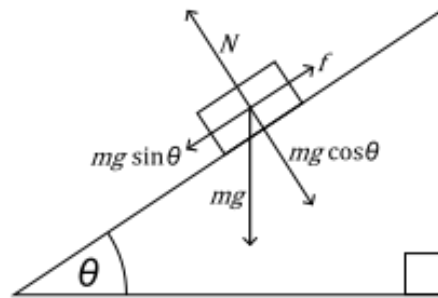# Answer on Question #44614, Physics, Mechanics | Kinematics | Dynamics

A cyclist starts from rest down a hill, of gradient 1 in 30. The gearing allows a constant tractive force of 180 N. The resistance to motion is 30 N. The total mass of cycle and cyclist is 85 kg. Calculate the constant acceleration in m/s².

Solution:

Given:

$m = 85$ kg,

$F = 180$ N,

$F_{fr} = f = 30$ N,

$a =?$

If the angle is expressed as a ratio (1 in n) then:

$$\theta = \tan^{-1}\left(\frac{1}{n}\right)$$

Thus,

$$\theta = \tan^{-1}\left(\frac{1}{30}\right) = 1.909°$$

The equation of motion is

$$ma = F + mg \sin\theta - F_{fr}$$

where g is the gravity acceleration constant (9.81 m/s²).

The acceleration is

$$a = \frac{F}{m} + g \sin\theta - \frac{F_{fr}}{m}$$

Thus,

$$a = \frac{180}{85} + 9.81 \cdot \sin 1.909° - \frac{30}{85} = 2.091 = 2.1 \text{ m/s}^2$$

Answer. $a = 2.1$ m/s².