

ukulele calculations

A = 0.72 mm T = 5.67 kg
0.072 cm

E = 0.83 mm T = 4.31 kg
0.083 cm

C = 1.04 mm T = 4.45 kg
0.104 cm

G = 0.74 mm T = 4.68 kg
0.074 cm

Tenor tuning

scale length = 43.2 cm

mass per unit volume = 1.1 g/cm³

Total force =

linear density (gm/cm) = $\pi r^2 \rho$ $\rho = 1.1$ ← for nylon

	A	E	C	G
linear density	0.004476	0.0059486515	0.004669808	0.002364263
frequency (Hz)	440	329.628	261.626	195.998
F _T (kg)	4.26	4.82	2.38	6.77

$F_T = 4 \rho L^2 f^2$

solve for force knowing frequency (43.2 cm)

A) $F_T = 4 \cdot 0.004476 \cdot 43.2^2 \cdot 440^2$
gm/cm cm Hz
 $F_T = 4 \cdot 0.004476 \cdot 1866.24 \cdot 193600$

$F_T = 4262839.68 \text{ gm cm/s}^2$ (Dynes)

$F_T = 4.26 \text{ kg}$

E) $F_T = 4 \rho L^2 f^2$

$F_T = 4 \cdot 0.0059486515 \cdot 43.2^2 \cdot 329.628^2$

$F_T = 1866.24 \cdot 108654.61$

$F_T = 4.82 \text{ kg}$

C) $F_T = 4 \cdot 0.004669808 \cdot 1866.24 \cdot 68448.1$

$F_T = 2.38 \text{ kg}$

G) $F_T = 4 \cdot 0.002364263 \cdot 1866.24 \cdot 38415.216$

$F_T = 6.77 \text{ kg}$

(A4-B4) (E4-f4) (C4-D4) (G3-A3) solved L for
new note

$$F_T = 4CL^2 f^2 \quad L = \sqrt{\frac{F_T}{4Cf^2}}$$

$$A4-B4 = 31.24$$

$$L = \sqrt{\frac{4262839.68}{4 \cdot 0.0059486515}} = 349.228$$

$$E4-f4 = 38.33$$

$$C4-D4 = 38.48$$

$$L = \sqrt{\frac{2386098.1964}{4 \cdot 0.004669808 \cdot 293.665^2}} = \sqrt{\frac{38.4869}{1610.8808}}$$

$$G3-A3 = 38.4866$$

$$L = \sqrt{\frac{677985.0922}{4 \cdot 0.002364263 \cdot 220^2}} = 457.7213$$