Problem:

A boat carrying number of stones is floating in a water tank. If the stones are unloaded into water, then water level will:

fall

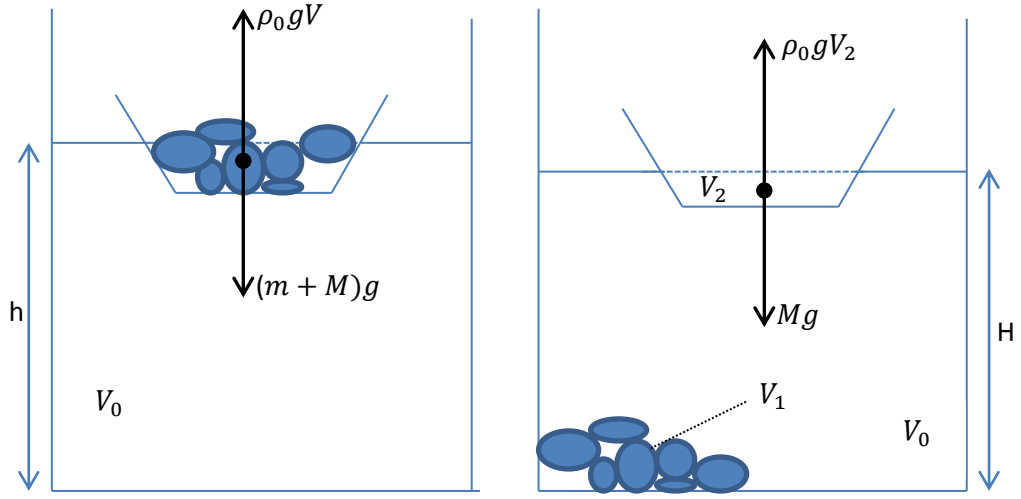
Rise

Remain unchanged

Depends on no. of stones

Solution:

Everything depends on the density of stones in comparison to water. As usual, density of stones is bigger than the density of water. Let's consider this situation in detail (see figures below).



The equilibrium conditions for boat with stones and without it are:

$$(m+M)g = \rho_0 gV$$

$$Mg = \rho_0 gV_2$$

Thus,

$$\begin{cases} V = \dfrac{m+M}{\rho_0} \\ V_2 = \dfrac{M}{\rho_0} \\ V_1 = \dfrac{m}{\rho_0} \\ \rho_0 < \rho \end{cases}$$

where

V – volume of displaced water by boat with stones

V_2 – volume of displaced water by boat without stones

m – mass of all stones together

M – mass of the boat

ρ_0 – density of the water

ρ – density of stones

V_1 – volume of displaced water by all stones

In assumption that base area is S,

$$\begin{cases} h = \dfrac{V + V_0}{S} = \dfrac{M + m}{S\rho_0} + \dfrac{V_0}{S} \\ H = \dfrac{V_1 + V_2 + V_0}{S} = \dfrac{m}{S\rho} + \dfrac{M}{S\rho_0} + \dfrac{V_0}{S} \end{cases}$$

Where h and H are initial and final levels of water in tank correspondingly. After comparison of h and H we can conclude that

$$h > H$$

in assumption that $\rho_0 < \rho$ (stones are heavier than water). So that the level of water will fall down if the stones are unloaded into water.