Answer on Question 68308, Physics, Mechanics | Relativity

Question:

An aeroplane taking off from a field has a run of 500 meters. What is the acceleration and take off velocity if it leaves the ground in 10 seconds.

Solution:

a) We can find the acceleration of an aeroplane from the kinematic equation:

$$d = v_0 t + \frac{1}{2} a t^2,$$

here, d is the distance travelling by the aeroplane before it take off, $v_0 = 0 \ m/s$ is the initial velocity of the aeroplane, a is the acceleration of the aeroplane and t is the time.

Then, we get:

$$d = \frac{1}{2} a t^2,$$

$$a = \frac{2d}{t^2} = \frac{2 \cdot 500 \ m}{(10 \ s)^2} = 10 \ \frac{m}{s^2}.$$

b) We can find the final velocity of the aeroplane as it leaves the ground from the kinematic equation:

$$v = v_0 + at,$$

$$v = at = 10 \ \frac{m}{s^2} \cdot 10 \ s = 100 \ \frac{m}{s}.$$

Answer:

a) $a = 10 \ \frac{m}{s^2}$.

b) $v = 100 \ \frac{m}{s}$.