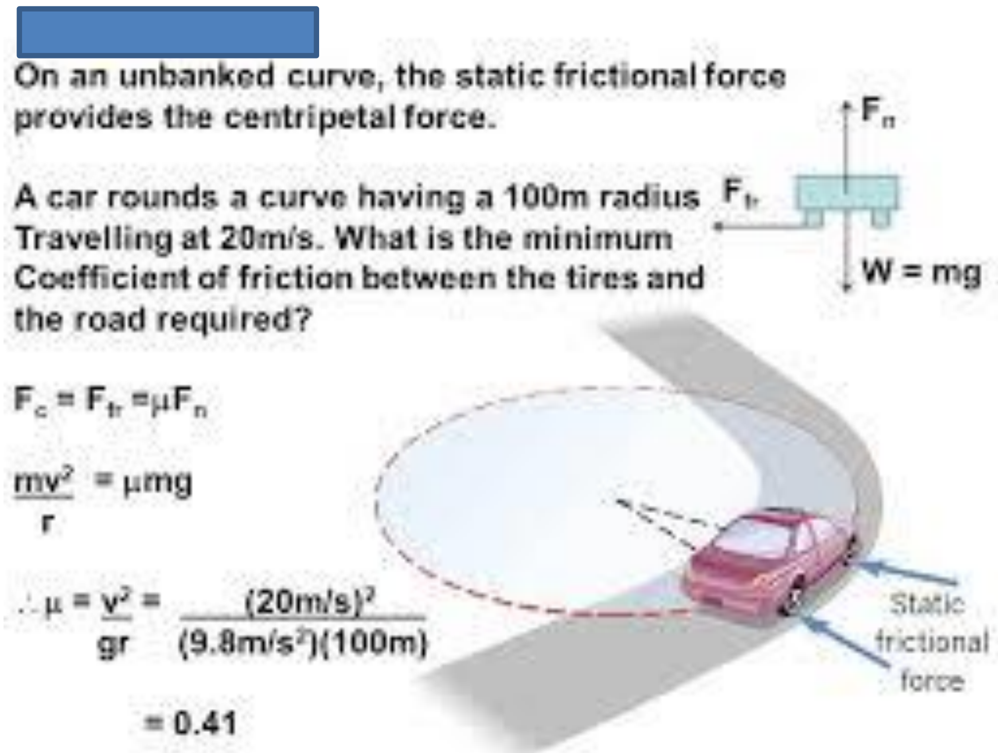
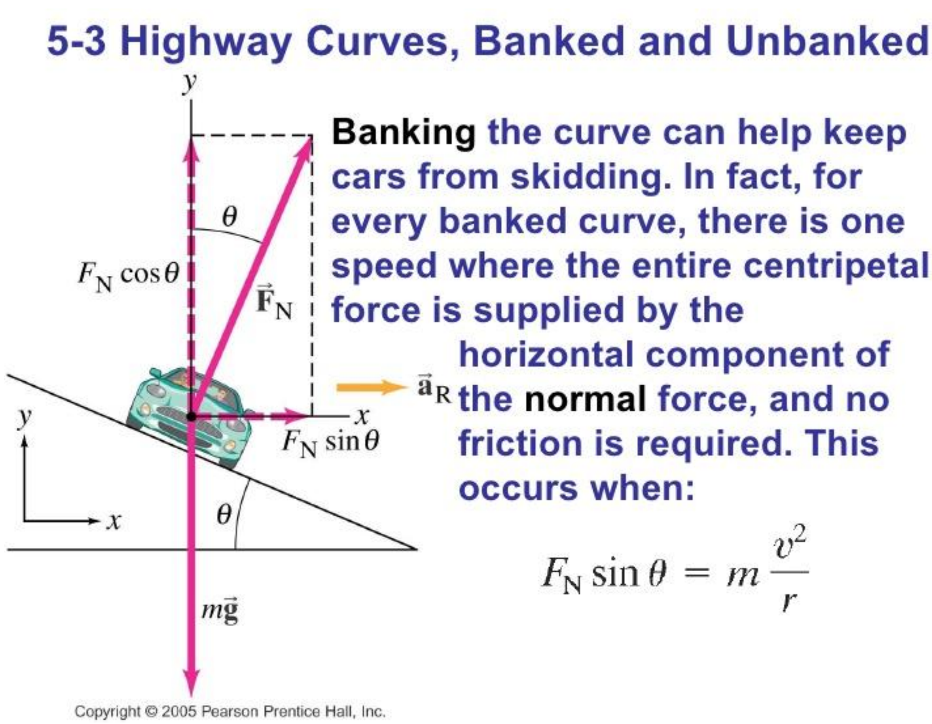
Physics of Banked and Unbanked Curves

