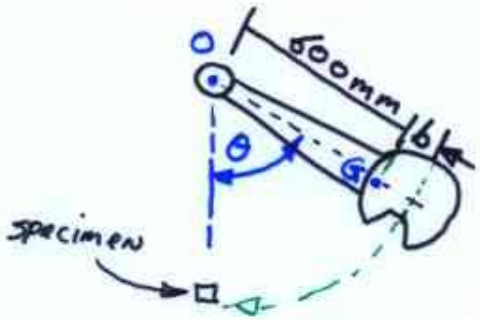
6/48 Impact tester

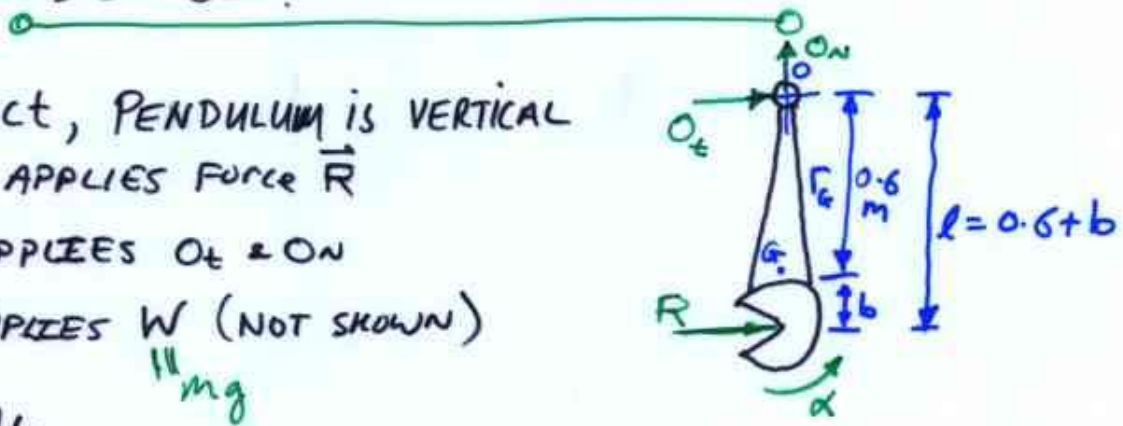
mass of pendulum 34kg

$k_o = 620\,mm$ radius of gyration

"b" has been chosen so that RXN at bearing O is minimised at impact.



FIND b & FIND force @ O WHEN pendulum is released $\rightarrow \theta = 60°$.



At impact, PENDULUM is VERTICAL

specimen APPLIES Force $\vec{R}$

BEARING APPLIES O_t & O_N

GRAVITY APPLIES W (NOT SHOWN) $W = mg$

$\sum F_t = m a_{G_t}$

$\overset{+}{\rightarrow} \Rightarrow O_t + R = m\overrightarrow{a_{G_t}} = m\overrightarrow{r\alpha}$

$$\boxed{R = m r_G \alpha - O_t} \quad (1)$$

Note $I_o = m k_o^2$

k_o = radius of gyration about O

$\sum M_o = I_o \alpha$

$$\Rightarrow \boxed{(R)(\ell) = I_o \alpha} \quad (2)$$

SUBST from (1) INTO (2)

$$(m r_G \alpha - O_t)(\ell) = I_o \alpha = m k_o^2 \alpha$$

we want to minimise O_t, so set it to ZERO.

$$\Rightarrow m r_G \alpha \ell = m k_o^2 \alpha$$

$$\Rightarrow \ell = \frac{k_o^2}{r_G} \quad \text{... center of percussion}$$

so $\ell = \dfrac{(0.620)^2}{(0.6)} = 0.6407\,m \Rightarrow \boxed{b = \ell - 0.6 = 40.7\,mm}$