows contents to be emptied out using gravity
<b>storage</b>	place to hold or store a product until it is needed



### Moving Soybeans Vocabulary Chart #2

<b>tarp</b>	short for “tarpaulin,” a heavy cloth or vinyl cover used to cover and protect items from rain or sun
<b>truck</b>	term used to describe a tractor and trailer used to haul products such as harvested crops; also known as a semi-trailer or tractor-trailer
<b>truck scale</b>	a large scale mounted on a cement foundation allowing trucks to drive onto a platform to be weighed
<b>yield</b>	amount of something produced; used to describe the amount of crops produced, i.e., “soybean yield”
<b>market</b>	place where a product such as crops might be bought or sold
<b>processing</b>	a series of actions meant to change and/or preserve a material, i.e., processing soybeans to make vegetable oil
<b>scale ticket</b>	a written document or paper filled out at the grain elevator and provided to the farmer who has delivered the grain; a receipt which proves how much grain was delivered
<b>bucket elevator</b>	mechanism found within an elevating or grain leg; a series of connected rectangular buckets which scoop grain out of an underground pit and lift it up to be dumped into pipes leading to storage bins



## Moving Soybeans Vocabulary Matching Exercise

**Directions: Draw lines to connect the terms with their definitions.**

<b>auger</b>	machine or mechanism with a moving belt on which material is moved from one place to another; conveyor belt
<b>bin</b>	container with a tapered opening at the bottom which allows contents to be emptied out using gravity
<b>bucket elevator</b>	a large scale mounted on a cement foundation allowing trucks to drive onto a platform to be weighed
<b>conveyor</b>	large, cylindrical steel building in which grain crops such as corn or soybeans are stored; also known as a grain bin
<b>dump</b>	a large screw within a cylinder or pipe, used to force material such as grain from one end of the pipe to the other
<b>fuel</b>	term used to describe a tractor and trailer used to haul products such as harvested crops; also known as a semi-trailer or tractor-trailer
<b>hopper</b>	short for “tarpaulin,” a heavy cloth or vinyl cover used to cover and protect items from rain or sun
<b>storage</b>	to unload material using gravity, as from the bottom of a grain truck or wagon
<b>tarp</b>	place to hold or store a product until it is needed
<b>truck</b>	materials such as wood, coal, or gas which are burned to produce heat or power
<b>truck scale</b>	amount of something produced; used to describe the amount of crops produced, i.e. “soybean yield”
<b>yield</b>	mechanism found within an elevating or grain leg; a series of connected rectangular buckets which scoop grain out of an underground pit and lift it up to be dumped into pipes leading to storage bins



### Moving Soybeans Vocabulary Matching – ANSWER KEY

Directions: Draw lines to connect the terms with their definitions.

<b>auger</b>	machine or mechanism with a moving belt on which material is moved from one place to another; conveyor belt
<b>bin</b>	container with a tapered opening at the bottom which allows contents to be emptied out using gravity
<b>bucket elevator</b>	a large scale mounted on a cement foundation allowing trucks to drive onto a platform to be weighed
<b>conveyor</b>	large, cylindrical steel building in which grain crops such as corn or soybeans are stored; also known as a grain bin
<b>dump</b>	a large screw within a cylinder or pipe, used to force material such as grain from one end of the pipe to the other
<b>fuel</b>	term used to describe a tractor and trailer used to haul products such as harvested crops; also known as a semi-trailer or tractor-trailer
<b>hopper</b>	short for "tarpaulin," a heavy cloth or vinyl cover used to cover and protect items from rain or sun
<b>storage</b>	to unload material using gravity, as from the bottom of a grain truck or wagon
<b>tarp</b>	place to hold or store a product until it is needed
<b>truck</b>	materials such as wood, coal, or gas which are burned to produce heat or power
<b>truck scale</b>	amount of something produced; used to describe the amount of crops produced, i.e. "soybean yield"
<b>yield</b>	mechanism found within an elevating or grain leg; a series of connected rectangular buckets which scoop grain out of an underground pit and lift it up to be dumped into pipes leading to storage bins





## How to Store a Billion Beans [Language Arts]

### Objectives:

1. Students will develop an understanding of how a grain elevator operation works.
2. Students will be able to define terms related to grain storage and transportation.

