Instructor Notes 3.1: Acteminophen Overdoses

Theme: Healthcare

Carnegie Foundation
for the Advancement of Teaching

Main Math Topic	Main Quantitative Reasoning Context	Productive Persistence Focus	Level of Productive Struggle
Dimensional analysis	Medical Dosages	Not applicable	Level 2

Prerequisite Assumptions

Before beginning this lesson, students should

- be able to multiply two fractions.
- be able to divide two fractions.
- understand that a fraction can be simplified by "canceling" or dividing common factors in the numerator and denominator.
- understand that multiplying by 1 does not change a value.
- be familiar with basic units of measure of length (feet, miles) and time (seconds, hours, minutes).

Specific Objectives

Students will understand that

- the units found in a solution may be used as a guide to the operations required in the problem—that is, factors are positioned so that the appropriate units cancel.
- units provide meaning to the numbers they get in calculations.

Students will be able to

- write a rate as a fraction.
- use a unit factor to simplify a rate.
- use dimensional analysis to help determine the factors in a series of operations to obtain an equivalent measure.

Specific Language and Literacy Objectives

Students will be able to

- read and comprehend the problem situation and dosage chart.
- complete CaS chart with quantitative and healthcare information from problem situation about acetaminophen overdoses.
- demonstrate an understanding of mathematics through complete and correctly written answers to problems.
- demonstrate the ability to describe, interpret, and synthesize information in lesson text.
- use appropriate quantitative and healthcare vocabulary to discuss mathematics in this lesson.

Explicit Connections

- *Canceling* units is based on the same mathematical concept as reducing common factors in the numerator and denominator of a fraction. This is actually a form of division and is based on the fact that anything (except 0) divided by itself is equal to 1 and that multiplying a number by 1 does not change the value of a number.

Notes to Self

- One thing I want to do during this lesson ...

- One thing I want to pay attention to in my students' thinking ...

- One connection or idea I want to remember ...

Suggested Timeline

Duration	Activity	Suggested Structure
7 minutes	Read Problem Situation 1 and Question 1 (CaS Chart)	Individual reading and class discussion
5 minutes	Let students work on Question 2	Small groups
4 minutes	Review Question 2 with class	Class discussion
5 minutes	Let students work on Question 3	Small groups
4 minutes	Review Question 3 with class	Class discussion
10 minutes	Introduce the concept and methodology of dimensional analysis and lead students through Questions 4	Class discussion
4 minutes	Let students work on Question 5 and ask students for answer. Students are expected to do the work in their groups at first.	Small groups
6 minutes	Let students work on Question 6	Small groups
5 minutes	Review Question 6 with class and Making Connections	Class discussion
OCE	Question 7 if not enough time in class	OCE

Special Notes

Lesson Packaging: Each contextualized lesson is designed to be used as a stand-alone lesson. However, it is highly recommended that packages of contextualized lessons be taught together. This provides students the opportunity to become familiar with the concepts in the lessons and practice using the three language and literacy tools. Suggested packaging includes:

Package 1: All twelve contextualized lessons

Healthcare Package A: lessons 1.4, 1.9, 3.1, 3.7

Healthcare Package B: lessons 1.4, 1.9,2.4, 3.1, 3.7, 4.3

Environment Package: lessons 1.8, 2.3, 3.2, 4.7

Information Technology and Healthcare Package: lessons 1.4, 2.7, 3.1, 4.2

Today's lesson is specifically contextualized for healthcare. In this lesson, students will be asked to think deeply about the important use of dimensional analysis in medical dosages. In PNL 2.9, students watched a video and wrote briefly about the Hutto Family and their daughter Brianna's tragic overdose. You may choose to show the video in class, as some students may not have watched the video at home. This video is motivating to students to learn dimensional analysis. Please note that the video is sensitive in nature, as it is dealing with the death of a young girl. You may want to allow some students to step out of the classroom who do not want to see the video. The link to the video is located here: https://www.youtube.com/watch?v=FmhnW0FU1g8.

Students also read about how dosages are calculated. PNL 2.9 has conversions students will need for class today, including: tsp to mL, mg to g, and lb to kg.

Students often have a difficult time learning the mathematics in this lesson as dimensional analysis can be a challenging topic. Having students complete 'Further Applications' will help provide students with additional practice with dimensional analysis.

