First, let us note that there are total 3 forces with which must conspire to produce one needed \( F_c \)

The vertical force is totally zero

\[
T_1 \cos \theta = T_2 \cos \theta + mg
\]

where \( \cos \theta = \frac{(1.6m/s)}{1m} = 0.8 \Rightarrow T_1 - T_2 = \frac{mg}{0.8} = 1.25 \text{ mg} \ldots (1)

The horizontal force results in centripetal acceleration

\[
T_1 \sin \theta + T_2 \sin \theta = \frac{mv^2}{r} = \frac{m(\frac{2\pi r}{T})^2}{r} = \frac{4\pi^2 mr}{T^2}, \sin \theta = 0.6
\]

Thus, \( T_1 + T_2 = \frac{4\pi^2 mr}{0.6T^2} \ldots (2)

(1) + (2), \( 2T_1 = m(1.25 + \frac{4\pi^2 r}{0.6T^2}) \) where \( r = 1m, \sin \theta = 0.6 \ m

\[
\Rightarrow T_1 = \frac{1}{2} (0.5\text{ kg}) (1.25 \cdot (9.8 \text{ m/s}^2) + \frac{4\pi^2 (0.6\text{ m})}{0.6 (0.125\text{ sec})^2}) = 9.9N
\]

Plug into (1) \( T_2 = T_1 - 1.25 \text{ mg} = 9.9N - 1.25 (0.5\text{ kg})(9.8 \text{ m/s}^2) = 3.8N
\]

We need \( f_c = -M R w^2 \) to keep particle going on circle if the viscous force \( f_v \) becomes less than \( f_c \) the particle will be separated out

\[
f_v < ma_c = m w^2 R = 0.5 \times \sqrt{\frac{10 - 10}{10 - 6 \times 0.5}} = 1.4 \times 10^{-2} \text{ rad/s}
\]

The forces which provide \( F_c \) do no work since they are always perpendicular to the direction of motion of the mass.