Culminating Project: Compose a Riff! (Teacher's Guide)

Musician Mickey Hart is looking for an original 8-note riff to kick off his upcoming performance. (Remember: a riff is a short melody that is repeated.)

You will compose a riff to submit for a "battle of the bands" style competition to determine whose song Hart will play live on stage. For your proposal for Mickey Hart you will:

1. Find note pairings in the D major scale
2. Calculate the tuning information for Mickey Hart's instrument, the beam
3. Create your arrangement and play your riff
4. Write a proposal to accompany your track
5. Play your riff in the class Battles of the Bands competition

Task 1: D Scale Tuning Ratios

The tables below show all possible responses. Students will do the calculations for their chosen ratios.

Root Note Name	Root Note Frequency	Complimentary Note Name	Tuning Ratio	Frequency of the Complimentary Note
D	294.34 Hz	D	1/2	588.68
D	294.34 Hz	A	2/3	441.51
D	294.34 Hz	G	3/4	392.45
D	294.34 Hz	B	3/5	490.57
D	294.34 Hz	F#	4/5	367.93
D	294.34 Hz	E	8/9	331.13
D	294.34 Hz	C#	53/100	555.36

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D Scale Tuning Ratios

D Scale Tuning Ratios Workspace:

Ratio: 1/2 $\frac{294.34}{x} = \frac{1}{2}$ 294.34 * 2 = x x= 588.68	Ratio: 4/5 $\frac{294.34}{x} = \frac{4}{5}$ 294.34 * 5 = 4x 1471.7 = 4x x= 367.93
Ratio: 2/3 $\frac{294.34}{x} = \frac{2}{3}$ 294.34 * 3 = 2x 883.02 = 2x x= 441.51	Ratio: 8/9 $\frac{294.34}{x} = \frac{8}{9}$ 294.34 * 9 = 8x 2649.06 = 8x x= 331.13
Ratio: 3/4 $\frac{294.34}{x} = \frac{3}{4}$ 294.34 * 4 = 3x 1177.36 = 3x x= 392.45	Ratio: 53/100 $\frac{294.34}{x} = \frac{53}{100}$ 294.34 * 100 = 53x 29434 = 53x x= 555.36
Ratio: 3/5 $\frac{294.34}{x} = \frac{3}{5}$ 294.34 * 5 = 3x 1471.7 = 3x x= 490.57	

Task 2: Tuning the Beam for Your Riff

To play your riff, you must prepare the necessary tuning information for Mickey's instrument, the beam. Use the formula learned in **Lesson 2 - Calculating Pitch** to determine the amount of tension needed to tune the beam to each of the 5 notes in your composition. (Recall that the length of the strings on the beam are 1.5748 meters long with a mass of 0.120 kilograms per meter.)

$$f_1 = \frac{\sqrt{\frac{T}{\mu}}}{2L}$$

where

$f_1 =$ fundamental frequency in Hertz (Hz)

$T =$ tension of the string in Newtons (N)

$\mu =$ mass per unit length of the string in kilograms per meter (kg/m)

$L =$ length of the string in meters (m)

This formula may be rearranged with T as the subject:

$$f_1 = \frac{\sqrt{\frac{T}{\mu}}}{2L}$$

Multiply both sides by $$(2L)(f_1) = \frac{\sqrt{\frac{T}{\mu}}}{2L}(2L)$$

Square both sides $$(2L)^2(f_1)^2 = \sqrt{\frac{T}{\mu}}^2$$

Multiply both sides by μ $$(\mu)(2L)^2(f_1)^2 = \frac{T}{\mu}(\mu)$$

$$T = (\mu)(2L)^2(f)^2$$

MATH AND MUSIC

Algebra Featuring Mickey Hart

Tuning the Beam Workspace:

Note Name: D $T = (\mu)(2L)^2(f)^2$ $T = (0.120\ kg/m)(2*1.5748\ m)^2(588.58\ Hz)^2$ $T = (0.120\ kg/m)(3.1496\ m)^2(588.58\ Hz)^2$ $T = (0.120\ kg/m)(3.1496\ m)^2(588.58\ Hz)^2$ $T = (0.120)(9.91998)(346426.4164)$ $T = 412385.17\ N$	Note Name: E $T = (\mu)(2L)^2(f)^2$ $T = (0.120\ kg/m)(2*1.5748\ m)^2(331.13\ Hz)^2$ $T = (0.120\ kg/m)(9.91998)(109647.08)$ $T = 130523.62\ N$
Note Name: F# $T = (\mu)(2L)^2(f)^2$ $T = (0.120\ kg/m)(2*1.5748\ m)^2(367.93\ Hz)^2$ $T = (0.120\ kg/m)(9.91998)(135372.48)$ $T = 161147.08\ N$	Note Name: G $T = (\mu)(2L)^2(f)^2$ $T = (0.120\ kg/m)(2*1.5748\ m)^2(392.45\ Hz)^2$ $T = (0.120\ kg/m)(9.91998)(154017.00)$ $T = 183341.4672\ N$
Note Name: A $T = (\mu)(2L)^2(f)^2$ $T = (0.120\ kg/m)(2*1.5748\ m)^2(441.51\ Hz)^2$ $T = (0.120\ kg/m)(9.91998)(194931.08)$ $T = 232045.49\ N$	Note Name: B $T = (\mu)(2L)^2(f)^2$ $T = (0.120\ kg/m)(2*1.5748\ m)^2(490.57\ Hz)^2$ $T = (0.120\ kg/m)(9.91998)(240658.92)$ $T = 286479.80$
Note Name: C# $T = (\mu)(2L)^2(f)^2$ $T = (0.120\ kg/m)(2*1.5748\ m)^2(555.36\ Hz)^2$ $T = (0.120\ kg/m)(9.91998)(308424.73)$ $T = 367148.06\ N$	