In OCE 3.1, students will encounter other types of rates and different contexts in which dimensional analysis can be used (e.g., miles per gallon, feet per second, miles per hour, gallons per cubic foot, dollars per hour).

Language & Literacy Support for the Lesson: Included in this lesson is a Comprehension and Synthesis (CaS) chart. The CaS chart gives students a visual way to organize and 'CaS' the various parts of a mathematics problem. The CaS chart helps students 'unpack' the problem situation. It helps students identify key quantitative and healthcare information that they must answer, and also identifying the key information they need to know in order to reason their way through solving the problem.

Prior to using a lesson with the CaS chart, students should complete the CaS chart mini-lesson about credit cards. This mini-lesson should take approximately 20 minutes, and includes a short video that introduces the CaS chart to students, and guides them on how to use it.

As you progress through the lesson, it is also important to check to ensure that students understand vocabulary words, the problem situations, and mathematical questions as you progress through the lesson as an additional language and literacy support for students.

Timing. This lesson will require the entire class period. You may want to monitor student discussion time to ensure lesson completion.

[Student Handout]

Specific Objectives

Students will understand that

- the units found in a solution may be used as a guide to the operations required in the problem—that is, factors are positioned so that the appropriate units cancel.
- units provide meaning to the numbers they get in calculations.

Students will be able to

- write a rate as a fraction.
- use a unit factor to simplify a rate.
- use dimensional analysis to help determine the factors in a series of operations to obtain an equivalent measure.

Specific Language and Literacy Objectives

Students will be able to

- read and comprehend the problem situation and dosage chart.
- complete CaS chart with quantitative and health care information from problem situation about acetaminophen overdoses.
- demonstrate understanding of mathematics through complete and correctly written answers to problems.
- demonstrate the ability to describe, interpret, and synthesize information in lesson text.
- use appropriate quantitative and healthcare vocabulary to discuss mathematics in this lesson.

Note: The CaS chart is a language and literacy support tool that is designed to help students better understand the problem situation. Problem situations help students make real-life connections to the mathematics in the lesson, but they often contain a lot of information in a few paragraphs. To solve the mathematics problem, students need to understand the main issue(s) is that need(s) to be resolved. They also need to recognize what quantitative information is available to them to solve the problem. It can be hard, for students, to identify the key issue(s), recognize the important quantitative information they will need, analyze and explain why this information is important, and finally to synthesize this information to solve the problem. The CaS chart will scaffold students as they complete each of these tasks, which will help them solve the mathematics problem.

Some students may have used similar tools in other classes to support reading. You may want to ask students if they have ever used a tool to support their reading. Students may mention KWL charts, annotations, double-entry journals, or another type of graphic organizer.

If this is the first time your students have used the CaS chart, begin by introducing it to students. Explain the purpose and have students look over the CaS Chart template, before students read the problem situation on their own. Note that students will have a blank CaS chart.

[Student Handout]

(1) Completing the CaS Chart

You will be using the Comprehension and Synthesis (CaS) Chart in this lesson. You first saw the CaS chart in a mini-lesson about selecting credit cards to purchase a laptop. Remember, using the CaS Chart will help you have a deeper understanding of the problem situation. CaS Charts will help you understand what the main issue(s) are that need to be resolved and to recognize what quantitative information is available to solve the problem. You will use CaS Charts in some of the Quantway lessons to 'unpack' problem situations and support problem-solving.

First, read through the steps for completing the CaS Chart below. As you read the problem situation on your own, complete the CaS Chart. You may wish to return to these steps as you complete the CaS Chart.

(a) Read through the problem situation below, **Problem Situation: Acetaminophen Overdoses.** As you are reading:

(b) Complete Column A.

- What issues in the in the problem situation do you need to understand in order to solve the problem? Is there contextual information that you need to know to understand the problem situation?

(c) Complete Column B.

- What quantitative information is provided in the problem situation that will help you solve the problem?
- Hint: quantitative information is often a number.

(d) Complete Column C.

- It's not necessary to solve the problem or use calculations right now. In this column, brainstorm ways you might address the issues presented in the problem situation (Column A) using the quantitative information in Column B. There are no wrong answers.