### Common Core Standards:

- RI.4.1 Refer to details and examples in the text when explaining what it says explicitly and when drawing inferences from the text.
- RI.4.4 Determine the meaning of general academic and domain-specific words or phrases in the text relevant to a grade 4 topic or subject area.
- RI.4.5 Describe the overall structure (e.g., chronology, comparison, cause/effect, problem/solution) of events, ideas, concepts, or information in the text or part of the text.
- RI.4.7 Interpret information presented visually, orally, or quantitatively (e.g., in charts, graphs, diagrams, time lines, animations, or interactive elements on Web pages) and explain how the information contributes to an understanding of the text in which it appears.
- RF.4.4 Read with sufficient accuracy and fluency to support comprehension.
- L.4.4 Determine or clarify the meaning of unknown and multiple-meaning words and phrases based on grade 4 reading and content, choosing flexibly from a range of strategies.

### Materials Needed:

- *How to Store a Billion Beans* background information (teacher)
- *Grain Storage: Bushels of Beans and Corn* photo – project for class to see or distribute copies for pairs of students to view
- vocabulary matching cards
- *Show What You Know about Grain Storage* worksheet
- optional: computer and projector to show Pod to Plate Video Episode IV – “Elevators and Trains” (available online at [www.podtoplate.org](http://www.podtoplate.org))



**Procedure:**

1. Project the *Grain Storage: Bushels of Beans and Corn* photo for the class to see. Alternatively, distribute copies of the photo for pairs of students to view and the *How to Store a Billion Beans* information sheet. Use the information sheet *How to Store a Billion Beans* to explain the photo. Be sure to emphasize vocabulary words during the explanation.
2. Show students the vocabulary matching cards. Explain that each student will receive either a vocabulary term or a definition. Once all cards have been distributed, students should use what they learned during the photo discussion to find their partner.
3. Pass out cards. If the bonus terms are used, there are enough cards for 30 students. Otherwise, there are enough for 24. If there are an uneven number of students, the teacher may participate in the matching activity.
4. When all students have found their partners, invite each pair to come forward and read their vocabulary term and definition. Challenge the class to decide whether each term and description is correctly matched.

**Evaluation:**

- Allow students to work with their partners or individually to complete the *Show What You Know about Grain Storage* worksheet.



## Vocabulary List for Pod to Plate Video Episode #4 – Elevators & Trains

**bin** – large, cylindrical steel building in which grain crops such as corn or soybeans are stored; also known as a grain bin

**bushel** – unit of weight used to measure grain or any dry material

**control room** – where computerized controls at an elevator are located; manages where grain is stored, operation of the grain dryer, and the condition of the stored grain

**dump pit** – large underground area at a grain elevator into which grain is dumped to then be lifted into the bins or buildings for storage

**elevating leg** – vertical steel structure containing a series of connected rectangular buckets which scoop grain from an underground pit and lift it up to be dumped into pipes leading to storage bins; also known as a grain leg

**grain dryer** – huge machine used to dry grain crops before storage to prevent the grain from spoiling

**grain elevator** – a grain storage facility which uses a system of connected buckets to scoop grain from underground pits and lift or elevate it up to be dumped into the correct building or bin; also refers to the lifting system itself

**locomotive** – special rail car powered by diesel or electricity and used to push or pull other train cars on a track; also known as an engine

**probe** – device used to pull a sample of grain out of a load being carried by a truck or wagon so that it may be inspected and tested

**soybeans** – name used for the round, tan seeds of the soybean plant; harvested soybeans are sometimes referred to as grain but they are technically oilseeds and not a grain like corn or wheat

**train car** – a vehicle with wheels designed to run on a track with connectors on the front and back which allow it to be linked to other train cars

**truck scale** – a large scale mounted on a cement foundation allowing trucks to drive onto a platform to be weighed; monitored by a person known as a scale operator

### Bonus terms

**aeration** – the process of circulating air within stored grain to keep it from spoiling

**foreign material** – refers to objects such as weed seeds, stones, insects, or plant parts which may be found in a sample of harvested grain; also known as F.M.

**LP gas** – stands for liquid propane, a type of fuel used to dry grain, heat buildings, or power stoves



## How to Store Billions of Beans Information Sheet

What would you do with a billion beans? If you were a farmer who raised **soybeans**, you would have to know what to do with them when you harvested them in the fall. In fact, you would need to know where they were going *before* you harvested all those beans. Where would you put them all?

Soybeans and other crops like field corn and wheat are stored in huge **bins** or buildings until they are transported by river, rail, or road to processing plants or even other countries. Many farmers have grain bins on their farms to store their own grain until they sell it. Others take their soybeans directly to a **grain elevator**. Either way, there has to be a way to get the soybeans out of the trucks or wagons and into storage.

