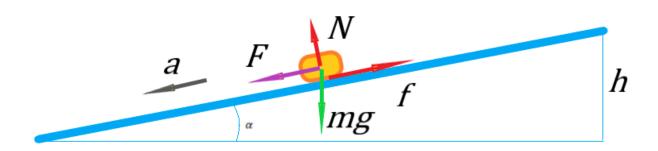Sam, whose mass is 75kg takes off down a 50m high, 10° slope on his jet powered skis. The skis have a thrust of 200N. Sam's speed at the bottom of the slope is 40m/s. What is the skis coeffecient of kinetic friction with the ice?

Solution

Calculate Sam's acceleration:

$$a = \frac{v^2}{2s} = \frac{v^2}{2 \cdot \dfrac{h}{\sin \alpha}} = \frac{v^2 \sin \alpha}{2h}.$$

According to Newton's second law:

$$ma = F - f + mg \sin \alpha,$$

where

$$f = \mu N = \mu mg \cos \alpha.$$

Thus,

$$\mu = \frac{F + m\left(g \sin \alpha - \dfrac{v^2 \sin \alpha}{2h}\right)}{mg \cos \alpha} = \frac{200 + 75(9.8 \sin 10° - \dfrac{40^2 \cdot \sin 10°}{2 \cdot 50}}{75 \cdot 9.8 \cdot \cos 10°} = 0.165.$$

Answer

$\mu = 0.165.$

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