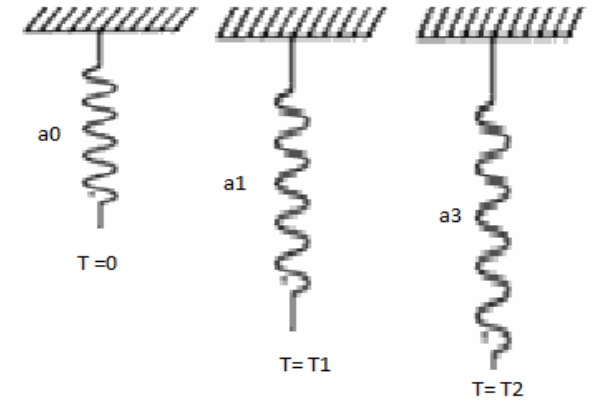
Answer on Question #62600, Physics / Mechanics | Relativity

A uniform elastic string has length a1 when tension is t1 and length a2 when tension is t2. The amount of work done in stretching it from its natural length-to-length a1+a2.

Solution:



$T_1=K\ (a_1-a_0)$

$T_2=K\ (a_2-a_0)$

K – Force constant of s string

a_0 – original length

$T_1 - T_2 = K\ a_1 - Ka_2$

$K= T_1 - T_2 / a_1 - a_2$

$T_1 = (T_1 - T_2 / a_1 - a_2) \times (a_1-a_0)$

$a_0 = a_1 - (T_1 (a_1 - a_2) / (T_1 - T_2)$

$a_0 = T_1a_1 - T_2 a_1 - T_1a_1 + T_1a_2) / (T_1 - T_2)$

$a_0 = T_1a_2 - T_2 a_1 / (T_1 - T_2)$

$a_3 = a_1 + a_2$

$$W = \int_{a_0}^{a_3} F(a)\,da = \int_{a_0}^{a_3} (ka)\,da = \frac{1}{2}ka_3{}^2 - \frac{1}{2}ka_0{}^2$$

$$W = \frac{1}{2}k(a_3{}^2 - a_0{}^2) = \frac{1}{2}\frac{(a_1T_1 - a_2T_2)^2}{T_1 - T_2(a_1 - a_2)}$$

Answer: $\frac{1}{2}\frac{(a_1T_1-a_2T_2)^2}{T_1-T_2(a_1-a_2)}$