

a car of 1000kg moves up a hill inclined at 30degree to the horizontal. if the total frictional force is 100N.find the force if the car is accelerating at 2m/s

Solution:

$m = 1000 \text{ kg}$ – mass of the car;

$\alpha = 30^\circ$ – angle with the horizon;

$F_f = 100\text{N}$ – total frictional force;

$a = 2 \frac{\text{m}}{\text{s}^2}$ – acceleration of the car;

Newton's second law for the car:

$$\vec{F}_f + \vec{m}\vec{g} + \vec{N} + \vec{F} = m\vec{a}$$

$$x: F - F_f - mg_x = ma \quad (1)$$

From the right triangle ABC:

$$\sin \alpha = \frac{mg_x}{mg} \Rightarrow mg_x = mg \sin \alpha \quad (2)$$

(2)in(1):

$$F - F_f - mg \sin \alpha = ma$$

$$F = ma + F_f + mg \sin \alpha = 1000\text{kg} \cdot 2 \frac{\text{m}}{\text{s}^2} + 100\text{N} + 1000\text{kg} \cdot 9.8 \frac{\text{N}}{\text{kg}} \cdot \sin 30^\circ$$

$$= 7000\text{N}$$

Answer: the force is $F = 7000\text{N}$.

