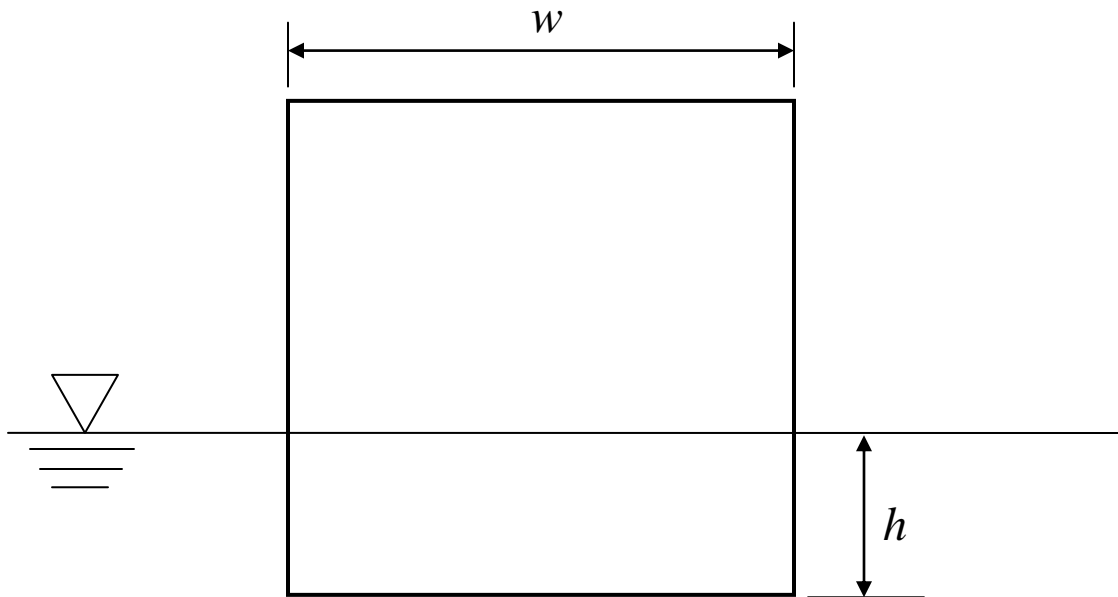
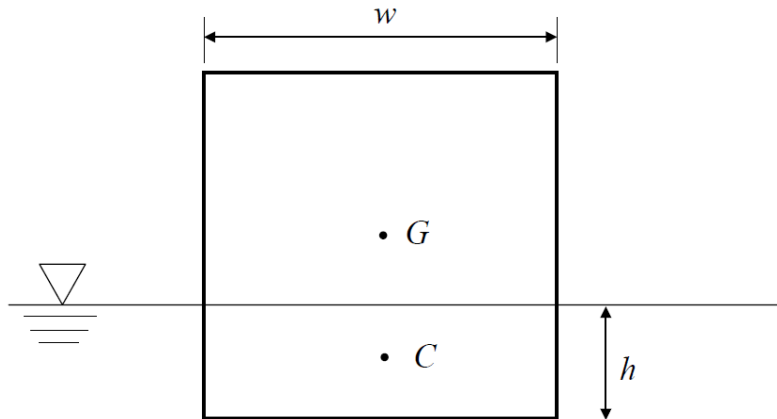


A floating body has a square cross-section of side w and a length L into the paper (not shown in the figure). The center of gravity (G) of the floating body is at the centroid of the cross-section. (a) Determine the ratio h/w for which the body is neutrally stable. (b) If the body is floating in water, what would be the specific gravity of the body material?



Solution:



(a) For neutral stability $GM = 0$, or

$$GM = \frac{I_{00}}{\nabla} - CG = 0$$

where

$$I_{00} = \frac{w^3 L}{12}$$

$$\nabla = hwL$$

$$CG = \frac{w}{2} - \frac{h}{2}$$

or,

$$\left(\frac{h}{w}\right)^2 - \frac{h}{w} + \frac{1}{6} = 0$$

Thus,

$$\frac{h}{w} = 0.211 \text{ or } 0.789$$

(b) The weight of the body is equal to the weight of water displaced.

$$\gamma_b V_b = \gamma \nabla$$

Therefore

$$S = \frac{\gamma_b}{\gamma} = \frac{\nabla}{V_b} = \frac{whL}{w^2L} = \frac{h}{w} = 0.211 \text{ or } 0.789$$