A 1270-kg car is being driven up a 7.73 ° hill. The frictional force is directed opposite to the motion of the car and has a magnitude of 524 N. A force F is applied to the car by the road and propels the car forward. In addition to these two forces, two other forces act on the car: its weight W and the normal force FN directed perpendicular to the road surface. The length of the road up the hill is 247 m. What should be the magnitude of F, so that the net work done by all the forces acting on the car is 164 kJ?

Solution.

We have that the sum of all forces in direction, which is parallel to hill, is $F_{sum} = F - F_f - W\sin\alpha$, where $F_f = 524N$ is frictional force, $W = mg$ is weigt ($m = 1270kg$), $\alpha = 7.73^{\circ}$.

The net work is $A = F_{sum} \cdot L = 164kJ$, where $L = 247m$ is the length of the road up the hill.

From hence $F_{sum} = \frac{A}{L} = 664N$.

From hence, $F = F_{sum} + F_f + W\sin\alpha = 2862N$

Answer

$F = 2862N$