4

A cyclist made a left turn on a rough level road surface at a constant speed *v*, as shown in Fig. 4.1. The total mass of the bicycle and rider is *m* and their combined centre of gravity is at G.

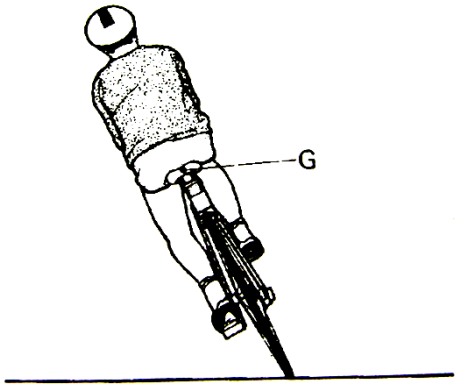

Fig. 4.1

(a)

In Fig. 4.1, draw and label all the forces acting on the system of the cyclist and his bicycle. Ignore forces parallel to the direction of motion. [2]

(b)

If the rider is negotiating a turn with a radius of curvature of 55 m, the total mass of the rider and bicycle is 80 kg, and the friction provided by the road surface is 70 N, calculate the speed with which he is turning.

speed = …….. m s^{-1}

[1]

(c)

The rider now makes the same left turn on a rough surface banked at 20° to the horizontal as shown in Fig. 4.2.

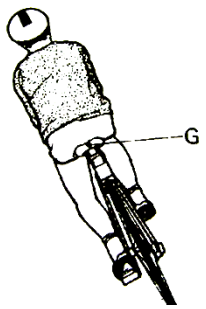

Fig. 4.2

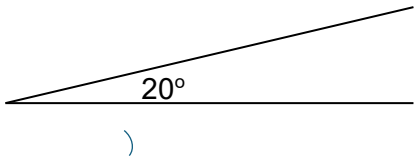

Fig. 4.2

Assuming that the frictional forces remain as 70 N, and radius of curvature is still 55 m,

(i)

explain how the banked surface assists the cyclist in travelling around the corner at a higher speed.

.....

.....

.....

.....[2]

(ii)

Calculate the new maximum speed with which the rider may negotiate the turn.

maximum speed = …….. m s^{-1}

[3]

[Total: 8]