Sample Question:

Air is moving at 1000 fpm in an 8" duct. The air moves through a transition to a 6" duct. What is the velocity pressure of the air in the 6" duct?

Solution:

The volume of air must remain constant when going through the transition. Set up the airflow equation for two separate duct pieces with a constant airflow.

$$Q = VA$$

Airflow = Velocity x Cross-sectional Area

$$Q_1 = Q_2$$

$$V_1A_1 = V_2A_2$$

$$\text{Cross-sectional Area} = \pi r^2 = \frac{\pi d^2}{4}$$

$$V_1\left(\frac{\pi\left(\frac{8}{12}\right)^2}{4}\right) = V_2\left(\frac{\pi\left(\frac{6}{12}\right)^2}{4}\right)$$

Divide by 12 to keep the units in square feet.

$$V_2 = V_1\left(\frac{\pi\left(\frac{8}{12}\right)^2}{4}\right)\left(\frac{4}{\pi\left(\frac{6}{12}\right)^2}\right)$$

$$V_2 = V_1\left(\frac{8}{6}\right)^2 = 1000 \text{ fpm } (1.778) = 1778 \text{ fpm}$$

$$V = 4005\sqrt{VP}$$

$$VP = \left(\frac{V}{4005}\right)^2 = \left(\frac{1778}{4005}\right)^2 = 0.197 \text{ inches of } H_2O$$

The correct answer is B: 0.197" H_2O