CaS Chart for Problem Situation Acetaminophen Overdoses

Column A	Column B	Column C
What are the main issue(s) in this problem situation?	**What is the key quantitative information you need to solve the issues in the problem situation?**	**Describe in writing how the information in Column B will help you address the issue(s) in Column A later in the lesson.**
Andy and Amanda call their doctor because their infant, Isabella, has a high fever. *Andy goes to store and finds infant's formula and children's formula of*	*(ex) Isabella is 6 months old.* *The doctor prescribes 1 teaspoon of acetaminophen.* *The concentration for children acetaminophen is 160 mg per 5 mL.*	*I know from Column A and B that Andy and Amanda need to figure out how many mg of acetaminophen to give a six-month old infant, since the doctor did not specify which formula to give Isabella. Andy and Amanda could use the information in Column B about concentration to figure out how many mg of medicine is in a*

acetaminophen. *Andy does not know which type to buy for Isabella because the doctor did not specify this.* *The infant's formula doesn't specify the amount, in teaspoons, for infants.* *Andy does not know the mL to teaspoon conversion.*	*The concentration for the infant's acetaminophen is 80 mg per 1 mL.*	*teaspoon for each of the formulas. First, they would also need to know how much a teaspoon is in mL.*

Problem Situation: Acetaminophen Confusion

Andy and Amanda are two new parents with a six-month-old little girl named Isabella. It is 2 a.m. Isabella just woke up crying. She has a fever of 102 degrees Fahrenheit. It is her first high fever. Andy and Amanda are worried. Amanda calls Isabella's doctor to see if they should bring the baby to the emergency room. The doctor tells her to give Isabella acetaminophen (Tylenol®) to try to lower the fever before bringing the baby to the hospital.

The doctor prescribes a teaspoon of acetaminophen. (Acetaminophen is the active ingredient in Tylenol®.) Andy rushes to his local grocery store to buy medicine for Isabella. While at the store, Andy sees different types of acetaminophen. He is confused (see Figure 1).

Figure 1: Different types of acetaminophen for children and infants

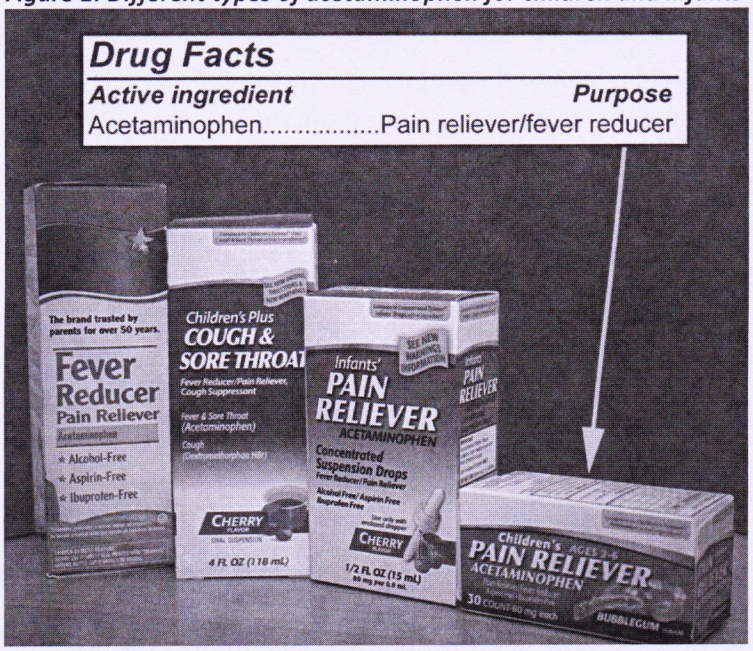

Figure 2: Infants' Acetaminophen Drug Facts

Drug Facts

Active Ingredient (in each 1.0 mL)	Purpose
Acetaminophen 80 mg	Pain reliever/Fever reducer

(Source: http://www.fda.gov/ForConsumers/ConsumerUpdates/ucm284563.htm)

Figure 3: Children Acetaminophen Drug Facts

Drug Facts

Active Ingredient (in each 5 mL)	Purpose
Acetaminophen 160 mg	Pain reliever/Fever reducer

(Source: http://www.fda.gov/ForConsumers/ConsumerUpdates/ucm284563.htm)

(Source: http://www.fda.gov/ForConsumers/ConsumerUpdates/ucm263989.htm)

Isabella's doctor did not specify the type of acetaminophen to use. Andy assumes the package would give the dose. But, the package only says to "consult a doctor" for children under 2 years. Andy notices two different types of acetaminophen for young children: children or infant acetaminophen. Andy thinks it might be a good idea to buy the infants' type, because Isabella is a six-month-old infant.

