Answer on Question#39995 – Physics - Mechanics | Kinametics | Dynamics

A 2400 W engine pulls a 200 kg block at constant speed up a 12.0 m long, 25.0° incline. Determine long does it takes to cover this distance

Solution:

$\mathrm{mg} = 200\mathrm{kg} - \text{mass of the block};$

$\alpha = 25° - \text{ angle of the plane with the horizontal};$

$\mathrm{P} = 2400\ \mathrm{W} - \text{power of the engine};$

$\mathrm{S} = 12.0\mathrm{m} - \text{traveled distance}$

$F - \ force\ which\ engine\ acts\ of\ the\ block$

The first law of equilibrium ($V = const$) along the X axis:

$$\mathrm{F} - \mathrm{mg_x} = 0$$

$$\mathrm{F} = \mathrm{mg_x} \qquad (1)$$

From the right triangle ABC:

$$\sin\alpha = \frac{\mathrm{mg_x}}{\mathrm{mg}};\ \mathrm{mg_x} = \mathrm{mg}\cdot\sin\alpha \qquad (2)$$

$(2)\mathrm{in}(1)$:

$$\mathrm{F} = \mathrm{mg}\cdot\sin\alpha$$

Work done by the engine:

$$\mathrm{A} = \mathrm{F}\cdot\mathrm{S} = \mathrm{mg}\cdot\mathrm{S}\sin\alpha \qquad (3)$$

Formula of the power (t – time of the work):

$$\mathrm{P} = \frac{\mathrm{A}}{\mathrm{t}} \Longrightarrow \mathrm{t} = \frac{\mathrm{A}}{\mathrm{P}} = \frac{\mathrm{mg}\cdot\mathrm{S}\sin\alpha}{\mathrm{P}} = \frac{200\mathrm{kg}\cdot 9.8\frac{\mathrm{N}}{\mathrm{kg}}\cdot 12\mathrm{m}\cdot\sin 25°}{2400\mathrm{W}} = 4.1\mathrm{s}$$

Answer: time to cover distance 12m is equal to $4.1\mathrm{s}$