Unbanked Curves



Banked Curves w/out Friction



Finding the banking angle for a given speed and radius (No friction force acting)

$$F_{net} = F_{centripetal}$$

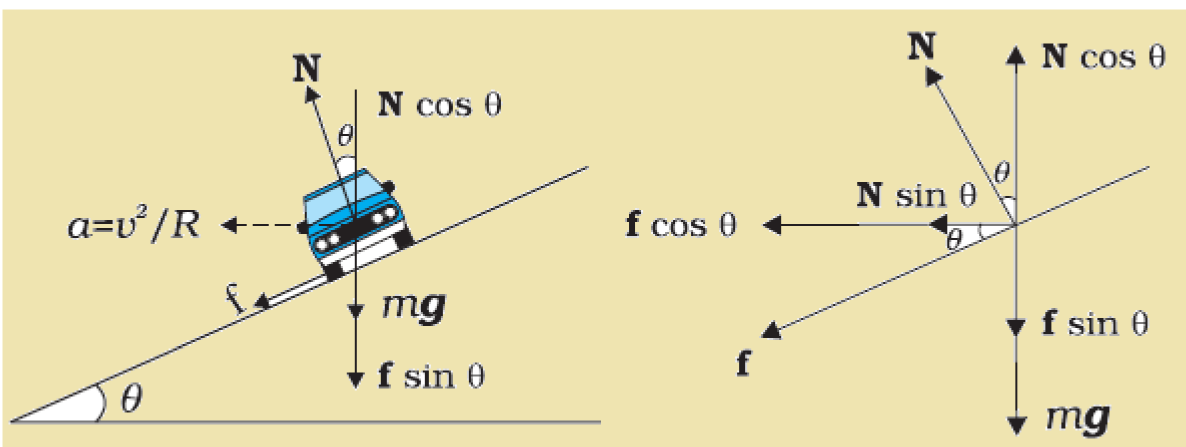
$$mg\tan\theta = \frac{mv^2}{r}$$

$$\tan\theta = \frac{v^2}{rg}$$

$$\theta = \tan^{-1}\left(\frac{v^2}{rg}\right) = \tan^{-1}\left[\frac{\left(25\frac{m}{s}\right)^2}{(100m)\left(9.8\frac{m}{s^2}\right)}\right] = 33^0$$

Banked Curves w/Friction

In this case, the friction force acts down the bank (opposite to the direction of impending motion – the car tends to slide up the bank) in addition to a component of the normal force. Both of these components add to provide the centripetal force. In this case friction would be an added advantage in helping the car to maintain circular motion around the curve.



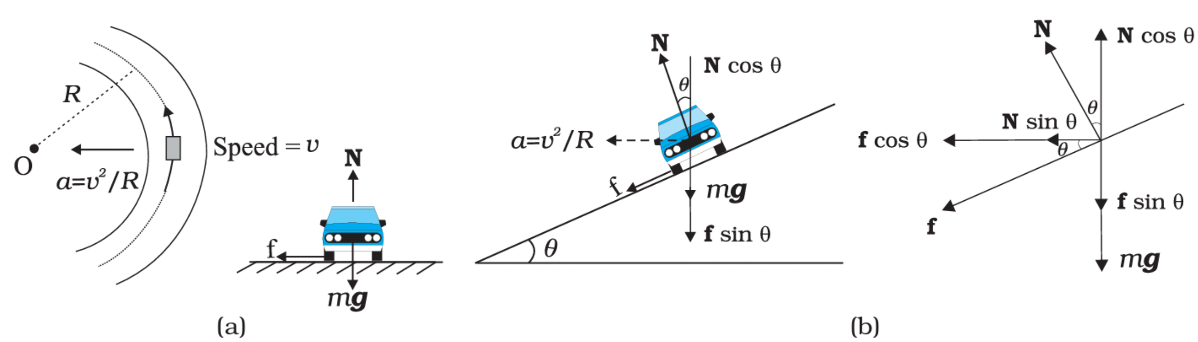


Fig. 5.14 *Circular motion of a car on (a) a level road, (b) a banked road.*