Grain is usually hauled off the farm by special semi trucks. The trailer of a grain truck is loaded from above by combines or grain carts which use an auger arm to move the grain from the machine to the truck. Once the truck is full, it travels to a grain elevator. Grain elevators are usually located near highways, railways, or rivers so that the stored grain can be moved easily to market.

When a truck arrives at an elevator, two important things must happen before the grain is unloaded. First, it must be determined how much grain is on the truck. Second, the grain must be tested for moisture content and quality. Both of these happen at the same time.

At the elevator, the truck must be driven first onto a huge **truck scale**. The scale weighs the entire truck, grain and all. The amount of grain in the truck is determined by subtracting the weight of the truck if it were empty from the total weight shown on the scale. One **bushel** of soybeans weighs 60 pounds so the total amount of grain on a truck would be calculated as follows:

$$\text{Total weight} - \text{weight of truck} = \text{weight of soybeans} \div 60 \text{ lbs.} = \text{number of bushels}$$

While the truck is on the scale, a **probe** is inserted into the load of grain. The probe sucks a sample into an office where a person tests the grain for moisture content and grain quality. The moisture content or wetness is measured as a percentage. Soybeans are usually harvested around 13% moisture and do not need to be dried using the elevator facility's **grain dryer**, which is fueled by **LP gas** or natural gas and is generally used to dry corn. Quality refers to whether the beans are whole, clean, of normal shape and size, and whether they contain any **foreign material**, or F.M. Foreign material could be weed seeds, small stones, insects or plant parts. Grain quality will determine how much the farmer will be paid.



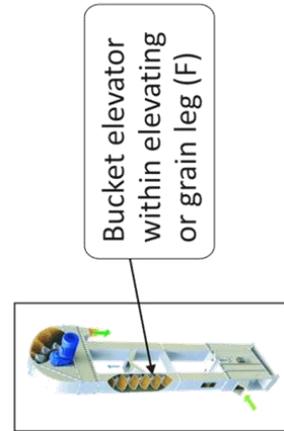
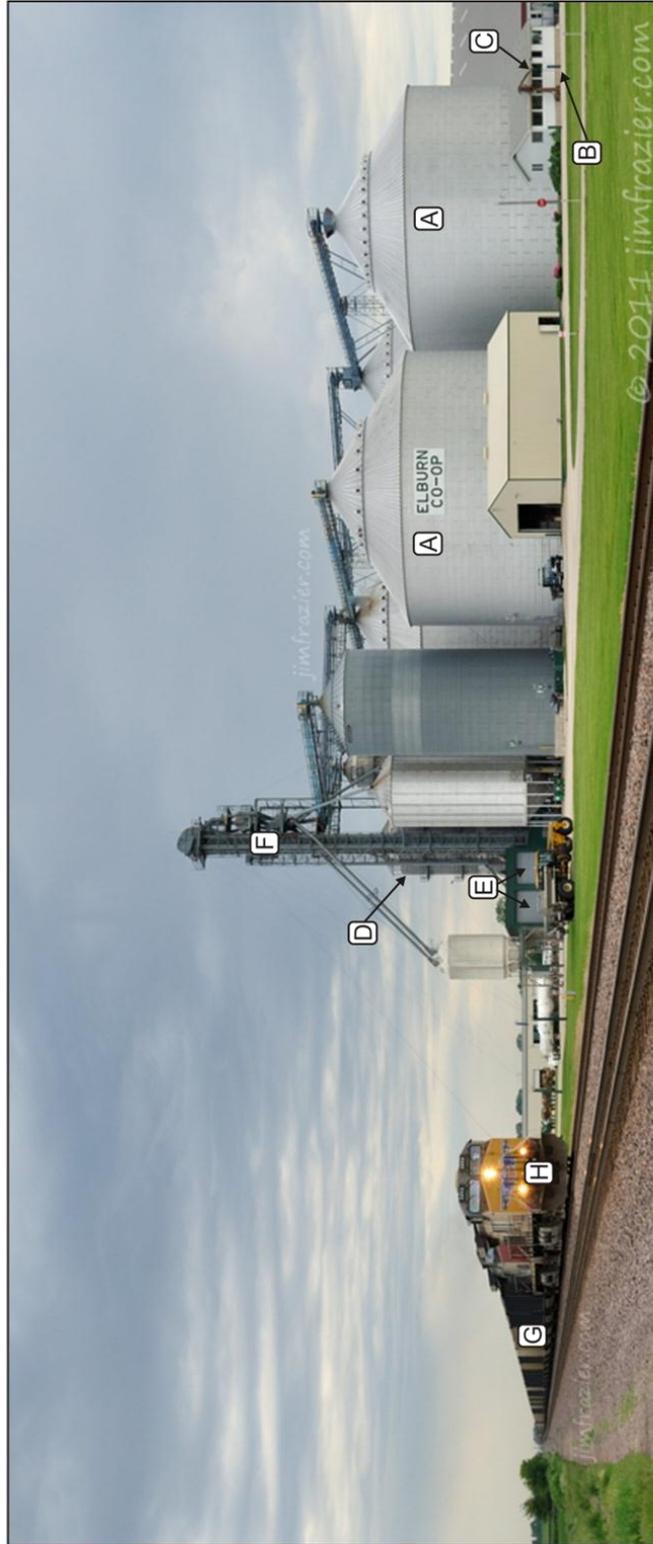
After the load is weighed and the grain tested, the truck is moved to a **dump pit**. A dump pit is an underground area covered by a heavy steel grate. The truck is positioned over the grate and then the hopper bottom of the trailer is opened so that the soybeans pour out of the truck and through the holes in the steel grate into the pit below. Dump pits at commercial grain elevators usually are sheltered by a steel building into which trucks drive before unloading.

