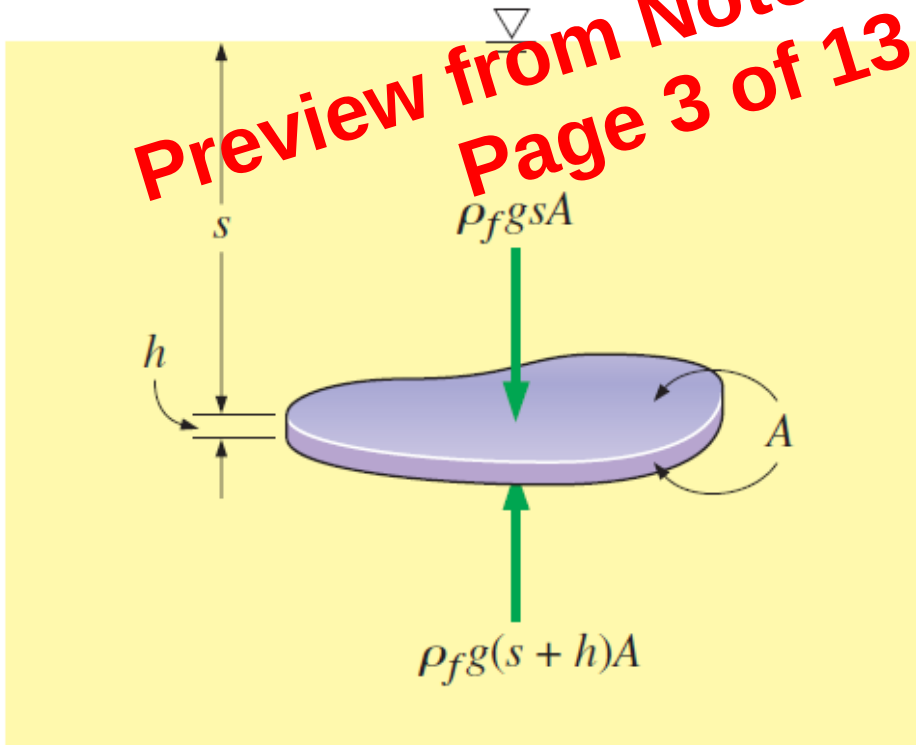


Buoyancy – Buoyant Force

Buoyant force: The upward force a fluid exerts on a body immersed in it. The buoyant force is caused by the increase of pressure with depth in a fluid.



The buoyant force acting on the plate is equal to the weight of the liquid displaced by the plate.

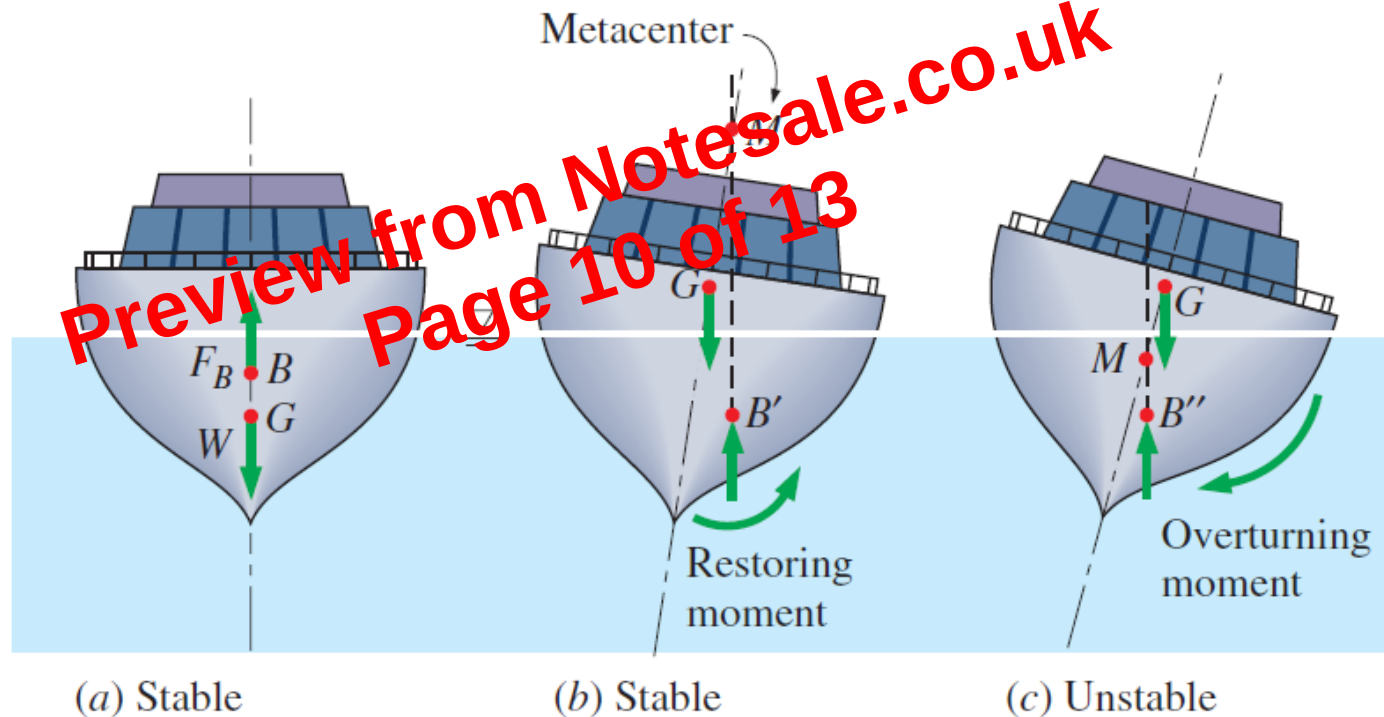
For a fluid with constant density, the buoyant force is independent of the distance of the body from the free surface.

It is also independent of the density of the solid body.

A flat plate of uniform thickness h submerged in a liquid parallel to the free surface.

$$F_B = F_{\text{bottom}} - F_{\text{top}} = \rho_f g (s + h) A - \rho_f g s A = \rho_f g h A = \rho_f g V$$

Stability of Immersed and Floating Bodies (cont'd)



A floating body is *stable* if the body is bottom-heavy and thus the center of gravity G is below the centroid B of the body, or if the metacenter M is above point G . However, the body is *unstable* if point M is below point G .

Metacentric height GM : The distance between the center of gravity G and the metacenter M —the intersection point of the lines of action of the buoyant force through the body before and after rotation.

The length of the metacentric height GM above G is a measure of the stability: the larger it is, the more stable is the floating body.