Andy looks closely at the formula on the back of each box. The concentration amount of acetaminophen is different in each formula.

The problem is that Andy is not sure what is best to give her. He does not know what a teaspoon is in milliliters (mL). He is worried he might give her too much or too little medicine.

Note: Students may argue that since Isabella is an infant, Andy should buy the infants formula. You should remind students that is what the parents assumed in the video, and resulted in the overdose.

You may want to discuss with students the current availability of infant and children's acetaminophen formulas. While companies have changed the formula for infants to match the children's formula, some of the old infant formulas are still on shelves.

(2) Which type of acetaminophen should Andy buy for Isabella? Is there any information missing that you need to be able to answer the question? Brainstorm possible answers with your group. Write your answer in **1-2 complete sentences.** (It is important to write complete sentences because it helps your instructor better understand your mathematical thinking.)

Answer:

We do not have enough information to answer this question. The doctor prescribed acetaminophen, but we do not know what type of acetaminophen or the dosage amount. We need to know what a typical dose would be for a six-month-old for both infant's and children's formulas of acetaminophen.

Note: Allow students to discuss what they think is missing. Encourage them to think of possibilities and make connections to the video they watched for PNL 2.9. In order for students to answer the question, they need answers to these questions:

- What is the dose of acetaminophen for a six-month-old?
- How much acetaminophen does a teaspoon of each type of acetaminophen provide?
- What is the teaspoon to mL conversion? (They will need to find the unit in mL.)

[Student Handout]

Acetaminophen Overdoses

Before the lesson, you watched the video "'It Just Goes Silent': Brianna Hutto and Tylenol." The video shows the tragic effects of confusing infants' and children's acetaminophen. Baby Brianna's parents were faced with the same dilemma as Andy and Amanda above. In both cases, doctors were not clear about the type of acetaminophen to give.

In this lesson, you will learn two ways to figure out dosages for patients. The first way is using a chart. The second way is to use the method called dimensional analysis.

Using a Dosage Chart

Let's practice using a dosage chart for acetaminophen.

Figure 4: Acetaminophen Dosage Chart

Child's Weight	Child's Age*	Dose (mg)
6 to 11 lbs	0-3 months	40
12 to 17 lbs	4-11 months	80
18 to 23 lbs	12-23 months	120
24 to 35 lbs	2-3 years old	160
36 to 47 lbs	4-5 years old	240
48 to 59 lbs	6-8 years old	320
60 to 71 lbs	9-10 years old	400
72 to 95 lbs	11 years	480
96+ lbs	12+	640

Whenever possible, use the child's weight to determine the proper dose.
NOTE: This chart was generated for Quantway purposes. Do not use this chart to figure out acetaminophen dosages for your children or patients. Consult the dosage chart for the particular brand of acetaminophen you are using. (SOURCES:
http://www.knowyourdose.org/sites/default/files/CHPA_Pediatrics_DosingChart_FINAL%5B1%5D.pdf;
http://assets.babycenter.com/ims/Content/acetaminophen_dosage_chart.pdf)

Note: It may also be helpful to discuss what 'concentration' means and provide examples (ex: concentrated laundry detergent, diluting powdered kool-aid, dissolving salt in water). It might also be helpful to bring in manipulatives, such as a children's medicine cup or medicine dropper to show and use as an aid in a discussion about formula concentrations.

(3) Answer the questions below. Show your calculations.

(a) What is the concentration of the infants' formula? What is the concentration of the children's formula?

(b) How many mL of infant acetaminophen should the doctor prescribe for the 5-year old patient?

(c) How many mL of children's acetaminophen should the doctor prescribe for the 5-year old patient?

(d) What would happen if too much acetaminophen is given for a particular concentration?

Answers:

(a) 80 mg per 1 mL (infant), 160 mg per 5 mL (children)

(b) 240 mg/80=3mL

(c) 160mg per 5 mL times =32 mg per 1 mL. 240 mg/32=7.5mL

(d) overdose

Note: Explain to students that 80 mg per 1 mL is a unit rate and can be written as a fraction 80 mg / 1mL or 1mL/80mg

Work for (c):

(1 mL / 80 mg) * (240 mg / 1) = 3 mL

240mg/(80mg/1mL) = (240/80)mL = 3 mL (infant formula)

(5 mL / 160 mg) * (240 mg / 1) = 7.5 mL

240mg/(32mg/1mL)=7.5 mL (children formula)

Students may have difficulty understanding metric units of volume, such as milliliters.

