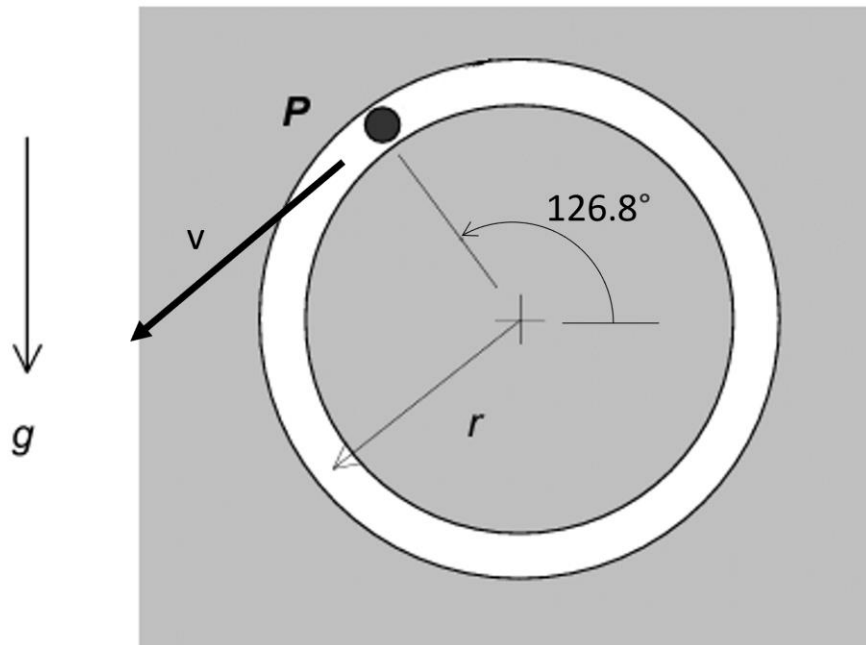


You may work in groups. You may use your book. You may not use the internet.

Particle P travels in a vertical plane within a smooth circular slot, where the radius of the slot is $r = 0.5$ meters. At the position shown below, the speed of P is known to be $v = 3$ m/sec. For this position:

- (a) P is in contact with the outer surface of the slot.
- (b) P is in contact with the inner surface of the slot.
- (c) P is in contact with neither surface of the slot.
- (d) More information is needed to answer this question

Provide a justification for your answer.



① FBD

P:



$$\phi = 90 - \theta$$

② Kinetics

$$\sum F_{en} = m \frac{v^2}{R} \Rightarrow -N + mg \cos \phi \Rightarrow N = m \left(\frac{v^2}{R} + g \cos \phi \right)$$

$$2 \cdot 9 > 9.81 + \cos \phi \Rightarrow N < 0 \Rightarrow \textcircled{a} \checkmark$$