The system shown is released from rest with the spring in its unstretched condition. The pulley is massless. Use energy methods.

(a) How far will \( m_1 \) move until the system is instantaneously at rest if the plane is frictionless?

(b) If the coefficients of friction between the block and plane are \( \mu_s = 0.33 \) and \( \mu_k = 0.44 \), how far will \( m_1 \) move before instantaneously coming to rest for the first time?

\[
\theta = 22.0^\circ \\
k = 1200 \text{ N/m} \\
m_1 = 14.30 \text{ kg} \\
m_2 = 17.25 \text{ kg}
\]

\[\begin{align*}
E_0 &= 0 = m_1 g x \sin \theta - m_2 g x + \frac{k}{2} x^2 \\
E_0 &= 0 = m_1 g x \sin \theta - m_2 g x + \frac{k}{2} x^2 \\
\Rightarrow \quad x &= \frac{2g (m_2 - m_1 \sin \theta)}{k} = \frac{9.8 \times 2 \times (17.25 - 14.3 \times \sin 22^\circ)}{1200} \\
&= 0.194 \text{ m}
\end{align*}\]

(b) Let us assume that the initial total energy is zero, which means that we measure the height change for each block from the original position (position).  

\[\begin{align*}
E_0 &= 0 = m_1 g x \sin \theta - m_2 g x + \frac{k}{2} x^2 + m_k m g \cos \theta x \\
x_1 &= \frac{2g (m_2 - m_1 \sin \theta)}{k} - \frac{2g m_k m g \cos \theta}{k} \\
&= 0.194 - \frac{2 \times 0.33 \cos 22^\circ \times 14.3 \times 9.8}{1200} = 0.123 \text{ m}
\end{align*}\]