Answer on Question 75610, Physics, Other

Question:

Calculate the net force acting on a $65.0\ g$ arrow as it accelerates forward from rest to a speed of $75.0\ m/s$ over a distance of $80.0\ cm$.

Solution:

The Newton's Second Law of Motion states that the acceleration of a body is directly proportional to the net force acting on it and is inversely proportional to its mass. We can state the Newton's Second Law of Motion mathematically as follows:

$$F_{net} = ma,$$

where, F_{net} is the net force acting on the body, m is the mass of the body, a is its acceleration.

Therefore, in order to find the net force acting on an arrow we need to find its acceleration. We can find the acceleration of an arrow from the kinematic equation:

$$v^2 = v_0^2 + 2as,$$

here, $v_0 = 0$ is the initial speed of an arrow, $v = 75.0\ m/s$ is the final speed of an arrow, a is the acceleration of an arrow and s is the distance.

Then, from this formula we can find the acceleration of an arrow:

$$a = \frac{v^2}{2s} = \frac{\left(75.0\ \frac{m}{s}\right)^2}{2 \cdot 0.8\ m} = 3516\ \frac{m}{s^2}.$$

Finally, we can find the net force acting on an arrow:

$$F_{net} = ma = 3516\ \frac{m}{s^2} \cdot 0.065\ kg = 228.5\ N.$$

Answer:

$F_{net} = 228.5\ N.$