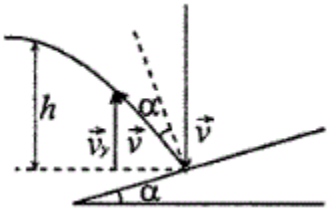
Answer on Question #49129, Physics, Mechanics | Kinematics | Dynamics

A jet of water with cross section of 6 square centimeter strikes a wall at an angle of 60 deg. to the normal rebounds elastically from the wall without losing energy. If the velocity of the water in water in the jet is 12m/s, the force acting on the wall is

(a)0.864 N (b)86.4 N (c)72 N (d) 7.2 N

Solution:



During the time Δt the wall is struck by the mass of water in a cylinder with a length of $l = vt$ and a cross section of A, i. e.,

$$m = \rho A v \Delta t,$$

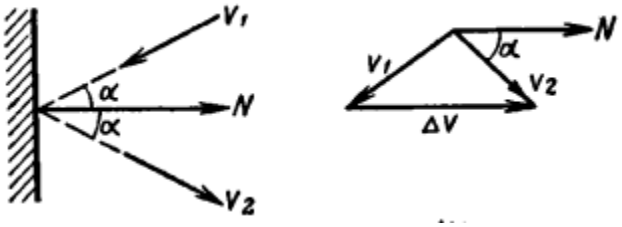
where ρ is the density of the water.

From the law the momentum conservation we have

$$F\Delta t = m\Delta v$$

The force is

$$F = \frac{m\Delta v}{\Delta t}$$



The change of velocity is

$$\Delta v = v_1 \cos\alpha - (-v_2 \cos\alpha) = (v_1 + v_2)\cos\alpha$$

$$v_1 = v_2 = v$$

Thus,

$$\Delta v = 2v\cos\alpha$$

Hence,

$$F = \frac{\rho A v \Delta t 2v\cos\alpha}{\Delta t} = 2Av^2\rho\cos\alpha$$

$$F = 2 * 6 * 10^{-4} * 12^2 * 1000 * \cos 60° = 86.4 \text{ N}$$

Answer: (b)86.4 N