

EXAMPLE Q. 6/150

CONSTRAINED MOTION

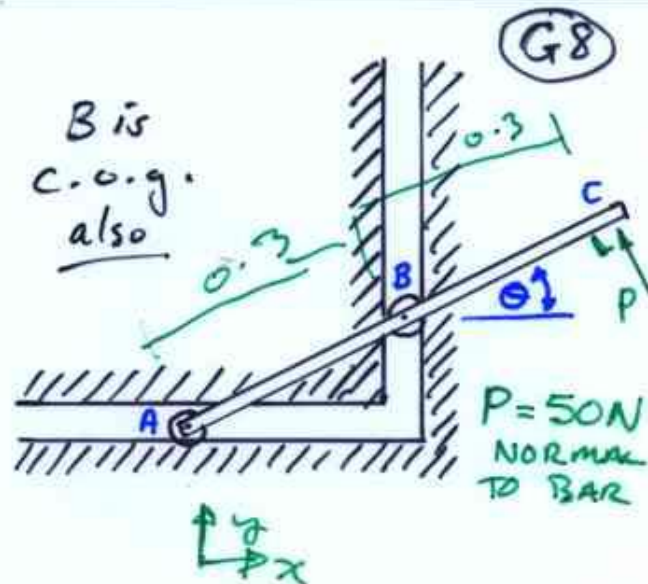
BAR LENGTH = 600 mm

MASS = 4 kg

starts @ $\theta = 0$

find velocity v at which
A will strike vertical support.

at $\theta = 90^\circ$.



Replace force P by a force + couple @ B

$$M = (50)(0.3) = 15\text{Nm}$$

$$U_{1 \rightarrow 2} = \Delta T + \Delta V_g \quad \text{no Ve term}$$

$$\Delta V_g \text{ is easy } \dots \Delta V_g = mg \Delta h = (4)(9.81)(0.3) = \underline{11.77\text{J}}$$

ΔT NEEDS A LITTLE MORE THOUGHT.

when $\theta = 90^\circ$ center of mass is STATIC

OBVIOUSLY $v_{Ax} = 0 \dots$ kinematics

$v_{Ay} = 0$ because it is @ peak of curve

$$\therefore \Delta T = \frac{1}{2} I_B \omega^2 = \frac{1}{2} \left(\frac{1}{12} (4) (0.6)^2 \right) \omega^2$$

$$v_A \text{ is vel of A } \Rightarrow \omega = \frac{v_A}{0.3}$$

$$\Delta T = \underline{0.667 v_A^2}$$

$$v = r\omega$$

SUBSTITUTE IN.

$$U_{1 \rightarrow 2} = \int_1^2 \vec{F} \cdot d\vec{r} + \int M d\theta$$

$$= \int_0^{0.3} 50 \cos \theta dy + \int_0^{\frac{\pi}{2}} 15 d\theta$$

