Use the passage below to answer questions 7–8.

Water flows through a pipe of varying width at a constant mass flow rate. At point A the diameter of the pipe is d_A and at point B the diameter of the pipe is d_B.

7. Which of the following equations describes the relationship between the water speed at point A, v_A, and the water speed at point B, v_A?

   A. $d_A v_A = d_B v_B$

   B. $d_A^2 v_A = d_B^2 v_B$

   C. $d_A d_B = v_A v_B$

   D. $\frac{1}{2} d_A v_A^2 = \frac{1}{2} d_B v_B^2$

8. If the cross-sectional area of point A is 2.5 m^2 and the cross-sectional area of point B is 5.0 m^2, how many times faster does the water flow at point A than at point B?

   F. $\dfrac{1}{4}$

   G. $\dfrac{1}{2}$

   H. 2

   J. 4

SHORT RESPONSE

9. Will an ice cube float higher in water or in mercury? Explain your answer.

10. The approximate inside diameter of the aorta is 1.6 cm, and that of a capillary is 1.0×10^{-6} m. The average flow speed is about 1.0 m/s in the aorta and 1.0 cm/s in the capillaries. If all the blood in the aorta eventually flows through the capillaries, estimate the number of capillaries.

11. A hydraulic brake system is shown below. The area of the piston in the master cylinder is 6.40 cm^2, and the area of the piston in the brake cylinder is 1.75 cm^2. The coefficient of friction between the brake shoe and wheel drum is 0.50. What is the frictional force between the brake shoe and wheel drum when a force of 44 N is exerted on the pedal?
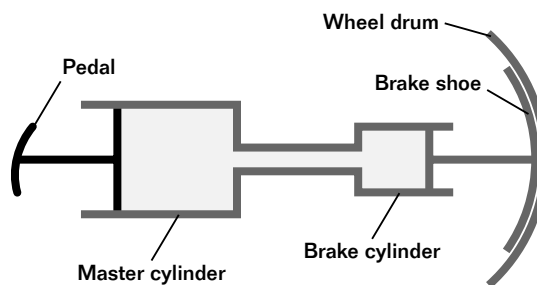
EXTENDED RESPONSE

Base your answers to questions 12–14 on the information below.

Oil, which has a density of 930.0 kg/m^3, floats on water. A rectangular block of wood with a height, h, of 4.00 cm and a density of 960.0 kg/m^3 floats partly in the water, and the rest floats completely under the oil layer.

12. What is the balanced force equation for this situation?

13. What is the equation that describes y, the thickness of the part of the block that is submerged in water?

14. What is the value for y?

> **Test TIP** For problems involving several forces, write down equations showing how the forces interact.

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