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**What does dog food have to do with math?**

**Video:** <https://youtu.be/iVm_R18p08w>

**Lesson Plan**

**Teacher Note:** Please preview the entire video and pre-work the solutions in order to anticipate students’ needs, misconceptions and materials unique to your classroom.

You will also need to determine the background knowledge of your students regarding the following math topics, and decide the best method for providing that background in order to support the conceptual understanding of the mathematics shown in the video.

* Rate
* Ratio
* Percent
* Unit Analysis
* Cubic Foot
* Vocabulary
	+ Bulk Density - Weight of a unit volume of loose, dry material.

**Common Core Mathematical Content Standards**

* 6.RP.3 Use ratio and rate reasoning to solve real world and mathematical problems.
* 7.RP.3 Use proportional relationships to solve multistep ratio and percent problems.

**Common Core Mathematical Practice Standards**

1. Make sense of problems and persevere in solving them.

2. Reason abstractly and quantitatively.

4. Model with mathematics.

7. Look for and make use of structure.

**Company Information**

**Nercon Eng. & Mfg., Inc.**has been engineering and manufacturing conveyor and consumer goods packaging equipment for over 38 years.  We are known for our expertise in design.  Our growing business currently employs about 150 people.  With the Nercon Corporate and Engineering office located in Neenah, Wisconsin and the production facility in Oconto, Wisconsin, our local family-owned business has been an active part of both the Fox Valley and Oconto area communities.

**Summary**

Conveyor systems move products and materials from one area to another. The correct speed of the conveyor is critical to efficiently move product. Too slow and customer orders will not be filled. Too fast and the product may cause a big mess! This video asks students to calculate the correct speed of a Nercon conveyor system used to move dog food.

**Pre-Activity Discussion:**

* Ask students to describe places they have seen conveyor systems at work and what types of products and materials the conveyor carried. (airports, postal service, bottling company)
* Discuss the types of things that would need to be taken into consideration when moving things on a conveyor. (size of items to be moved, elevation change, turns, speed of conveyor)

**Part 1 (0:00 - 0:50)**

* Problem: How many cubic feet of dog food per hour does the conveyor system need to move?
* Given information:
	+ 480,000 pounds of dog food produced each day.
	+ Production runs 24 hours per day
* The first step suggested by Nick is using unit analysis to find the number of pounds of dog food produced each hour.
* Have students complete part one of the student handout

**Part 2: (0:53 - 1:20)**

* The solution to the first step (20,000lb/hr) is then used with the new, given information (the dog food has a bulk density of 40lb/cu.ft) to determine the number of cubic feet of dog food that the conveyor system needs to move every hour.
* Have students complete part two of the student handout.

**Part 3 (1:23 - 1:37)**

* The problem has now changed because the dog food manufacturer wants to increase production from 20,000 lb/hr to 30,000 lb/hr.
* Have students complete part three of the handout.

**Differentiation:**

* The questions on the student handout are scaffolded to meet the needs of students who may need extra support.
* Eliminating some of the added questions and just posing the questions from the video would be a possible differentiation strategy for students who do not need the extra support.
* Students may also benefit by working with others as part of a partner/group investigation.

**Extension:**

* Give students a different starting quantity of dog food produced, and have them calculate the conveyor speed. For example. 500,000 pounds per day (easier) or 700 tons per year (more challenging)
* Give students a speed for the conveyor (i.e. 900 cu. ft./hr) and have them calculate the amount (in pounds) of dog food that can be produced each day.

**Student Handout - *What does dog food have to do with math?***  Name(s):

**Pre-Video Discussion:**  *Notes on important background information.*

**Problem:**  *At what speed (in cubic feet per hour) will the conveyor system need to move?*

**Given information:**

* 480,000 pounds of dog food produced each day.
* Production runs 24 hours per day

**Part One**

A. How many pounds of dog food are produced each hour?

**Part Two**

B. What new information was given to you to help you solve the problem?

C. Using your answers from part A and B, calculate the number of cubic feet of dog food that the conveyor system needs to move every hour.

**Part Three**

D. The company has now changed the amount of dog food that it is producing every hour. What is this new amount?

E. Do you think that the conveyor speed will need to increase or decrease to accommodate this new amount? Justify your reasoning.

F. Calculate the new conveyor speed (in cubic feet per hour).

**ANSWER KEY:**

**Part One**

A. How many pounds of dog food are produced each hour?

$$\frac{480,000 lb}{1 day} \*\frac{1 day}{24 hours}= \frac{480,000 lb \*day}{24 hours \*day}= \frac{480,000 lb}{24 hours}=\frac{24 \* 20,000 lb}{24 \* 1 hour}= \frac{20,000 lb}{1 hour}$$

$$=20, 000 pounds per hour$$

**Part Two**

B. What new information was given to you to help you solve the problem?

 ***The bulk density of the dog food is 40 pounds per cubic foot***

C. Using your answers from part A and B, calculate the number of cubic feet of dog food that the conveyor system needs to move every hour.

 $\frac{20,000 lbs}{1 hour}\*\frac{1 cu ft}{40 lbs }=\frac{20,000 lbs \*c u ft}{40 lbs \*hour}= \frac{40 \* 500 cu. ft}{40 \*1 hour}= \frac{500 cu. ft.}{1 hour}$

$$=500 cubic feet per hour$$

**Part Three**

D. The company has now changed the amount of dog food that it is producing every hour. What is this new amount? ***300,000 lb per day***

E. Do you think that the conveyor speed will need to increase or decrease to accommodate this new amount? Justify your reasoning. ***Increase.*** ***Answers vary***

F. Calculate the new conveyor speed (in cubic feet per hour).

***Similar steps as C above. 750 cu.ft. per hour***