[Student Handout]

Using Dimensional Analysis

Dimensional analysis is a method of setting up problems that involves converting between different units of measurement. It is also called *unit analysis* or *unit conversion*. Many healthcare professionals—including pharmacists, dieticians, lab technicians, and nurses—use unit analysis. It is also useful for everyday conversions in cooking, finances, and currency exchanges.

Many people can do simple conversions without dimensional analysis. However, they are more likely to make mistakes on more complex problems. In healthcare situations, like calculating dosages of medicine, mistakes can be very serious, even fatal. Doctors and nurses rely on dimensional analysis to check their calculations.

The advantage of using dimensional analysis is that it is a way to check your calculations. It is always important that you develop your own methods to solve problems. But, this is a time when you are encouraged to learn and use a specific method. Once you have learned dimensional analysis, you can decide when to use it and when to use other methods.

Problem #4 walks you through the dimensional analysis process.

(4) Let's return to Andy and Amanda's dilemma. At the grocery store, Andy calls the doctor but cannot reach him. Instead, Andy speaks to the on-call Advice Nurse.

> Imagine you are this Advice Nurse. You want to know how much medicine should be administered to Isabella. Isabella is a 6-month-old child who weighs 15 pounds (lb). The medicine comes in a liquid form. You will measure in teaspoons (tsp). The children's concentration is 160 mg per 5 mL.

Step 1: Start with what you need to know. You need to calculate how many teaspoons (tsp) should be given to a 15 pound (lb) child. The target unit for this calculation is *tsp*.

$$\rightarrow tsp$$

Step 2: We start with a rate that has the target unit in the numerator. Since 1 teaspoon holds contains 5 milliliters (mL) of liquid, we have:

$$\frac{1\ tsp}{5\ ml} \rightarrow tsp$$

Step 3: We want the mL to cancel out in the denominator, because this is not the unit we are looking for. In children's acetaminophen, every 5 mL of this medicine has 160 mg of the drug. We write it as a rate and multiply by it. Milliliters cancel in this step:

$$\frac{1\ tsp}{5\ \cancel{ml}} * \frac{5\ \cancel{ml}}{160\ mg} \rightarrow tsp$$

Step 4: Now we need to cancel milligrams (mg). We know Isabelle weighs 15 pounds and recommended dosage for her weight is 80 mg (see the chart presented in figure 4 above). We can use this weight to complete our calculation.

$$\frac{1\ tsp}{5\ \cancel{ml}} * \frac{5\ \cancel{ml}}{160\ \cancel{mg}} * \frac{80\ \cancel{mg}}{1} \rightarrow tsp$$

The only unit left is *tsp,* which is our goal. Now we carry out the numerical calculation and obtain $\frac{1}{2}$ teaspoon of children's acetaminophen.

Note: Dimensional analysis is a mathematical tool, or device, for problems involving units and/or conversion. This is one realm of the course in which discovery learning principles are not easily applied. In other words, it is useful, here, to "show" the students the technique. On Question 4, that technique is explicitly written out in part to insure that students have a clear example, as they would in a textbook, for how to apply dimensional analysis. On Question 4, then, the instructor should lead the class through the example, instructing students on the technique. Different instructors have different strategies for using dimensional analysis; the strategy exemplified here in Question 4 embodies an algorithmic approach, wherein the desired units, for the answer "leads off" the calculation, setting up a chain that ends by the cancellation of all units but the desired set.

[Student Handout]

(5) Use dimensional analysis to calculate how many teaspoons (tsp) Andy should give Baby Isabella if he buys *infants' acetaminophen* instead.

Answer: 1 mL, is equal to about 0.2 tsp. Infant formula is usually given in mL via a dropper (not in teaspoons.)

1 *tsp* / 5~~*mL*~~* 1 ~~*mL*~~/ 80 ~~*mg*~~ * 80 ~~*mg*~~ / 1 = 0.2 tsp

Note: Many students may have difficulty setting up the dimensional analysis right away. Let students work in the group first; explain that the method depends on units and they must carefully use units when setting-up the calculations. It may be helpful to model dimensional analysis on the board with students. Ask someone to present the method to the class. If no one comes up with the right set-up, the instructor should present the solution on the board following the same process presented in question (4).

