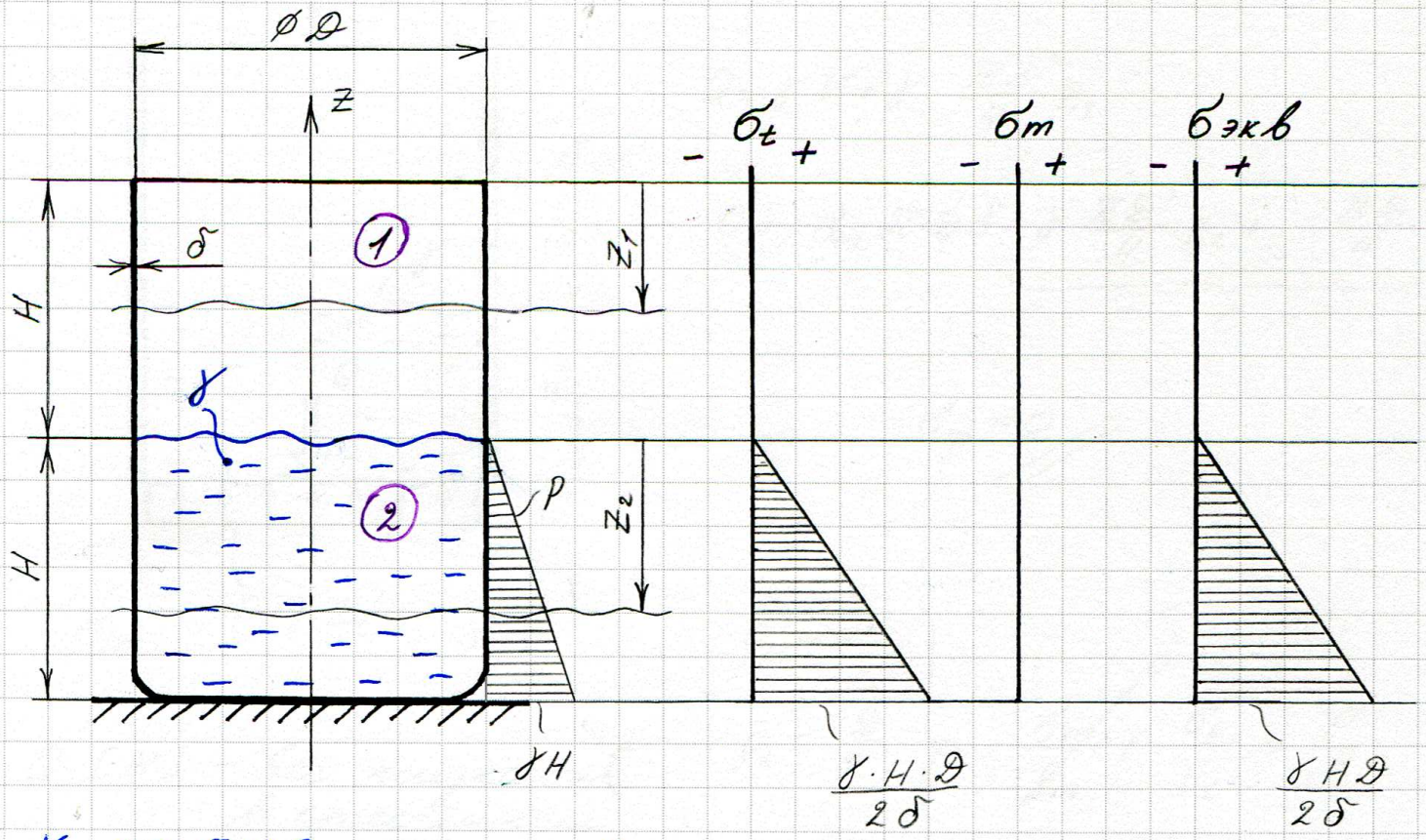
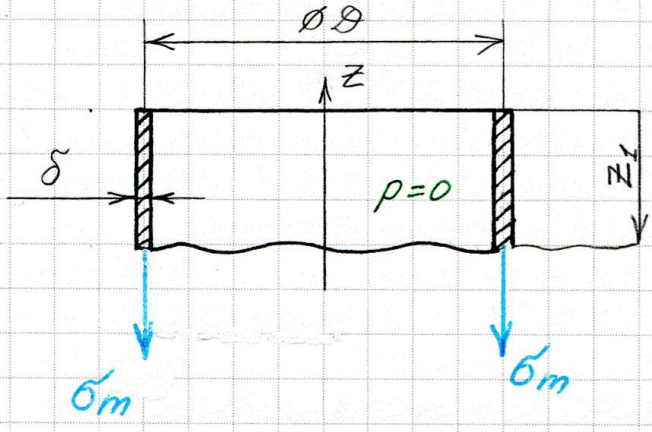
5 Цилиндрическая оболочка под действием внутреннего гидростатического давления:



