Sample AP Problems (10d)

1. The idea that the velocity of a fluid is high when pressure is low and that the velocity of a fluid is low when the pressure is high embodies a principle attributed to
   (a) Torricelli (b) Pascal (c) Galileo (d) Archimedes (e) Bernoulli

2. The pressure in a pipe carrying a liquid with a density of ρ and an initial velocity v at the inlet is P, which is y meters lower than its outlet, which has a velocity of 2v. In these terms, what is the final pressure?

   $(A)\ \frac{P}{2}\rho\left(3v^2+2gy\right)$

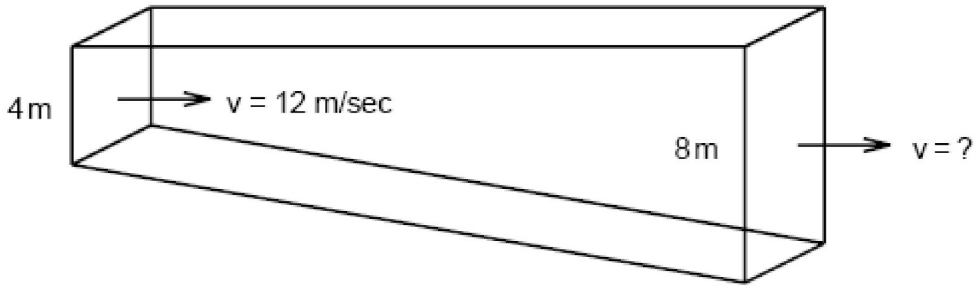
   $(B)\ P-\frac{1}{2}\rho\left(3v^2+2gy\right)$

   $(C)\ P+\frac{1}{2}\rho\left(-3v^2+\rho gy\right)$

   $(D)\ \frac{\frac{1}{2}\rho\left(v^2-4v^2\right)-\rho gy}{P}$

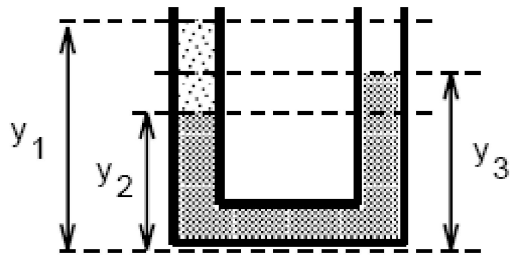
   $(E)\ P\left[\frac{1}{2}\rho\left(v^2-4v^2\right)-\rho gy\right]$

3. A river gradually deepens, from a depth of 4 m to a depth of 8 m as shown. The width, W, of the river does not change. At the depth of 4 m, the river's speed is 12 m/sec. Its velocity at the 8 m depth is



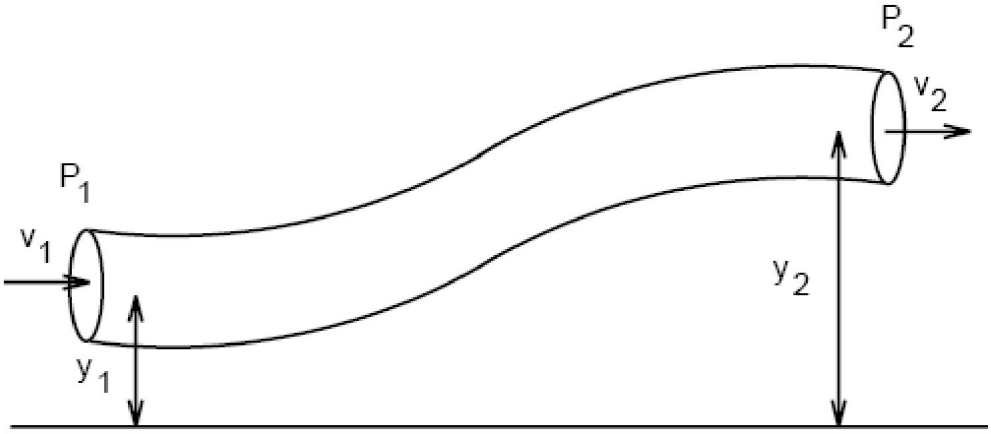
   (a) 12 m/sec (b) 24 m/sec (c) 6 m/sec (d) 8 m/sec (e) 16 m/sec

4. In the open manometer shown, water occupies a part of the left arm, from a height of y_1 to a height of y_2. The remainder of the left arm, the bottom of the tube, and the right arm to a height of y_3 are filled with mercury.



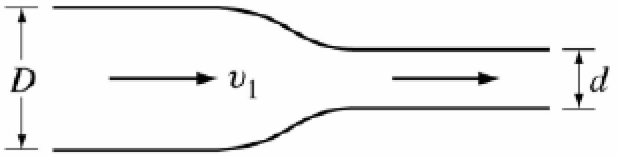
Which of the following is correct?
(a) the pressure at a height y_3 is the same in both arms.
(b) the pressure at a height y_2 is the same in both arms.
(c) the pressure at the bottom of the right arm is greater than at the bottom of the left arm.
(d) the pressure at a height y_3 is less in the left arm than in the right arm.
(e) the pressure at a height y_1 is greater in the left arm than in the right arm.

