**LESSON TITLE: Safe Drinking Water at School**

**STANDARDS ALIGNMENT:**

| GRADE 3 |
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| 3.0A: Represent and solve problems involving multiplication and division.  3.0A 3: Use multiplication and division within 100 to solve word problems in situations involving equal groups, arrays, and measurement quantities.  3.OA.D.8 Solve two step word problems using the four operations. Represent those problems using equations with a letter for the unknown.  3.NBT.A.2 Fluently add and subtract within 1000, using strategies and algorithms based on place value, properties of the operations.  3.MD.A.2 Measure and estimate liquid volumes. Add, subtract, multiply or divide to solve one-step word problems involving masses or volumes in the same units. |
| GRADE 4 |
| 4.0A.A.2 Multiply and divide within 1000 to solve word problems.  4.OA.A.3 Solve multi-step word problems with the four operations, including problems in which remainders must be interpreted.  4.NBT.B.4 Fluently add and subtract multidigit whole numbers using a standard algorithm.  4.NBT.B.5 Multiply a whole number of up to 4 digits by a one-digit number .. using strategies based on place value and properties of the operations.  4.MD.A.1 Know relative sizes of measurement units within one system of units; within a single system of measurement express measurements in a larger unit in terms of a smaller unit.  4.MD.A.2 Use the four operations to solve word problems in real-world context involving… liquid volume. |
| GRADE 5 |
| 5.OA.A.1 Use parentheses and brackets in numerical expressions and evaluate expressions with these symbols.  5.NBT.B.5 Fluently multiply multi-digit whole numbers using a standard algorithm.  5.NBT.B.6 Apply and extend understanding of division to find whole-number quotients of whole numbers with up to four-digit dividends and two-digit divisors.  5.MD.A.1 Convert between different sized standard-measurement units within a given measurement systems, and use these conversions in solving multi-step real-world problems. . |

MP: 1  Make sense of problem and persevere in solving them.

MP: 3 Construct viable arguments and critique the reasoning of others.

MP: 4  Model with Mathematics

***CONNECTIONS (Consider while planning):***

| **Prior Math Knowledge** | **Family/Community/Cultural Connections** | **Language Considerations** |
| --- | --- | --- |
| -equal groups  -skip counting by a given number  -repeated addition, repeated subtraction  -multiplication (equal group model)  -division with leftovers  -reasoning about the meaning of “remainders” or “leftovers”  -volume liquid measurement (cups, ounces, gallons, equivalencies) | -local schools and communities checking water supplies  -drinking water from plastic bottles or reusable bottles  -Portables in some schools have water dispensers with large jugs  -measuring cup (8 oz) from cooking | -Water dispenser  -contamination  -measuring cups |

**TASK:**

Every year, schools check the drinking water for poisonous chemicals such as lead and copper. In some schools, water fountains are not safe. Signs are posted, “do not use.” If our school water fountains were unsafe, each classroom would use a water dispenser with a large jug of water to make sure everyone has enough water to drink.

**How many large jugs of water would we need so that everyone in our class has enough drinking water for:** **1 day of school?**

**Optional Extensions: 1 week of school?** **1 month of school?**

**Task Information Sheet:**

There are 2 versions of the task info sheet. One states information in cups, the other in ounces.

• 1 large jug holds 5 gallons of water

• 16 cups of water in 1 gallon, OR 128 ounces of water in 1 gallon

**HOW MUCH WATER DO WE NEED TO DRINK EACH DAY?**

Here are recommendations for how much water people should drink each day.

| Age | How many cups / ounces of water per day? |
| --- | --- |
| 4 to 8 years old | 5 cups / 40 ounces |
| 9 to 13 years old | 7-8 cups / 56-64 ounces |
| 14-18 years old, and adults | 8-10 cups / 64-80 ounces |

**POSSIBLE ASSUMPTIONS:**

Students may make assumptions related to:

• Number of students vs number of People in class (e.g. Count adults? Do you count students who bring their own water bottles?)

• How much water 1 person or student will drink in one day

• Consider time of year (spring, summer, fall, winter), and daily schedule (PE? No PE?) as those factors might impact daily water intake

• Whether the daily drinking need will be met during school only, or whether students will also drink water outside of school, and therefore the drinking water at school need will be less than the overall daily drinking water need.

• Number of students who will bring water from home, and size of their water bottles. Will they need to refill their bottles at school?

•Whether students have access to safe water at home. Is the water just unsafe in the school? Or also in the broader community?

***MATERIALS NEEDED:***  PPT, Student Task Handout, Individual/Group Recording sheet

**ANTICIPATED STUDENT STRATEGIES:**

Students will need some guidance about the volume of a cup. In this case we are talking about a **measuring cup (8 oz)** not a “drinking cup” which could range from 8oz, 12 oz, 16 oz 32 oz (big gulp). Students will need to determine how many **cups** a person might drink daily.