$\gamma = g \cdot \rho, \left[\frac{H}{м^3}\right]$ - удельный вес жидкости.

① : $(0 \le z_1 \le H)$



$\sum F_z = 0 = -\sigma_m \cdot \pi D \delta$

$\sigma_m = 0$

$\rho_m = \infty$

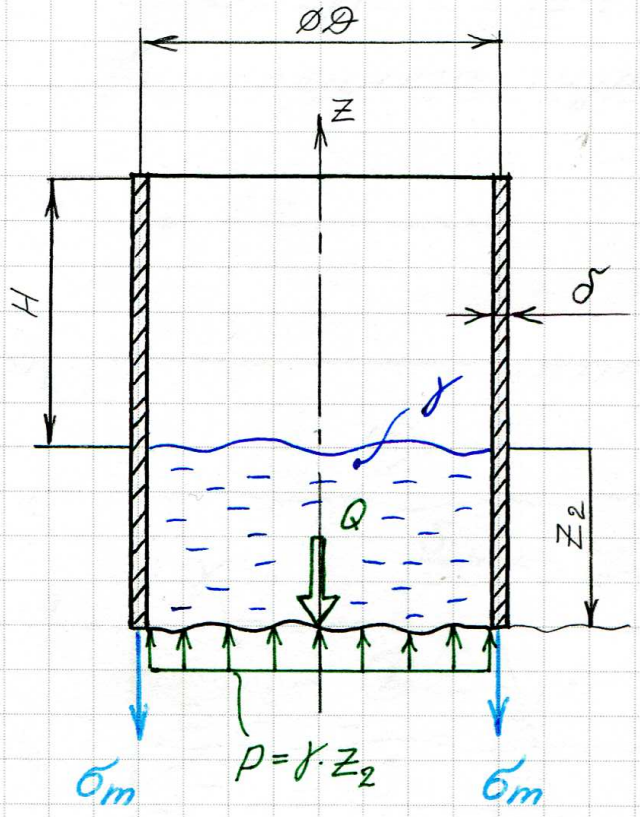
$\rho_t = D/2$

$p = 0$

$\sigma_m = 0$

$\frac{\sigma_m}{\rho_m} + \frac{\sigma_t}{\rho_t} = \frac{p}{\delta}$ $\Rightarrow$ $\sigma_t = 0$

② : $(\ 0 \le z_2 \le H\ )$



$$\sum F_z = 0 = -\sigma_m \cdot \pi \cdot D \cdot \delta - Q + p \cdot \frac{\pi D^2}{4}$$

$$Q = \gamma \cdot V = \gamma \cdot \frac{\pi D^2}{4} z_2$$

$$0 = -\sigma_m \cdot \pi \cdot D \delta - \underbrace{\gamma \cdot \frac{\pi D^2}{4} z_2 + \gamma \cdot \frac{\pi D^2}{4}}_{0}$$

$$\sigma_m = 0$$

Q, [H] - вес жидкости в отсечённом объёме.

$$\left.\begin{aligned} \rho_m &= \infty \\ \rho_t &= \frac{D}{2} \\ p &= \gamma \cdot z_2 \\ \sigma_m &= 0 \end{aligned}\right\}$$

$$\frac{\sigma_m}{\rho_m}^{\,0} + \frac{\sigma_t}{\rho_t} = \frac{p}{\delta}$$

$$\sigma_t = \frac{p \cdot \rho_t}{\delta} = \frac{\gamma \cdot z_2 \cdot D}{2\delta}$$

$z_2 = 0$: $\sigma_t = 0$

$z_2 = H$: $\sigma_t = \frac{\gamma H D}{2\delta}$

Эквивалентное напряжение:

$$\sigma_{экв} = \max(\sigma_m, \sigma_t) = \sigma_t$$