[Student Handout]

(6) In this question you will explore the differences in the concentrations between children's acetaminophen and infants' acetaminophen. We consider little Isabela who is a 6-month-old child and weighs 15 pounds as an example.

(a) How many mg of acetaminophen should be given to Isabella?

(b) Using the dosages calculated for Isabella, compare the portion of a teaspoon dosage of infant's acetaminophen to the portion of a teaspoon dosage of children's acetaminophen. Calculate the ratio of children's acetaminophen concentration to the infant's acetaminophen concentration. Write a sentence that interprets this ratio in the given context.

(c) Recall that children's acetaminophen has a concentration of 160 mg per 5 mL and infants' acetaminophen has a concentration of 80 mg per 1 mL.. Calculate the ratio of infant's acetaminophen concentration to the children's acetaminophen concentration. Write a sentence that interprets this ratio in the given context.

(d) Write **1-2 complete sentences** to describe and explain the differences between the infants' and children's formula. In your answer, use the Tylenol Problem situation and the calculations you have made in this lesson to help you discuss the differences between the two formulas.

Note: Students may ask why the infant formula is more concentrated. You could explain to students that this is so the baby will have to consume less liquid.

Answers:

(a) 80 milligrams regardless the concentrations.

(b) Emphasize to the students that when you have common units, (tsp) in this case, you can see the difference between the concentrations more clearly. The infants' concentration is 2.5 times the strength of the children's concentration (0.5tsp /0.2 tsp = 2.5). Make a connection to lesson 1.6 when students encountered ratios for the first time.

(c) $\frac{80\ mg/1ml}{160mg/5ml} = \frac{80\ mg}{1\ ml} \div \frac{160\ mg}{5\ ml} = \frac{80\ mg}{1\ ml} * \frac{5\ ml}{160\ mg} = 2.5$ *. Here it is important to point out that in order to compare the strength of medications, the specific dosage is not required as exhibited by a comparison to part b above. By finding the ratio, one can see that the infant's formula is more concentrated and one must be cautious when giving it to a child. If students are having trouble dividing two fractions, you can try changing children's concentration rate to unit rate. 160mg per 5 mL is the same as 32 mg per 1 mL. Now students should see that in 1 mL, the infant formula has 2.5 times the medication (80/32=2.5)*

(d) The infants' formula is 2.5 times more concentrated than the children's formula. That means that 1 milliliter of infants' formula contains 2.5 times the amount of acetaminophen than the children's formula. Making a mistake by mixing up the two formulas may result in a dangerous overdose of acetaminophen.

[Student Handout]

(7) As parents to an infant, Andy and Amanda must consider what to feed Isabela. For newborns, there are two different types of formula: a 'Ready-to-Feed' liquid, and a powder formula. Formula is very expensive. Andy and Amanda must calculate the cost for each formula to determine which one fits their budget. They must feed little Isabela every 3 hours, and each feeding is 140 mL. Remember, 1 ounce= 30 mL.

(a) The 'Ready-to-Feed' liquid costs $8 for 32 ounces of formula. What is the cost of using the 'Ready-to-Feed' formula for 1 month?

(b) The powdered formula is $32 for 1 container of powder. This makes 169 ounces of formula when mixed with water. What is the cost of using the powdered formula?

Answers:

*(a) 8/32 ounce * 1 ounce/30 mL* 140 mL/1 feeding*1 feeding/3 hours* 24 h/1 day* 30 days/1 month =806400/2880=$280*

(b) $32/169 ounces 1 ounce/30 mL*140mL/1 feed* 1 feeding/3 hours* 24 h/1 day* 30 days/1 month=3225600/15210=$212*

Note: As a class, discuss which formula would be cheaper for Andy and Amanda. Ready-to-feed formula is more convenient to use but it is $68 more expensive (or 32% more) each month than the powdered formula.

Making Connections

Record the important mathematical ideas from the discussion.

Making Connections: Main Ideas to Highlight

***Canceling* units is based on the same mathematical concept as canceling common factors in the numerator and denominator of a fraction. This is actually a form of division and is based on the fact that anything (except 0) divided by itself is equal to 1 and that multiplying a number by 1 does not change the value of a number.**

Note: You might consider if you want to use the term *canceling* as it tends to obscure this understanding—it is important to get students to explain the process mathematically. Students will often use the term *canceling*, but it is more correct to refer to the operation as division.