As soybeans are being unloaded into the pit, a conveyor moves the grain to the bucket elevator. The bucket elevator is located within a steel structure often called an **elevating leg** or grain leg. It works somewhat like an elevator for people in that grain gets on at the bottom and is lifted to where it needs to go. However, instead of one elevator car, a bucket elevator is a continuous series of connected rectangular containers which, one after another, scoop grain up and lift it to the top of the elevator. Also, unlike a people elevator, the “cars” or buckets in a bucket elevator travel back down the grain leg upside down! Computerized controls within the grain facility’s **control room** determine into which bin the elevated grain will be dumped.

Once the soybeans have been stored in the proper grain bin, they will be periodically aerated to keep them from spoiling. **Aeration** involves circulating air through the grain using fans which force air into the base of the bin.

Once the stored soybeans are sold, they will be emptied from their storage bin and loaded onto **train cars** pulled by **locomotives**, river barges pushed by towboats, or trucks to be transported either to a processing facility or overseas to another country.

# Grain Storage: Bushels of Beans & Corn



- A - bin
- B - truck scale
- C - probe
- D - grain dryer
- E - dump pits
- F - elevating leg
- G - train cars
- H - locomotive



### How to Store a Billion Beans Vocabulary Matching Cards

Directions: Cut cards apart. Distribute terms and definitions randomly to students. Students must circulate among the class until they find the card that matches theirs.

<p><b>bin</b></p>	<p>large, cylindrical steel building in which grain crops such as corn or soybeans are stored; also known as a grain bin</p>
<p><b>bushel</b></p>	<p>unit of weight used to measure grain or any dry material</p>
<p><b>control room</b></p>	<p>where computerized controls at an elevator are located; manages where grain is stored, operation of the grain dryer, and the condition of the stored grain</p>



Vocabulary Matching Cards, continued

<p><b>dump pit</b></p>	<p>large underground area at a grain elevator into which grain is dumped to then be lifted into the bins or buildings for storage</p>
<p><b>elevating leg</b></p>	<p>vertical steel structure containing a series of connected rectangular buckets which scoop grain from an underground pit and lift it up to be dumped into pipes leading to storage bins; also known as a grain leg</p>
<p><b>grain dryer</b></p>	<p>huge machine used to dry grain crops before storage to prevent the grain from spoiling</p>



Vocabulary Matching Cards, continued

<p><b>grain elevator</b></p>	<p>a grain storage facility which uses a system of connected buckets to scoop grain from underground pits and lift or elevate it up to be dumped into the correct building or bin; also refers to the lifting system itself</p>
<p><b>locomotive</b></p>	<p>special rail car powered by diesel or electricity and used to push or pull other train cars on a track; also known as an engine</p>
<p><b>probe</b></p>	<p>device used to pull a sample of grain out of a load being carried by a truck or wagon so that it may be inspected and tested</p>



