Answer on Question #69570-Physics / Other

A firewoman opens the fire hose, and water sprays forward. What is the action force and what is the reaction force?

Solution

Let us denote as ρ the density of water, A the area of the fire hose, v the speed of water.

In terms of second Newton's law the action force

$$F_{\text{action}} = \frac{\Delta p}{\Delta t}.$$

The change of a momentum is

$$\Delta p = (\Delta m)v = (\rho A v \Delta t)v = \rho A v^2 \Delta t.$$

So

$$F_{\text{action}} = \frac{\rho A v^2 \Delta t}{\Delta t} = \rho A v^2.$$

In terms of a third Newton's law

$$\mathbf{F}_{\text{reaction}} = -\mathbf{F}_{\text{action}}.$$

Answers: $F_{\text{reaction}} = F_{\text{action}} = \rho A v^2$.

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