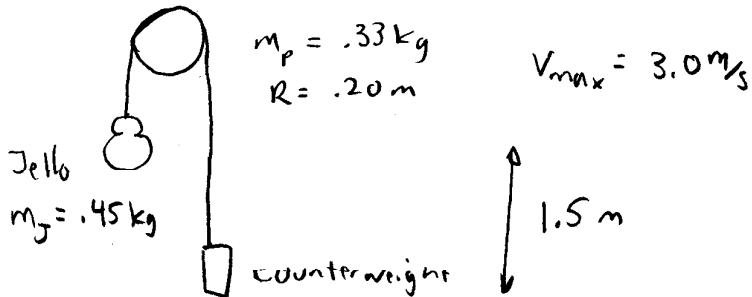


Problem A

Context-Rich Problems: Solutions Outline

FOCUS the PROBLEM

Draw a picture of the situation including ALL the information given in the problem.



Question(s): What is the problem asking you to find?

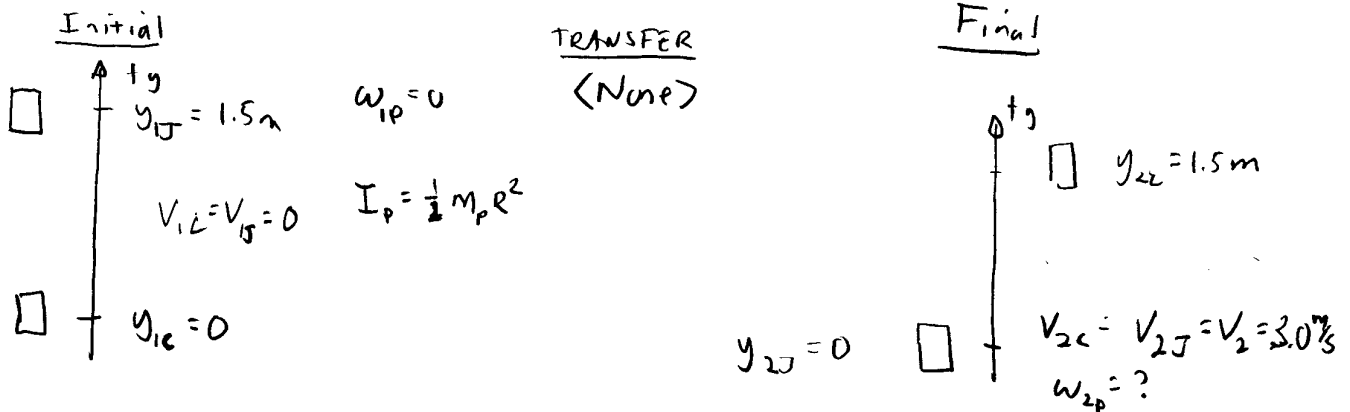
What should the counterweight's mass be so $v_{max} = 3.0 \text{ m/s}$

Approach: Outline the approach you will use.

Use conservation of energy including rotation

DESCRIBE the PHYSICS

Draw physics diagram(s) and define ALL quantities uniquely.



Which of your defined quantities is your Target variable(s)?

m_P

Quantitative Relationships: Write equations you will use to solve this problem.

$$W_{EXT} = \Delta K + \Delta U + \Delta E_{int}$$

$$\omega = VR$$

$$U = mgy$$

$$K = \frac{1}{2} mV^2 + \frac{1}{2} I\omega^2$$

PLAN the SOLUTION

Construct Specific Equations (Same Number as Unknowns)

$$W_{ext}^0 = \Delta K + \Delta U + \Delta E_{int}$$

$$K_1 + U_1 = K_2 + U_2$$

$$m_J g y_{1J} = \frac{1}{2} m_J v_2^2 + \frac{1}{2} m_C v_2^2 + \frac{1}{2} I \omega^2 + m g y_{2C}$$

$$m_J g y_{1J} = \frac{1}{2} m_J v_2^2 + \frac{1}{2} m_C v_2^2 + \frac{1}{2} (\frac{1}{2} m_p R^2) \frac{v_2^2}{R^2} + m g y_{2C}$$

Solve for m_C

$$m_C g y_{2C} + \frac{1}{2} m_C v_2^2 = m_J g y_{1J} - v_2^2 (\frac{1}{2} m_J + \frac{1}{4} m_p)$$

$$m_C (g y_{2C} + \frac{1}{2} v_2^2) = m_J g y_{1J} - v_2^2 (\frac{1}{2} m_J + \frac{1}{4} m_p)$$

$$m_C = \frac{m_J g y_{1J} - v_2^2 (\frac{1}{2} m_J + \frac{1}{4} m_p)}{g y_{2C} + \frac{1}{2} v_2^2}$$

Check Units

$$\frac{\frac{(m)(L)(L)}{(T)^2} - \frac{(L)^2}{(T)^2} (m)}{\frac{L}{(T)^2} (L) + \frac{(L)^2}{(T)^2}} = (m)!$$

EXECUTE the PLAN

Calculate Target Quantity(ies)

$$m_C = \{ (645 \text{ kg}) (9.8 \text{ m/s}^2) (1.5 \text{ m}) - (3.0 \text{ m/s})^2 (\frac{1}{2} (1.45 \text{ kg}) + \frac{1}{4} (1.83 \text{ kg})) \} \div \{ (9.8 \text{ m/s}^2) (1.5 \text{ m}) + \frac{1}{2} (3.0 \text{ m/s})^2 \} = \boxed{0.20 \text{ kg}}$$

EVALUATE the ANSWER

Is Answer Properly Stated?

Yes

Is Answer Unreasonable?

No, It is less than the Jello

Is Answer Complete?

Yes

(extra space if needed)