33.4 **A tee connection receives $4gpm$ of water from a $\frac{3}{4}$ inch schedule 40 steel pipe and $3\frac{ft}{s}$ of water from a 1-$\frac{1}{4}$ inch schedule 40 steel pipe. Water exits into a 1-$\frac{1}{2}$ inch schedule 40 steel pipe. What is the velocity in the outlet pipe? Ignore friction loss.**

A. $2.4\frac{ft}{s}$

B. $2.8\frac{ft}{s}$

C. $3.3\frac{ft}{s}$

D. $4.8\frac{ft}{s}$

Make a table to organize the volume flow rate, diameter, area, and velocity at each location in the tee and populate known quantities. The volume flow rate at the exit will equal the sum of the two entering volume flow rates. Use the Steel Pipe Friction Tables to gather the nominal diameters. Use diameter to find area: $A = \frac{\pi}{4}D^2$. Use $Q = VA$ to find volume flow rate and where required rearrange to $V = \frac{Q}{A}$ to find velocity.

	$\frac{3}{4}in$ Entering Water	$1\frac{1}{4}in$ Entering Water	$1\frac{1}{2}in$ Exiting Water
Q	$4\frac{gal}{min}\left(\frac{1ft^3}{7.48gal}\right)\left(\frac{1min}{60sec}\right) = .0089\frac{ft^3}{s}$	$\left(3\frac{ft}{s}\right)(.0104ft^2) = .0312\frac{ft^3}{s}$	$.0089\frac{ft^3}{s} + .0312\frac{ft^3}{s} = .0401\frac{ft^3}{s}$
V	–	$3\frac{ft}{s}$	$V = \frac{Q}{A} = \frac{.0401\frac{ft^3}{s}}{.0141ft^2} = \mathbf{2.8\frac{ft}{s}}$
D	–	$1.38in$	$1.61in$
A	–	$.0104ft^2$	$.0141ft^2$

Specify the velocity at the outlet, $2.8\frac{ft}{s}$.
Answer B