Vocabulary Matching Cards, continued

<p><b>soybeans</b></p>	<p>name used for the round, tan seeds of the soybean plant; harvested soybeans are sometimes referred to as grain but they are technically oilseeds and not a grain like corn or wheat</p>
<p><b>train car</b></p>	<p>a vehicle with wheels designed to run on a track with connectors on the front and back which allow it to be linked to other train cars</p>
<p><b>truck scale</b></p>	<p>a large scale mounted on a cement foundation allowing trucks to drive onto a platform to be weighed; monitored by a person known as a scale operator</p>



Vocabulary Matching Cards, continued

<p><b>aeration</b> <b>(bonus term)</b></p>	<p>(bonus term) the process of circulating air within stored grain to keep it from spoiling</p>
<p><b>foreign material</b> <b>(bonus term)</b></p>	<p>(bonus term) refers to objects such as weed seeds, stones, insects, or plant parts which may be found in a sample of harvested grain; also known as F.M.</p>
<p><b>LP gas</b> <b>(bonus term)</b></p>	<p>(bonus term) stands for liquid propane, a type of fuel used to dry grain, heat buildings, or power stoves</p>



## Show What You Know about Grain Storage

**Directions:** Use words from the Word Bank to fill in the blanks in the paragraph below.

Harvested soybeans are stored in huge \_\_\_\_\_ or buildings. Many farmers store their crop on the farm while others use trucks to take their grain to a \_\_\_\_\_ . These facilities are usually located near highways, railways, or rivers. This allows stored grain to be moved easily to market.

At the grain elevator, the truck must drive onto a huge \_\_\_\_\_ to be weighed so the amount of grain, or number of \_\_\_\_\_ in the truck may be determined. While this is happening, the moisture and quality of the soybeans is checked using a \_\_\_\_\_ , which sucks a sample of grain out of the truck and into an office to be tested. Soybeans usually dry down enough in the fields prior to harvest, so they do not contain enough moisture for the facility's \_\_\_\_\_ to be used as it is for field corn.

After the load is weighed and tested, the truck will move to a \_\_\_\_\_ . This underground area is covered by a heavy steel grate and sheltered by a steel building. The truck is positioned over the grate and the bottom of the trailer opened. This allows the soybeans to pour into the pit below.

Once the soybeans are in the pit, they are moved up and into the grain bins with a bucket elevator. The bucket elevator is located within a steel structure called an \_\_\_\_\_ . It works a bit like an elevator in a building, but instead of lifting people, it lifts corn in rectangular buckets. At the top of the structure, the buckets dump their grain into steel pipes leading to the grain bins below. Computers in the grain elevator's \_\_\_\_\_ direct the grain to the correct bin.



When the stored soybeans are sold, they are emptied from the storage bin into \_\_\_\_\_ pulled by \_\_\_\_\_ \_\_\_\_\_, river barges pushed by towboats, or trucks, depending on the location of the elevator. The soybeans are then transported to a processing facility or even to another country.

**Bonus terms**

1. A person who is checking grain samples for quality will look for \_\_\_\_\_ such as weed seeds, small stones, insects, or plant parts.
2. Grain dryers can be fueled by \_\_\_\_\_ or natural gas.
3. Grain that is stored in bins must be kept from spoiling, so large fans at the base of each bin force air through the stored crop. This is called \_\_\_\_\_.

**Word Bank**

<b>bins</b>	<b>elevating leg</b>	<b>probe</b>	<b><u>Bonus Terms</u></b>
<b>bushel</b>	<b>grain dryer</b>	<b>soybeans</b>	<b>aeration</b>
<b>control room</b>	<b>grain elevator</b>	<b>train car</b>	<b>foreign material</b>
<b>dump pit</b>	<b>locomotives</b>	<b>truck scale</b>	<b>LP gas</b>



**Materials Needed:**

- computer and projector to show Pod to Plate Video Episode IV – “Elevators & Trains” (available online at [www.podtoplate.org](http://www.podtoplate.org))
- pencils
- scratch paper for working problems
- *Soybean Math Facts by the Bushel!* handout
- *Solving Soybean Scenarios* worksheet
- bushel basket (authentic, plastic one from big box store, borrow one from local farmer or county agriculture literacy coordinator, or use a similar sized container with similarly volume, i.e., cardboard box or laundry basket)
- sheets of paper, old newspapers, packing material (“peanuts”), craft cotton balls, skeins of yarn, small to medium sized playground balls, or misc. student-selected items from the classroom (gather enough of each type of item to fill the bushel basket)
- bathroom scale

**Background:**

This lesson, *Soybean Math Fun by the Bushel*, will work best after implementation of the related vocabulary lesson, *Billions of Beans*. After implementing the vocabulary lesson, students should be shown the video “Elevators and Trains” (Episode IV) and/or “Trucking” (Episode V) found at [www.podtoplate.org/videos](http://www.podtoplate.org/videos). Once students are familiar with the vocabulary and content of the video(s), this math lesson will build more effectively on students’ understanding.



