

TOPIC

Fluids – Section X – Question 2

QUESTION

Water flows with a velocity of 1 m/s in a pipe with an inner diameter of 5 cm. The flow is split into 2 pipes, each having an inner diameter of 3 cm. The velocity in the 3 cm pipes (in m/s) is

- (A) 1.38
- (B) 1.67
- (C) 2.76
- (D) 3.34

HINTS

- mass flow rate = density \times velocity \times cross sectional area
- mass is conserved when the flow goes from one pipe to the two pipes.

SOLUTION

The flow is split evenly so the mass flow rate through a 3 cm pipe (2) is one-half that of through the 5 cm pipe (1):

$$0.5\rho A_1 V_1 = \rho A_2 V_2$$

So

$$V_2 = \frac{0.5A_1 V_1}{A_2}$$

where A is the cross-sectional area and V is velocity.

The cross sectional areas are

$$\begin{aligned} A_1 &= \frac{\pi D_1^2}{4} \\ &= \frac{\pi(0.05)^2}{4} \\ &= 0.00196m^2 \\ A_2 &= \frac{\pi D_2^2}{4} \\ &= \frac{\pi(0.03)^2}{4} \\ &= 0.00071m^2 \end{aligned}$$

Thus the velocity in the 3cm pipe is

$$\begin{aligned} V_2 &= 0.5 \frac{0.00196m^2}{0.00071m^2} (1) \\ &= 1.38m/s \end{aligned}$$

ANSWER

(A)

CONTRIBUTOR
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