Answer on Question 50742, Physics, Mechanics | Kinematics | Dynamics

Question:

A bullet loses $(1/n)$-th of its velocity when it passes through one plank. How many such planks are required to stop the bullet?

Solution:

Let the initial velocity of the bullet would be v, then its velocity after it passing through the first plank would be $v\left(1-\frac{1}{n}\right)$. Let us assume that the energy loss per plank is constant. Then, we can use the law of conservation of energy (total initial energy of the bullet is equal to the total energy loss while it passing through N planks):

$$\frac{1}{2}mv^2 = \left(\frac{1}{2}mv^2 - \frac{1}{2}m\left(v-\frac{v}{n}\right)^2\right)N.$$

Therefore, we can obtain the number of planks that are required to stop the bullet:

$$N = \frac{\frac{1}{2}mv^2}{\frac{1}{2}mv^2 - \frac{1}{2}mv^2\left(1-\frac{1}{n}\right)^2} = \frac{1}{1-\left(1-\frac{1}{n}\right)^2} = \frac{n^2}{2n-1}.$$

Answer:

The number of planks that are required to stop the bullet is $N = \frac{n^2}{2n-1}$.