(i) Overview

Students will work in cooperative groups to create a musical instrument from empty 1-liter bottles. The groups will use fractional equivalents to tune the bottles.

Grade Levels: 4–6

(⊚) Concepts

- Multiplication

- Division

- Measurement

- Problem solving

☆ Materials

- ▦ TI-15 Explorer™ calculators

- Empty 1-liter bottles (8 per group)

- Empty 2-liter bottles (2 bottles for Introduction activity)

- Water

- Funnels

- Rulers

- Metric measuring cups or graduated cylinders

- Student activity sheet

(✓) Assessment

Throughout the activities, questions are included for formative assessment. Student work samples should be used as a check for understanding. Have the students use the TI-15 to show their calculations.

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Introduction

Fill one 2-liter bottle half full with water. Blow across the mouth of the bottle to make a sound. Take an empty 2-liter bottle. Blow across the mouth of the bottle to make a sound. Discuss the two different pitches: the empty bottle will have a lower pitch than the half-full bottle. (Note: students may confuse high and low pitches with loud and soft sounds. Help them understand the difference.)

Presenting the Problem

1. Review the four steps of problem solving with the students:

    o understanding the problem

    o making a plan

    o carrying out the plan

    o evaluating the solution

2. Have students read the *Problem* page and restate the problem in their own words. Make sure the students are clear on what the problem asks.

3. Discuss with students the information in the problem. The chart shows the volume of water needed to create the pitches. Note: The shape of the one liter bottle makes a difference in the pitch.

4. If groups have difficulty with the problem, use the *Things to Consider* page. This page provides guiding questions to help the students solve the problem.

5. Allow the teams time to practice the selected song. Each student in the team should have two bottles (assuming teams of four) that should not be shared with anyone else.

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Evaluating the Results

1. After the presentations are made, have students examine the various solutions presented.

Questions for Students:

- ❖ *How are the presentations similar?*
- ❖ *How are the presentations different?*

2. Ask them to compare the numbers used.

Questions for Students:

- ❖ *Did all groups use the same numbers?*
- ❖ *Why do you think this is so?*

3. Ask them to determine the reasonableness of the results.

Questions for Students:

- ❖ *Did each group answer the question?*
- ❖ *Do the numbers used make sense?*
- ❖ *Did all of the groups consider all of the variables?*

4. Ask groups to analyze the variety of ways students used the calculator to solve the problem.

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SOLUTIONS

Student Activity

Name _____

Date _____

Recycled Sounds

The Problem: How can an eight-note scale be made with 1-liter bottles?

In the first part of the activity, students will fill bottles with different amounts of water to make different pitches. Students will then perform a melody on the tuned bottles.

Using the Calculator

Multiplying Fractions

What happens to a number when you multiply it by a fraction?

Try this:

1 Multiply 12 times $\frac{1}{2}$.

Press	The display shows:
12 ⊗ 1 [n] 2 [d] [Enter]	Answer: 6

Now try this:

2 Multiply 12 times $\frac{1}{3}$.

Press	The display shows:
12 ⊗ 1 [n] 3 [d] [Enter]	Answer: 4

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Try one more:

③ Multiply 12 times $\frac{1}{6}$.

Press	The display shows:
12 ☒ 1 ⑪ 6 ⑥ 🄴ⁿᵗᵉʳ	Answer: 2

A conjecture is a mathematical hypothesis. Write a conjecture about what happens when you multiply by a unit fraction (a fraction with 1 in the numerator). Test your conjecture by trying several more examples.

Possible answer: When you multiply by a unit fraction the product is smaller than the whole number. The product is also equal to the quotient of the whole number and the denominator of the fraction.

What do you suppose would happen if you multiplied a number by a fraction other than a unit fraction?

Possible answer: When you multiply by a unit fraction the product is smaller than the whole number. The product is also equal to the quotient of the whole number and the denominator of the fraction.

④ Multiply 12 times $\frac{3}{4}$.

Press	The display shows:
12 ☒ 3 ⑪ 4 ⑥ 🄴ⁿᵗᵉʳ	Answer: 9

⑤ Multiply 12 times $\frac{3}{5}$.

Press	The display shows:
12 ☒ 3 ⑪ 5 ⑥ 🄴ⁿᵗᵉʳ	Answer: $7\frac{1}{5}$

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6 Multiply 12 times $\frac{4}{5}$.

Press	The display shows:
12 ⊠ 4 ⬜ 5 ⬜ ⏎	Answer: $9\frac{3}{5}$

Write a conjecture about what happens when you multiply by a fraction. Test your conjecture by trying several more examples.

Possible answer: When you multiply by a fraction, the product is smaller than the whole number.

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