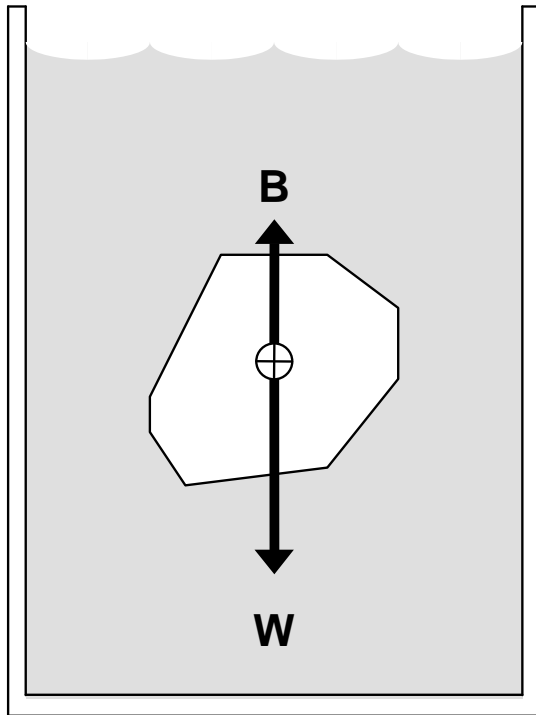


## Bouyancy



An object either fully or partially submerged in a fluid is acted on by a downward force,  $W$ , equal to its weight and an upward force,  $B$ , equal to the weight of the fluid displaced by the object.

That's why concrete canoes (and steel ships) float; they are shells that use a relatively small amount of material to displace a much larger amount of water.

A concrete canoe 20' long and 2.5' wide displaces approximately 2000 lb of water and yet weighs less than 200 lb!

This phenomenon, called buoyancy, is the basis of the specific gravity test for aggregate.

If we weigh an object in air, then weigh it suspended in water, the difference is just the weight of water displaced by the object:

$$W_{in\ air} - W_{in\ water} = W_{water\ displaced}$$

If we divide the weight of the object in air by the weight of water displaced by the object, we get the specific gravity of the object:

$$\frac{W_{in\ air}}{W_{water\ displaced}} = \frac{\gamma_{object} V_{object}}{\gamma_{water} V_{object}} = \frac{\gamma_{object}}{\gamma_{water}} = G_s$$

where the symbol  $\gamma$  denotes the unit weight. Note that if we know the weight of water displaced by the object, we can also compute its volume:

$$\gamma_{water} V_{object} = W_{water\ displaced} \quad \Rightarrow \quad V_{object} = \frac{W_{water\ displaced}}{\gamma_{water}}$$

This is a convenient way to determine the volume of objects with irregular shapes.