SHOW ALL WORK!!!!
REPORT ALL NUMBERS TO THREE SIGNIFICANT FIGURES!
Use the conversion constants and data given on the front page.

Two pendulums of mass m and 2m and length ℓ are attached to the same point by strings. One of the pendulums is moved such that it makes a 90° angle with the vertical and released. Describe the motion (velocities) after collision and calculate the maximum angle (angles are + to the right and − to the left) each of these will move with the vertical after the collision if the collision is

(a) completely inelastic;
(b) perfectly elastic.
(c) Find the fraction of the initial energy lost in the collision for both (a) and (b).

\[ \text{Cons. of energy, body m} \]
\[ m g \ell = \frac{m v_0^2}{2} \rightarrow v_0 = \sqrt{2 g \ell} \]  

1. Elastic collision.

\[ \frac{m v_0^2}{2} = \frac{m v_1^2}{2} + \frac{2 m v_2^2}{2} \]
\[ v_0 = v_1 + 2 v_2 \]
\[ v_1 + 2 v_2 = v_0 - \frac{2}{3} \]

\[ \frac{m v_0^2}{2} = \frac{m v_1^2}{2} + \frac{2 m v_2^2}{2} \]
\[ v_0^2 = v_1^2 + 2 v_2^2 \]
\[ v_0 = v_1 + 2 v_2 \]
\[ 2 v_2 (3 v_2 - 2 v_0) = 0 \]
\[ v_2 = \frac{3}{2} v_0 \]
\[ \frac{v_1}{v_0} = \frac{1}{3} \]

\[ \Theta \theta _1 = 1 - \frac{v_1^2}{2 g \ell} = 1 - \frac{1}{3} \frac{9}{9} = 2 \left( 7.2 \right) \]

\[ \Theta \theta _2 = 1 - \frac{v_2}{9} = \frac{5}{9} = \Theta \theta _2 = 5 \left( 3 \right) \]

\[ \Delta \theta = \frac{3 m v_0^2}{2} - m g \ell = \frac{1}{3} m g \ell \]

\[ \Theta \theta _2 = 0 \quad \text{(energy is conserved)} \]

\[ \Theta \theta _a = 1 - \frac{v_1^2}{2 g \ell} = 1 - \frac{1}{3} \frac{9}{9} = 2 \left( 7.2 \right) \]