$$
\begin{aligned}
K &= -\Delta GP \\
\frac{1}{2}mv^2 &= mg(H-y) \\
v^2 &= 2g(H-y)
\end{aligned}
$$

$$
\begin{aligned}
F_c &= m\frac{v^2}{r} \\
&= m\frac{2g(H-y)}{\frac{H}{2}} \\
&= 2mg\frac{H-\left(\frac{H}{2}+\frac{H}{2}\sin\theta\right)}{\frac{H}{2}} \\
&= 2mg\left(2-\frac{\frac{H}{2}(1+\sin\theta)}{\frac{H}{2}}\right) \\
&= 2mg\left(1-\sin\theta\right)
\end{aligned}
$$

$$
\begin{aligned}
W\sin\theta &> F_c \\
mg\sin\theta &> 2mg\left(1-\sin\theta\right) \\
\sin\theta &> 2-2\sin\theta \\
3\sin\theta &> 2 \\
\sin\theta &> \frac{2}{3} \\
\theta &> \boxed{41.8^\circ}
\end{aligned}
$$