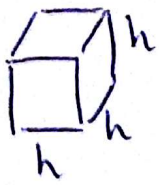
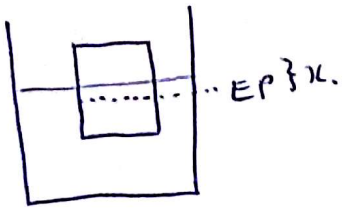
13E

⑤ 

relative density = s

(i).

- 

Archimedes' principle –
Force upwards (buoyant)
= weight of water displaced

$B = -mg$

$B = -Vpg$

$B = -(h^2 x)(1000)(g)$

$B = \boxed{-1000h^2 g x}$

(*) negative, because force opposite to displacement!
(⊕↓ ↑⊖)

(*) = force upwards when block pushed down distance x.

- what's the mass of the whole block?

$m = Vp = h^3(1000s)$

$m = \boxed{1000h^3 s}$

- back to our buoyant force

$B = -1000h^2 g x$

$ma = -1000h^2 g x$

$(1000h^3 s)a = -1000h^2 g x$

$$hsa = -gx$$

$$\boxed{a = -\frac{g}{hs}x.} \quad \therefore \text{ SHM.}$$

$$a = -\omega^2 x.$$

$$\therefore \omega^2 = \frac{g}{hs}$$

$$\therefore \boxed{\omega = \sqrt{\frac{g}{hs}}} \quad \therefore \text{ angular velocity } = \sqrt{g/hs}.$$

$$T = \frac{2\pi}{\omega} = \frac{2\pi}{\sqrt{g/hs}}$$

$$T = \boxed{2\pi\sqrt{\frac{hs}{g}}} \quad \therefore \text{ periodic time } = 2\pi\sqrt{hs/g}$$

(ii). if relative density of water = k :

- $B = -1000kh^2gx.$
- $ma = -1000kh^2gx.$
- $(1000h^2s)a = -1000khgx.$

$$hsa = -kgx.$$

$$a = -\frac{kg}{hs}x.$$

$$\omega = \sqrt{\frac{kg}{hs}} \quad \therefore T = \boxed{2\pi\sqrt{hs/kg}}$$

(*) following exactly same steps as before.