

An engineer must design a runway to accommodate airplanes that must reach a ground velocity of 61 m/s before they can take off. These planes are capable of being accelerated uniformly at the rate of 2.5 m/s². How long will it take the planes to reach take off speed? What must be the minimum length of the runway?

Velocity of the airplane equals:

$$v = at$$

where a – acceleration, t – time.

Therefore, time equals:

$$t = \frac{v}{a} = \frac{61}{2.5} \text{ s} = 24.4 \text{ s}$$

During this time plane covers the distance:

$$d = \frac{at^2}{2} = \frac{2.5(24.4)^2}{2} \text{ m} = 744 \text{ m}$$

Answer: time equals 24.4 s, minimum length of the runway equals 744 m