**Answer on Question 66683, Physics, Mechanics, Relativity**

**Question:**

A $2\,m$ long string vibrates in 4 loops at $50\,Hz$. The linear density of the string is $0.0004\ g/cm$. Calculate the tension in the string.

**Solution:**

We know from the conditions of the task that the string vibrates in 4 loops. One complete wave in a standing wave pattern consists of two loops. Therefore, the length of the string is equal to two wavelengths of the wave:

$$L = \frac{1}{2}n\lambda = \frac{4}{2}\lambda = 2\lambda,$$

here, $L$ is the length of the string, $n$ is the number of the loops, $\lambda$ is the wavelength.

From this formula we can find the wavelength of the wave travelling in the string:

$$\lambda = \frac{L}{2} = \frac{2\,m}{2} = 1\,m.$$

Then, we can find the velocity of the wave from the wave speed formula:

$$v = f\lambda,$$

here, $v$ is the velocity of the wave, $f$ is the frequency and $\lambda$ is the wavelength.

Let's substitute the numbers:

$$v = f\lambda = 50\,Hz \cdot 1\,m = 50\,\frac{m}{s}.$$

Finally, we can find the tension in the string from the formula:

$$v = \sqrt{\frac{T}{\mu}},$$

here, $v$ is the velocity of the wave in the string, $T$ is the tension in the string, $\mu$ is the linear density of the string.

Then, we get:

$$v^2 = \frac{T}{\mu},$$

$$T = \mu v^2 = 0.00004\ \frac{kg}{m} \cdot \left(50\ \frac{m}{s}\right)^2 = 0.1\ N.$$

**Answer:**

$T = 0.1\ N.$