

Develop a Winning Case Strategy

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

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

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

So, $\vec{dF}_y = -(\vec{dA} \cdot \vec{P})\hat{j}$

Magnitude of net buoyant force

$$= \oint_A \|\vec{dF}_y\|$$

$$= \oint_A -(\vec{dA} \cdot \vec{P})$$

$$= \oint_A (-\vec{P}) \cdot \vec{dA}$$

$$= \oint_V \nabla \cdot (-\vec{P}) d\tau \quad (\text{Divergence Theorem})$$

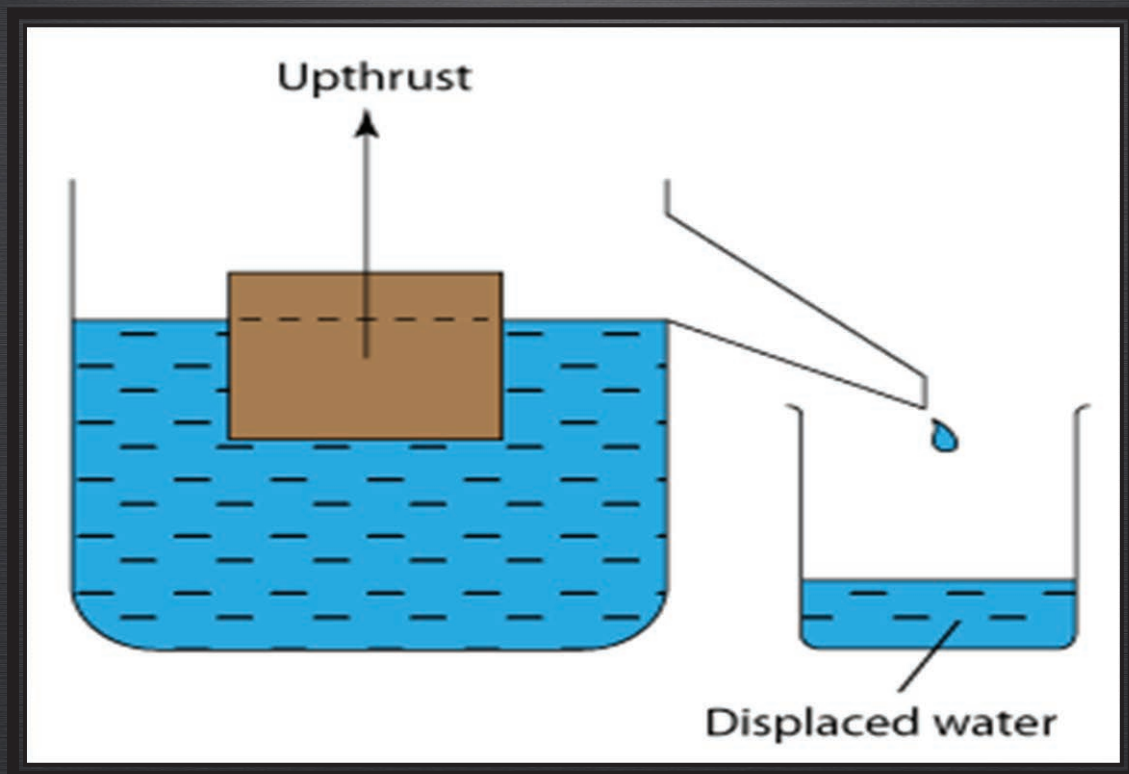
$$= \oint_V (\nabla \cdot (-\rho g(H - y)\hat{j})) d\tau$$

$$= \oint_V (\nabla \cdot (\rho g(y - H)\hat{j})) d\tau$$

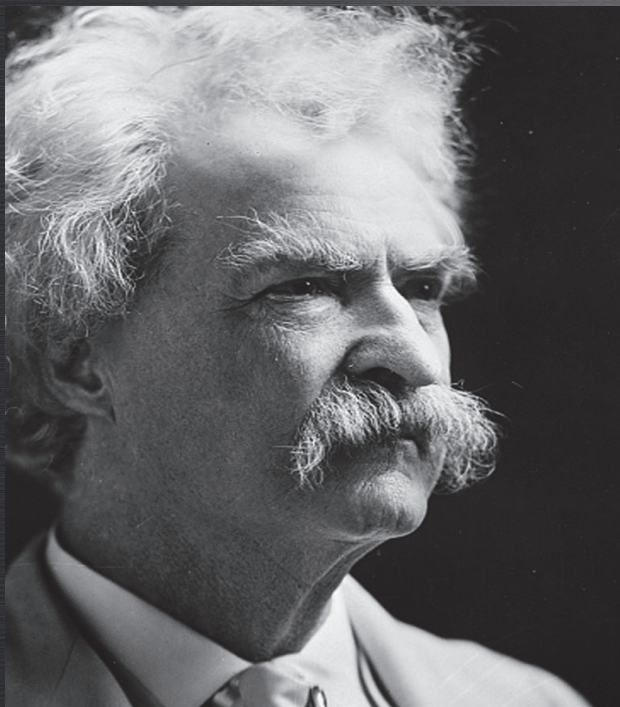
$$= \oint_V \rho g d\tau$$

$$= \rho g V = \text{weight of displaced fluid}$$

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“It is easier to
manufacture seven
facts than one
emotion.”

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