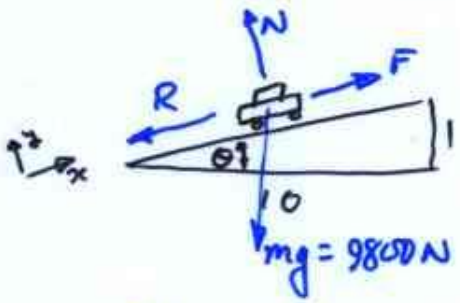
CAR, Mass = 1000kg. ENGINE PRODUCES 21kW GH0
climbs a hill

(a) when slope is 10%, steady speed of 15ms^{-1}, FIND Resistance to motion

(b) Slope flattens out to 4%, & speed still at initial 15ms^{-1} find initial accln (assume resistance unchanged).



R is resistance to motion

Power = 21 000 W

Power is $\vec{F} \cdot \vec{v}$

$\Rightarrow (F)(15) = 21000$

$\therefore F = \frac{21000}{15} = 1400N$

(a) Resolve mg into component DOWN HILL & NORMAL TO ROAD. DOWN-HILL $\Rightarrow (1000)(9.8)(\sin\theta) \approx 980N$

NO ACCLN

$\Rightarrow \Sigma F_x = 0 \Rightarrow F - R - (mg)_x = 0$

$R = F - (mg)_x = 1400 - 980 = 420N$

(b) Slope of 4% $\Rightarrow \sin\theta \approx 0.04$

$\therefore (mg)_x = (9800)(0.04) = 392N$

TRACTIVE force is still 1400N (Power & velocity unchanged)

Resistance still 420N (we're told this)

$\Sigma F_x = ma_x$

$\Rightarrow F - R - (mg)_x = (ma)_x$

$\frac{(1400 - 420 - 392)}{1000} = a_x \Rightarrow a_x = 0.59 ms^{-2}$

m ↗

NOTE
if power stays const, over time
$v \uparrow \Rightarrow F \downarrow \Rightarrow a \downarrow$ also.