Answer on Question #40600, Physics, Mechanics

Question:

A sprinter reaches his maximum speed in 2.5 second from rest with constant acceleration. he then maintains that speed and finishes the 100 yards in the overall time of 9.6 seconds. Determine the maximum speed?

Answer:

Acceleration:

$$v = at_a$$

t_a – time of acceleration, a is acceleration

$$t_a = \frac{v}{a}$$

Distance travelled:

$$l_a = \frac{at_a^2}{2} = \frac{vt_a}{2}$$

For uniform motion distance equals:

$$l_u = v \cdot t_u$$

$t_u = t - t_a$ – time of uniform motion

Total distance equals:

$$vt_u + \frac{v}{2}t_a = l$$

$$v = \frac{l}{t_u + \frac{t_a}{2}} = \frac{l}{t - t_a + \frac{t_a}{2}} = \frac{l}{t - \frac{t_a}{2}} = \frac{91.44m}{9.6s - 2.5s} = 12.9\frac{m}{s}$$

Answer: $12.9\frac{m}{s}$