Facilitation Prompts

- What does it mean to "cancel" units? Why is it allowed?
- How does this relate to simplifying or multiplying fractions?

[Student Handout]

Further Applications

(1) Do an Internet search *dimensional analysis* or *unit analysis*. Find at least one site that provides examples of how to make conversions using this technique.

(a) Record the site name and URL address.

(b) Copy one example as shown on the site.

(2) You are the on-call Advice Nurse on the night shift. A parent calls from home about his five-year-old son who is suffering from pain. Earlier that day, the son was seen in the emergency room for a broken arm. Although his arm is in a cast, he is in a lot of pain. You contact the pediatric doctor on-call to ask for what advice to give the parents.

The pediatric doctor on-call prescribes 7.5 mL of children's acetaminophen formula every four hours to lower the child's fever. The children's formula has 160 mg of acetaminophen per 5 mL.

The parent only has the infants' formula available at home. You must calculate the amount of infants' formula the parents can give their child.

(a) Determine the amount, in milliliters, of infants' formula that parents should administer.

(b) Provide recommendations to the parents about the use of children's and infants' formulas of acetaminophen. The parents have both an 8-month-old and a 5-year-old son at home. Explain any concerns you have about mixing up acetaminophen formulas (Write 2-3 complete sentences.)

Answers

(a)

Step 1: (160mg/5~~mL~~)(7.5~~mL~~/1)=240mg of acetaminophen (original problem)*

Step 2: (1mL/80~~mg~~)(240~~mg~~/1)=3 mL*

OR in one step

(1mL/80mg)(160mg/5mL)*(7.5mL/1)=3mL*

OR Alternatively,

If students realize that since the concentration of infants' formula is 2.5 times the children's formula, the amount of children's formula is 2.5 times the infants' formula. Therefore, the amount of infants' formula would be 7.5mL/2.5=3 mL.

(b) The parents should be aware of how many milligrams the doctor is prescribing rather than the mL prescribed. This is because the infants formula is more concentrated than the children's formula. In other words, if you had the same amount of children's formula of acetaminophen and the same amount of infant's formula

acetaminophen, the infant's formula would contain 2.5 times higher dose of acetaminophen than the children's formula.

Key to OCE

(1) i

(2) Answers will vary.

(3) (a) 4/24 or 1/6

(b) Five boxes will be shaded.

(c) Four boxes will be shaded.

(4) Answer: 6-month-old should receive 80 mg (in the 4-11 month old range). One dose, as prescribed, is 2.5 mL. (Once students know that, they may rule out the infant concentration, because they are given more than 1 mL. Encourage them to think through using dimensional analysis.)

Children's concentration is 160mg/5 mL. Doctor prescribes 2.5 mL. This gives you 80 mg.

Infants' concentration is 80mg/1mL. Doctor prescribes 2.5 mL. This gives you 200 mg.

The doctor intends for you to administer the children's concentration.

(5) Answer: (1g/1000mg) (160mg/5mL)(1000mL/1L)(2L/order)=64 grams

(6) (a) *0.5mL.*

*(1 mL / 200 mg) * (1000 mg / 1 g) * (.1 g / 1 dose) = 0.5 mL / 1 dose*

(b) (1 tsp / 5~~mL~~)(1~~mL~~/300~~mg~~)*(1000~~mg~~/1~~g~~)*(3~~g~~/1)= 2 teaspoons*

(7) 21.3 mi/hr

(8) ii

(9) (a) $26.56/year

(b) $64.12/year

(10) (i) $\frac{23\ miles}{1\ gallon}$ (ii) $\frac{12\ feet}{1\ second}$; (iii) $\frac{5\ gallons}{1\ minute}$; (iv) $\frac{\$7.15}{1\ hour}$

(11) (i) 20 mi/gal; (ii) 56.25 m/hr; (iii) $9.55/hr

(12) Answers will vary.

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version 1.0, was created by The Charles A. Dana Center at The University of Texas at Austin under sponsorship of the Carnegie Foundation for the Advancement of Teaching. This version and all subsequent versions result from the continuous improvement efforts of the Carnegie Networked Improvement Community. The network brings together community college faculty and staff, designers, researchers and developers. It is a research and development community that seeks to harvest the wisdom of its diverse participants through systematic and disciplined inquiry to improve developmental mathematics instruction. For more information on the Quantway® Networked Improvement Community, please visit **carnegiefoundation.org**.

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