These set of questions and problems are meant for reviewing and reinforcing the concepts discussed in the “Mass Balances” series of videos. Please review those videos before proceeding with these problems.

Mass Balances (MB) Review Problems

MB-001: For an incompressible fluid flowing through a pipe, a reduction in cross sectional area:
(A) Produces an increase in pressure
(B) Produces a decrease in velocity
(C) Violates the principle of conservation of mass
(D) Produces an increase in velocity

MB-002: A steady stream of gas is measured as 50 ft^3/min upstream of a compressor and as 28 ft^3/min at the compressor discharge. The compressor inlet and outlet have the same cross-sectional areas, and there is nothing wrong with the flow meters. Of the following statements, the one that is false is:
(A) The measurements indicate a violation of the mass conservation principle
(B) The difference is due to a change in density across the compressor
(C) Volume flow rate is not necessarily conserved in some processes
(D) In this steady-state process, the amount of mass inside the compressor at any instant does not vary with time.

MB-003: A steady stream of gas is measured as 50 ft^3/min upstream of a compressor and as 28 ft^3/min at the compressor discharge. The mass flow rate is known to be 4.4 lbm/s. The gas density (lbm/ft^3) at the compressor discharge is nearest:
(A) 0.16
(B) 5.3
(C) 7.2
(D) 9.4

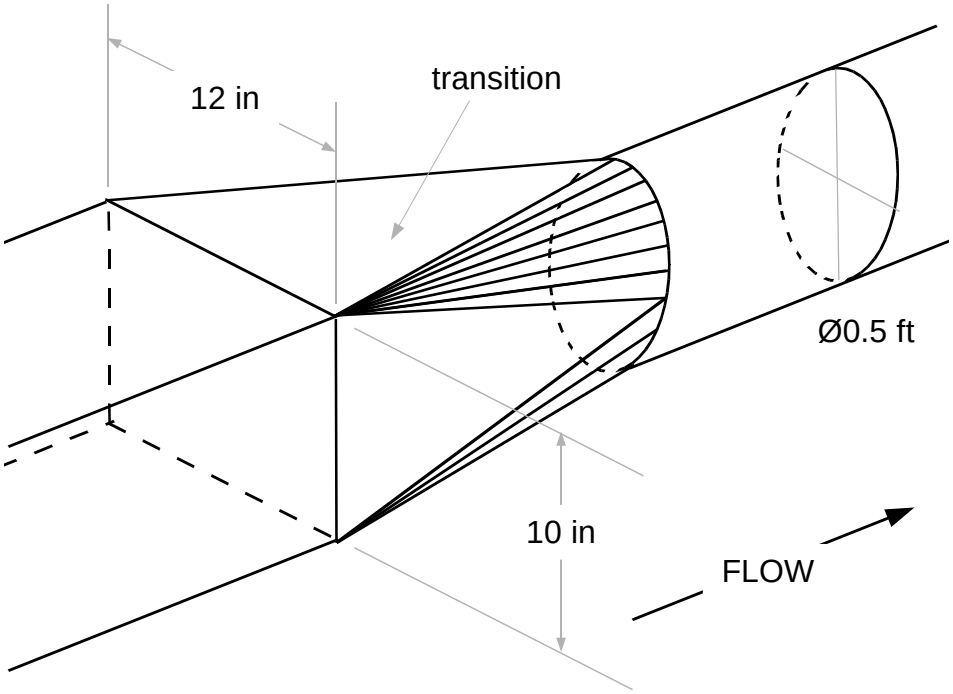
MB-004: An air conditioning sheet metal duct has a rectangular cross-section of 12 inches by 10 inches. A transition piece converts the cross-section into a circle with a 0.5 ft diameter, as shown in the figure. Treating the air as incompressible, the ratio of average air velocity in the circular duct downstream to that in the rectangular duct upstream of the transition piece is nearest:

(A) 0.24

(B) 4.2

(C) 51

(D) 611



MB-005: The Everett river is 50 ft wide and 3 ft deep with an average water velocity of 3 ft/s. The McGill river is 80 ft. wide and 5 ft deep, with an average water velocity of 4 ft/s. These two rivers merge, to form a larger river – the Ulysses. At a location sufficiently downstream of the merger, the Ulysses is 100 ft wide and 6 ft deep and has an approximately uniform average velocity. This average water velocity (ft/s) of the Ulysses river is nearest:

(A) 3.3

(B) 3.4

(C) 3.5

(D) 5

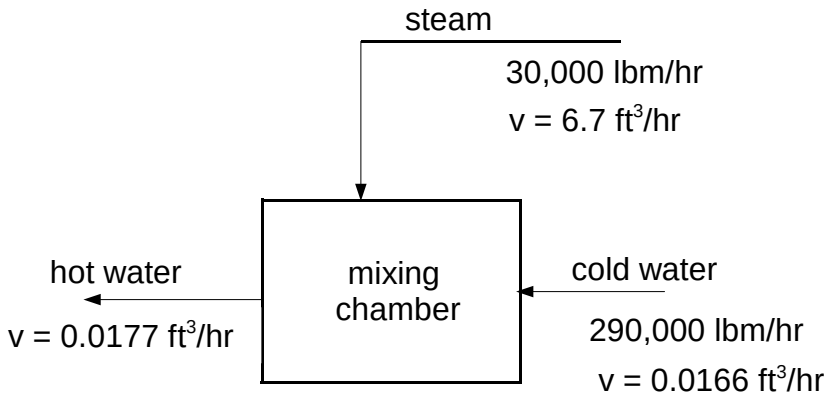
MB-006: Steam flows steadily into a mixing chamber at a rate of 30,000 lb/hr where it is mixed with 229,000 lb/hr of relatively cold liquid water. The resulting stream is hot water as shown in the figure. The hot water average velocity in the discharge pipe from the mixing chamber is known to be 1080 ft/min. The hot water pipe inner diameter (in) is nearest:

(A) 2.0

(B) 3.0

(C) 3.5

(D) 4.0



The answers are in the next page

Mass Balances (MB) Review Problems: ANSWERS

MB-001	**D**
MB-002	**A**
MB-003	**D**
MB-004	**B**
MB-005	**B**
MB-006	**D**