

UNIT: UKULELE

ACT-BASED MATH: CALCULATING UKULELE STRING FREQUENCY

OBJECTIVE:

Use the **wave equation** to determine the frequency of ukulele strings.

ACT SCORE TARGET: 28-32

FORMULA: $f = v/\lambda$, where

- f = frequency (Hz)
- v = wave speed (m/s)
- λ = wavelength (m)

MATERIALS NEEDED

- Ukulele (or stringed instrument for measurement)
- Ruler or measuring tape
- Calculator
- Reference chart or app with standard ukulele tuning
- Student worksheet or notebook

STUDENT DIRECTIONS:**Goal:**

You will apply the wave equation to calculate the frequency of sound produced by a ukulele string and compare your results to real-world musical tuning. This activity builds skills in applying formulas, unit conversions, and interpreting wave behavior—all aligned with the ACT Math section for scores in the 28–32 range.

Step 1: Measure the String

1. Use a ruler or measuring tape to find the length of an open ukulele string (from nut to saddle).
Example: A string might measure 0.33 meters (33 cm).
2. Remember, for the fundamental frequency, the wavelength is twice the length of the string:

$$\lambda = 2 \times \text{string length}$$

Example:

$$\lambda = 2 \times 0.33 = 0.66 \text{ m}$$

Step 2: Use the Wave Equation

3. Use the speed of sound in air if the question doesn't specify another medium:

○ Use $v = 343 \text{ m/s}$ for air.

- Or use the provided wave speed in string material if given (e.g., 400 m/s in the ACT-style question).

4. Plug your values into the formula:

$$f = \frac{v}{\lambda}$$

Step 3: Compare with Real Ukulele Frequencies

5. Use a tuning chart or app to find the standard tuning frequencies for ukulele strings (like G4 = 392 Hz, C4 = 261.6 Hz, E4 = 329.6 Hz, A4 = 440 Hz).
6. Compare your calculated frequency to the closest standard note.

✓ *Is your result close to a real tuning value? What factors might cause small differences (e.g., string tension, temperature)?*

ACT-STYLE QUESTION:

- A ukulele string is **0.65 m long**, and the speed of sound in the string is **400 m/s**. What is the frequency of the fundamental harmonic?
 - A. 307.7 Hz
 - B. 615.4 Hz
 - C. 1230.8 Hz
 - D. 2461.6 Hz