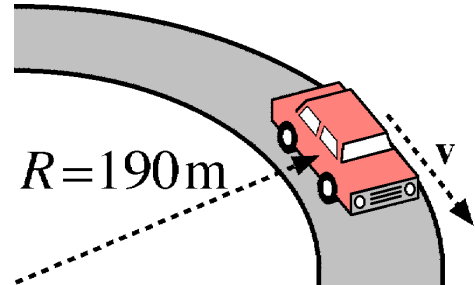


## Car around a corner

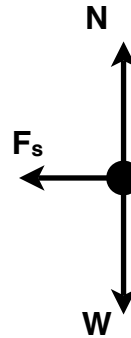
A car of mass 1.6 t travels at a constant speed of 72 km/h around a horizontal curved road with radius of curvature 190 m. (Draw a free-body diagram)

What is the minimum value of  $\mu_s$  between the road and the tyres that will prevent slippage?



### Solution:

Draw the free-body diagram. Looking at the car head on, so that the centre of the circle is to the left, there are three forces acting:



The centripetal force is provided by the friction between the tyres and the road. Thus

$$F_s = \mu_s N = mv^2/r$$

and since there is no net force in the vertical direction,

$$N = W = mg$$

so

$$\mu_s mg = mv^2/r$$

$$\mu_s = v^2/rg$$

Now  $v = 72 \text{ km/h} = 72,000/3600 \text{ ms}^{-1} = 20 \text{ ms}^{-1}$

so

$$\mu_s = 20^2 / (190 \times 9.8) = 0.21$$

This is the *minimum* value for  $\mu_s$ . If  $\mu_s$  is any smaller than this, then there won't be sufficient force towards the centre of the circle for the car to follow the curve and it will slip.