•RATIOS: Some students might use ratios: determine 1 gallon for 2 students, 2 gallons for 4 students. Students might decide that each child will drink 8 cups. 2 students will drink 16 cups and 16 cups is 1 gallon. They might keep track of gallons and number of students, in this case 20 students are in a class.

Gallon 1 2 3 4 5 … 9 10

Kids 2 4 6 8 10 … 18 20

Then they would use the fact that 1 jug is 5 gallons, and they figured the class needed 10 gallons of water, the kids could reason that the class of 20 students would need 2 jugs.

• REPEATED ADDITION: Some students might use repeated addition 8+8+8+8…. Or 5+5+5+5… to get the number of cups needed for the class. Depending on the assumption made about cups per person per day. 8 cups, 5 cups.

• SKIP COUNTING: Some students might skip count by twos using fingers to get X amount of total cups, if each student drinks 2 cups.

•MULTIPLICATION: Some students may multiply the amount of water per person per day, by the number of people in the class, to find the total volume of water needed. (e.g., 25 people times 40 ounces per person per day, is 1000 ounces needed per day)

•REPEATED SUBTRACTION. To find how long a jug will last, students make subtract the amount of water needed per person per day, or the amount needed per class per day, from the total volume of the 5 jug container. (e.g. 80 cups in the 5 gallon jug, subtract 6 cups repeated (daily portion for one person) to find how many daily servings are in the jug)..

•DIVISION: To find how long a jug will last, students make divide the total volume of the 5 gallon container by the amount of water needed per person per day to find how many daily servings are in the jug (80 cups divided by 5 cups per person; or 640 ounces divided by 40 ounces per person).

• PICTURES: depicting number of jugs used

• CONVERSIONS between units. Some students who are provided with the information in ounces may convert the information to cups, for ease of computation. Students may express the volume of the 5 gallon jug in cups, or in ounces, using the provided conversions (e.g., if there are 16 cups in one gallon, then the 5 gallon jug contains 80 cups; if there are 128 ounces in one gallon, then the 5 gallon jug contains 128x5, or 640 ounces)

**LESSON OUTLINE**

### **BEFORE:** Lesson Launch

• Notice & Wonder: Images related to clean water as a human right, water fountains with caution tape.

• OPTIONAL: Show video clip to provide background on water crisis in Flint Michigan, OR water crisis in schools in various parts of the country.

* CNN student video – Flint Water Crisis (January 2016)
* 1 minute video about Flint Water Crisis (AJ+)
* Video about water in Detroit schools
* Video about water crisis in schools nationwide

• Launch task and use table What do we KNOW, what do we NEED TO KNOW, and what ASSUMPTIONS or Decisions to we have to make.

• Then distribute the TASK INFO SHEET to students. Revisit the “Need to Know” list, use the info sheet to answer some of the “Need to Know” questions.

•Draw students’ attention to equivalencies between gallons and cups, or gallons and ounces. •Use REALIA if possible to provide visual representations of these quantities. Clarify the difference between a cup (hold up measuring cup) and a gallon (hold up empty gallon container, such as a milk gallon or water gallon), and a 5 gallon jug (hold up large water jug for reference). Task info sheet includes the equivalencies between these units. You can also choose to have students figure out the equivalency if this is relevant content for your students.

• Review recording sheet to show their work and solution.

**DURING**: Lesson Exploration

• Some students try to guess how many jugs before writing down ideas. Encourage students to express their ideas with numbers and pictures so we understand their “guess” about the number of jugs.

• Encourage students to look at fact sheet to help them make decisions**.**

• Students may generate assumptions, but then not use the assumptions in their models (for example, adults need more water than kids, or some students will bring water bottles from home). Encourage students to consider how their assumptions are influencing their models and operations. Students may get confused by different units involved in the problem, and may lose track of what different numbers represent.

•Encourage students to label all quantities and ask them to explain what each number means in the context of the problem.

•If groups have figured out the number of jugs needed for ONE school day, pose an extension task -- what about for one week of school? One month of school? [for one week and one month, students might consider which week/month as the time of year might impact water needs, and at the month level, the number of days in school varies from month to month]

**AFTER**: Lesson Summary

* • How did you determine the daily needs? How did you handle the range?
* •What is different/similar about the plans?
* • What is similar/different about the number of jugs needed?
* • What were some important decisions or assumptions made in your plan?

**Consider making a table to compare students’ plans.**

| Number of People | Water per Person per school day | Total number of 5 gallon jugs needed | Leftover water? |
| --- | --- | --- | --- |
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