A vertical U tube of uniform cross-section contains water in both the arms .A 10cm glycerin column (R.D=1.2)is added to one of the limbs .the level difference b/w the two free surface in the two limbs will be ?

Solution:

$h_h = 10\text{cm} = 0.1\text{m} - \text{hight of the glycerin in first arm;}$

$h_w - \text{hight of the water in second arm;}$

$\rho_w = 1000\frac{\text{kg}}{\text{m}^3} - \text{density of the water;}$

$\rho_h = 1200\frac{\text{kg}}{\text{m}^3} - \text{density of the glycerin;}$

$x - \text{level difference b/w the two free surface in the two limbs;}$

Pressures at level AA' of the water and glycerin are equal:

$AA': p_w = p_h$

$\rho_h g h_h = \rho_w g h_w \qquad (1)$

$h_w = h_h + x \qquad (2)$

$(2)\text{in}(1):$

$\rho_h g h_h = \rho_w g(h_h + x)$

$\rho_h h_h = \rho_w h_h + \rho_w x$

$$x = \frac{\rho_h h_h - \rho_w h_h}{\rho_w} = \frac{0.1\text{m}\left(1200\frac{\text{kg}}{\text{m}^3} - 1000\frac{\text{kg}}{\text{m}^3}\right)}{1000\frac{\text{kg}}{\text{m}^3}} = 0.02\text{m} = 2\text{cm}$$

Answer: the level difference b/w the two free surface in the two limbs will be 2cm.