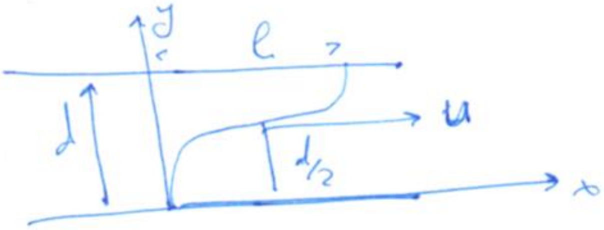
ДЗ 1 Задача 1

Дано: d; $v_к$.

Найти: l; τ; $x(y)$

Решение



$$\begin{cases} v_x = U(y) \\ v_y = v_к \end{cases} \qquad \tau = d/v_к \text{ время движения}$$

$$U(y) = a(y - d/2)^2 + b$$

уравнение парабол при $y = d/2$

$$b = U$$

$U(d) = 0$ на берегу

$$a(d^2/4) + U = 0 \qquad a = -\frac{4U}{d^2}$$

$$U(y) = -\frac{4U}{d^2}(y - d/2)^2 + U$$

$$y = v_к t$$

$$x = \int_0^t U\,dt - \frac{4U}{d^2}\left(v_к t - d/2\right)^2 dt$$

$$x = Ut - \frac{4}{3}U/d^2 \frac{1}{v_к}\left(v_к t - d/2\right)^3$$

$$x = \frac{Uy}{v_к} - \frac{4}{3}U/d^2 \frac{1}{v_к}\left(v_к y/v_к - d/2\right)^3$$

$$x = \frac{U}{v_к}y - \frac{4}{3}\frac{U}{v_к}\frac{1}{d^2}\left(y - d/2\right)^3 + \frac{4}{3}\frac{U}{v_к}\frac{1}{d^2}\left(d/2\right)^3$$

$$x = \frac{U}{v_к}\left(y - \frac{4}{3}\left(y^3 - \frac{3d}{2}y^2 + \frac{3d^2}{4}y\right)\frac{1}{d^2}\right).$$

$$x = \frac{U}{v_к}\left(\frac{2y^2}{d} - \frac{4}{3}y^3/d^2\right).$$

$$x = \frac{4U}{3v_к d^2}\left(\frac{3}{2}y^2 d - y^3\right)$$

$$l = \frac{4U}{3v_к d^2}\left(\frac{3}{2}d^3 - d^3\right) = \frac{2Ud}{3v_к}$$