13E

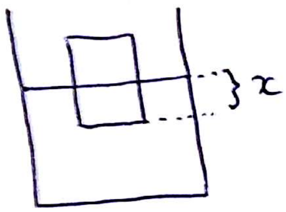
(6) rel. density = 0.6

$h = 80\,cm = 0.8\,m$
$w = 50\,cm = 0.5\,m$
$b = 20\,cm. = 0.2\,m.$

(i). at equilibrium, $F_{up} = F_{down}$.

F_{up} ↑ buoyant force

F_{down} ↑ weight.



F_{up} = weight of water displaced.

$= V\rho g$

$= (0.5)(0.2)(x)(1000)(g)$

$= \boxed{100gx}$ N.

F_{down} = weight of block.

$= V\rho g$

$= (0.5)(0.2)(0.8)(600)(g)$

$= \boxed{48g}$ N

$\therefore\ 100\cancel{g}x = 48\cancel{g}$

$100x = 48$

$x = 0.48\,m = \boxed{48\,cm}$

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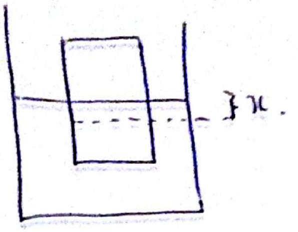
(ii).



$F_B = -V\rho g$

$= -(0.5)(0.2)(x)(1000)(g)$

$= -100gx.$

$ma = -100gx.$

- $m = V\rho$

$= (0.5)(0.2)(0.8)(600)$

$= 48 \text{ kg}.$

$\therefore 48a = -100gx.$

$$\boxed{a = -\frac{100g}{48}x.}$$

$\therefore$ SHM.

$$\omega^2 = \frac{980}{48}$$

$$\boxed{\omega = \sqrt{\frac{245}{12}}}$$

$\therefore$ angular velocity $= \sqrt{\frac{245}{12}}$

$a = -\omega^2 x$

$a_{max} = -\omega^2 A = \underline{\underline{\omega^2 A}}$ ← NB: max acceleration when x at extreme position.

- $\omega = \sqrt{\frac{245}{12}}$, $A = 2\,cm = 0.02\,m.$

$\therefore a_{max} = \left(\frac{\sqrt{245}}{12}\right)^2 (0.02)$

$= \boxed{\frac{49}{120}}\ m/s^2$