**Procedure:**

1. In a whole group setting, teachers will provide a bushel basket for students to use in this hands-on activity. Students will sit in a large circle around the basket.
2. Use paper, newspapers, packing material (“peanuts”), craft cotton balls, skeins of yarn, small to medium-sized playground balls, or misc. student-selected items from the classroom to complete this hands-on activity. Students should be invited to choose an item with which to fill the basket, then offer predictions on how many of the chosen item it will take to fill the basket and how much the basket will weigh when full. Students then can be invited to come forward and gradually fill the basket. After the basket is full, it should be weighed on the bathroom scale. Once it has been weighed and the weight and number of items recorded, the basket can be emptied. A new type of item should be chosen, predictions made, basket filled and weighed, and so on until at least three different types of items have been tried. The difference in weights and number of items should help to illustrate the concept that a bushel of one item may be very different than a bushel of another item even though the items fill the same amount of space (volume).
3. Teacher will distribute *Soybean Math Facts by the Bushel!* handout. Class will read and discuss information on the fact sheet.

**Evaluation:**

- Distribute the *Solving Soybean Scenarios* worksheet to students (you may choose to have them work in pairs). Using the previously discussed and distributed *Soybean Math Facts by the Bushel* fact sheet and scratch paper if needed, students should solve the soybean math scenarios given.



## Soybean Math Facts by the Bushel! Information Sheet

What is a bushel?



- A bushel is a unit of weight used to measure grain (or any dry good/material).
- 1 bushel = 4 pecks, 8 gallons, or 64 pints,
- One bushel of soybeans weighs approximately 60 pounds
- One train car holds about 4,000 bushels
- One semi-truck trailer holds about 1,000 bushels.
- Grain bins come in different sizes. Different sized grain bins have different volumes and hold various amounts in bushels.



## Solving Soybean Scenarios

1. If you had 2 ½ bushels of soybeans, about how much would they weigh in total?
2. How much would the soybeans weigh in one typical semi-truck trailer?
3. How much would one train car weigh if it were filled with soybeans?
4. How many semi-truck trailers, filled with soybeans, could dump their load onto one train car?
5. In the video, “Elevators and Trains”, it is stated that the elevator operation fills 20 train cars at a time. At this rate, how many groups of 20 train cars will be filled in a 100-car train?
6. Video #4, “Elevators and Trains”, shares that a 100-car train takes approximately 16 hours to load with soybeans at that facility. Given this information, how many hours would it take to load three 100-car trains?



7. A typical train car can hold 4,000 bushels of product. Given this fact, how many bushels can a 100-car train hold?
  
8. Grain bins vary in size. If the grain elevator had a 50,000 bushel grain bin, how many semi-truck trailers full of soybeans would it take to fill it?
  
9. How many train cars would be filled using the soybeans from the full 50,000-bushel grain bin?
  
10. In Video #5, “Trucking”, semi-trucks are used to haul soybeans into the grain elevator. If the elevator has a grain bin that holds 500,000 bushels, how many train cars would it fill?
  
11. If a semi-truck completely loaded with soybeans was weighed on the elevator’s scale, what would the net weight of the soybeans likely be?
  
12. If a semi-truck exactly half full of soybeans was weighed on the elevator’s scale, what would the net weight of the soybeans likely be?



Answer Key (one possible method to solve each provided):

1.  $60 + 60 + 30 = 150$  pounds (or lbs.)
2.  $1,000 \times 60 = 60,000$  pounds
3.  $4,000 \times 60 = 240,000$  pounds
4.  $4,000/1,000 = 4$  semi-truck trailers full
5.  $100/20 = 5$  groups of train cars
6.  $16 \times 3 = 48$  hours
7.  $4,000 \times 100 = 400,000$  bushels
8.  $50,000/1,000 = 500$  semi-truck trailers
9.  $50,000/4,000 = 12 \frac{1}{2}$  train cars
10.  $500,000/4,000 = 125$  train cars
11.  $1,000 \times 60 = 60,000$  pounds
12.  $60,000/2 = 30,000$  pounds