Develop a Winning Case Strategy

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Pressure function in the fluid $P(x, y, z) = \rho g(H - y)$

$\overrightarrow{dF}$ = Force exerted on the body by the fluid at the infinitesimal surface area $\overrightarrow{dA}$

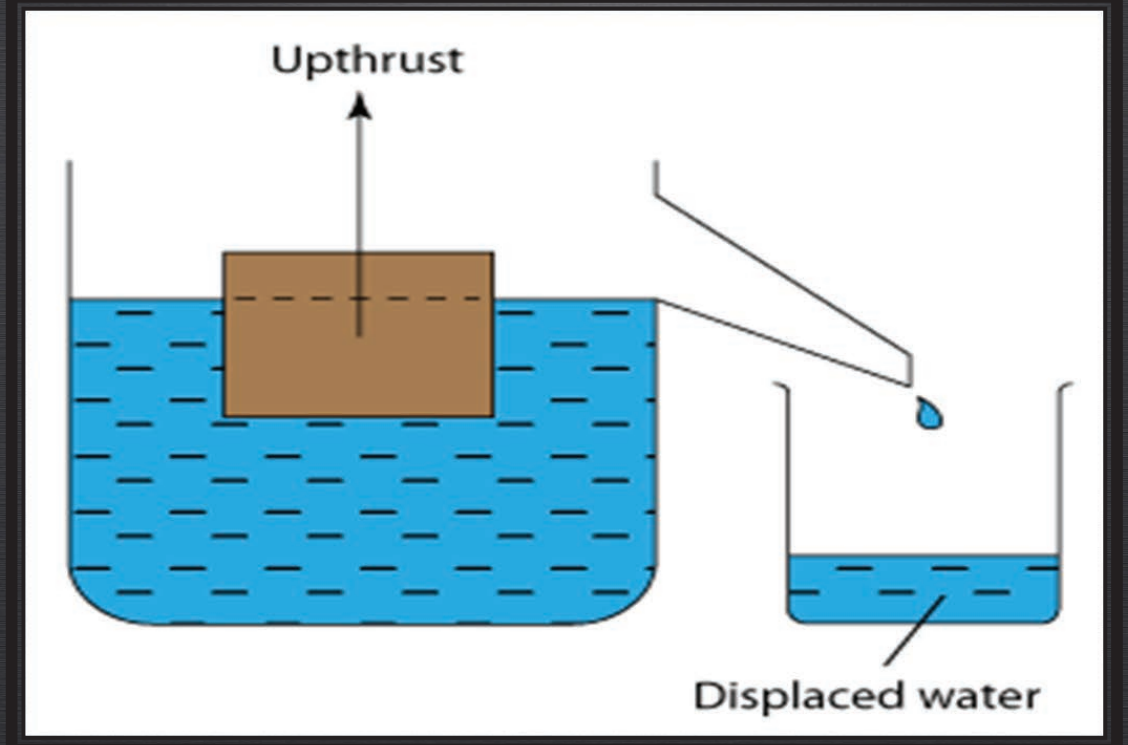
Let $\overrightarrow{dF_y}$ be the y-component of $\overrightarrow{dF}$ and $\overrightarrow{P} = \rho g(H - y)\hat{j}$

So, $\overrightarrow{dF_y} = -(\overrightarrow{dA} \cdot \overrightarrow{P})\hat{j}$

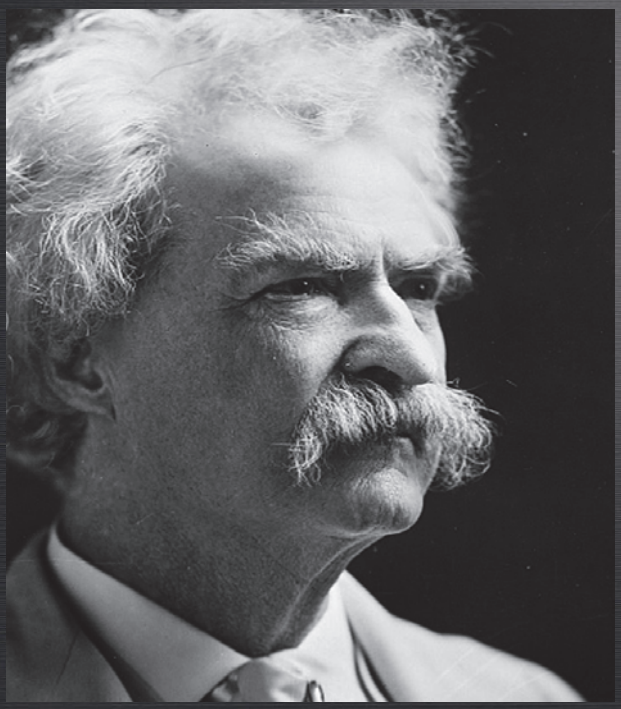
Magnitude of net buoyant force

$$= \oint_A \|\overrightarrow{dF_y}\|$$
$$= \oint_A -(\overrightarrow{dA} \cdot \overrightarrow{P})$$
$$= \oint_A (-\overrightarrow{P}) \cdot \overrightarrow{dA}$$
$$= \oint_V \nabla \cdot (-\overrightarrow{P}) d\tau \qquad \text{(Divergence Theorem)}$$
$$= \oint_V (\nabla \cdot (-\rho g(H - y)\hat{j}))d\tau$$
$$= \oint_V (\nabla \cdot (\rho g(y - H)\hat{j}))d\tau$$
$$= \oint_V \rho g d\tau$$
$$= \rho g V = \text{weight of displaced fluid}$$

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"It is easier to manufacture seven facts than one emotion."

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Also available as part of the eCourse
[Answer Bar: Taking Your Car Crash Case to Trial]

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