5. Water flows in a pipe of uniform cross-sectional area A.



The pipe changes height from $y_1 = 2$ meters to $y_2 = 3$ meters. Since the areas are the same, we can say $v_1 = v_2$.
Which of the following is true?
(a) $P_1 = P_2 + \rho g(y_2 - y_1)$
(b) $P_1 = P_2$
(c) $P_1 = 0$
(d) $P_2 = 0$
(e) $\rho_1 > \rho_2$

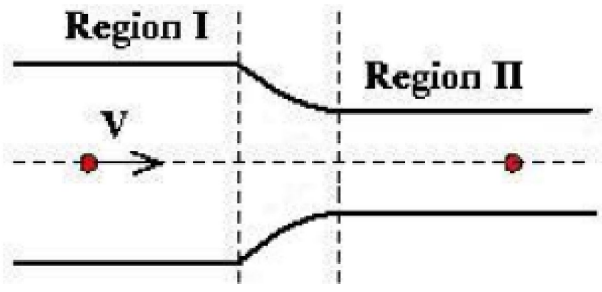
6. Water flows through the pipe shown. At the larger end, the pipe has diameter D and the speed of the water is v_1 .



What is the speed of the water at the smaller end, where the pipe has diameter d ?

$$(A)\ v_1 \qquad (B)\ \frac{d}{D}v_1 \qquad (C)\ \frac{D}{d}v_1 \qquad (D)\ \frac{d^2}{D^2}v_1 \qquad (E)\ \frac{D^2}{d^2}v_1$$

7. A piece of an ideal fluid is marked as it moves along a horizontal streamline through a pipe, as shown in the figure. In Region I, the speed of the fluid on the streamline is V . The cylindrical, horizontal pipe narrows so that the radius of the pipe in Region II is



half of what it was in Region I. What is the speed of the marked fluid when it is in Region II?

(A) 4V (B) 2V (C) V (D) V/2 (E) V/4

8. A ball that can float on water has mass 5.00 kg and volume 2.50 x 10^{-2} m^3. What is the magnitude of the downward force that must be applied to the ball to hold it motionless and completely submerged in freshwater of density 1.00 x 10^3 kg/m^3?
   (A) 20.0 N
   (B) 25.0 N
   (C) 30.0 N
   (D) 200 N
   (E) 250 N

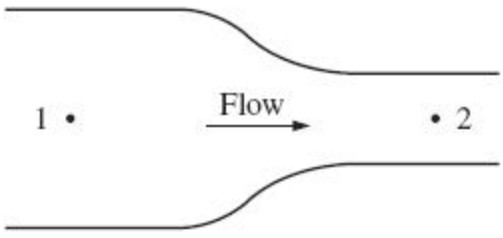
Questions 9-10: Refer to the diagram below and use 10 m/s^2 for *g* and 100,000 N/m^2 for 1 atm.

15 m 15 m 15 m

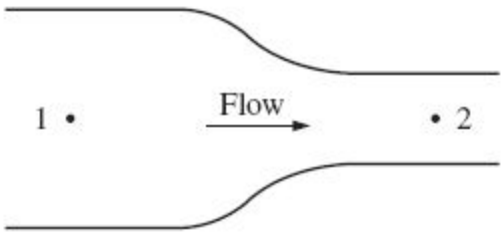
9. The pressure at A is 9.5 atm and the water velocity is 10 m/s. What is the water velocity at point C?
   (a) 2.5 m/s (b) 5 m/s (c) 10 m/s (d) 20 m/s (e) 40 m/s

10. The pressure at C is
    (a) 0 N/m^2 (b) 100,000 N/m^2 (c) 150,000 N/m^2 (d) 800,000 N/m^2 (e) 1,100,000 N/m^2

11. A fluid flows steadily from left to right in the pipe shown. The diameter of the pipe is less at point 2 then at point 1, and the fluid density is constant throughout the pipe. How do the velocity of flow and the pressure at points 1 and 2 compare?



Velocity	Pressure
(A) $v1 < v2$	$p1 = p2$
(B) $v1 < v2$	$p1 > p2$
(C) $v1 = v2$	$p1 < p2$
(D) $v1 > v2$	$p1 = p2$
(E) $v1 > v2$	$p1 > p2$



12. A fluid flows steadily from left to right in the pipe shown. The diameter of the pipe is less at point 2 then at point 1, and the fluid density is constant throughout the pipe. How do the velocity of flow and the pressure at points 1 and 2 compare?

	Velocity	Pressure
(A)	$v1 < v2$	$p1 = p2$
(B)	$v1 < v2$	$p1 > p2$
(C)	$v1 = v2$	$p1 < p2$
(D)	$v1 > v2$	$p1 = p2$
(E)	$v1 > v2$	$p1 > p2$