Circular Motion – Q2 [7 marks] (2/6/21)

Exam Boards

OCR : Mechanics (Year 1)

MEI: Mechanics b

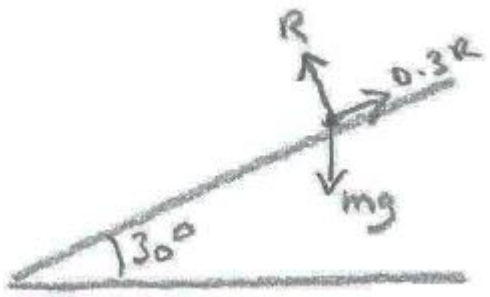
AQA: -

Edx: Mechanics 2 (Year 1)

A bike is being ridden round a circular track of radius 50m, banked at 30°. If the coefficient of friction is 0.3, what is the slowest speed possible? [7 marks]

A bike is being ridden round a circular track of radius 50m, banked at 30°. If the coefficient of friction is 0.3, what is the slowest speed possible? [7 marks]

Solution



Vertical equilibrium ⇒

$R\cos 30° + 0.3R\sin 30° = mg$ (1) [2 marks]

Circular motion ⇒ $R\sin 30° - 0.3R\cos 30° = \frac{mv^2}{50}$ (2) [2 marks]

(1)&(2) ⇒ $R = \frac{mg}{\cos 30° + 0.3\sin 30°} = \frac{mv^2}{50(\sin 30° - 0.3\cos 30°)}$ [1 mark]

$\Rightarrow v^2 = \frac{9.8(50)(0.5 - 0.3\left(\frac{\sqrt{3}}{2}\right))}{\frac{\sqrt{3}}{2} + 0.3(0.5)} = \frac{117.694}{1.01603} = 115.837$

$\Rightarrow v = 10.762 = 10.8\, ms^{-1}$ (3sf) [2 marks]