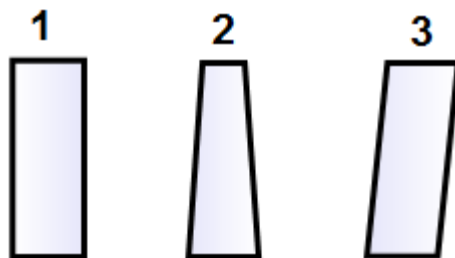


PSI Algebra Based Physics

Fluids

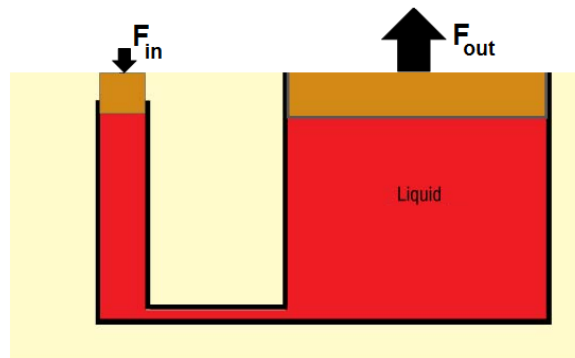
Multiple Choice Problems

- Two substances A with a density 2000 kg/m^3 and B with a density 3000 kg/m^3 are selected for an experiment. If the experiment requires equal masses of each liquid, what is the ratio of substance A volume to substance B volume (V_A/V_B)?
(A) $1/2$ (B) $1/3$ (C) $2/3$ (D) $3/2$ (E) $3/1$
- The density of a substance is ρ , the volume is V , and the mass is m . If the volume is tripled without changing the density, what is the mass?
(A) $m/3$ (B) m (C) $3m$ (D) $6m$ (E) $9m$
- A perpendicular force is applied to a certain area and produces a pressure P . If the same force is applied to a twice bigger area, the new pressure on the surface is:
(A) $2P$ (B) $4P$ (C) P (D) $P/2$ (E) $P/4$
- There are two round tables in the physics classroom: one with the radius of 1 m the other with a radius of 2 m . What is the relationship between the two forces applied on the tabletops by the atmospheric pressure (F_1/F_2)?
(A) $1/2$ (B) $1/4$ (C) $2/1$ (D) $4/1$ (E) $1/6$

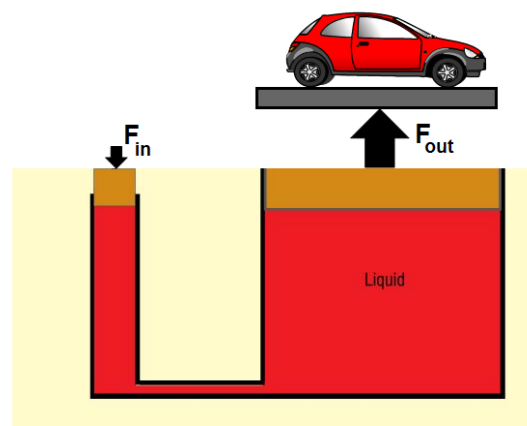


- Three containers are used in a chemistry lab. All containers have the same bottom area and the same height. A chemistry student fills each of the containers with the same liquid to the maximum volume. Which of the following is true about the pressure on the bottom in each container?
(A) $P_1 > P_2 > P_3$
(B) $P_1 < P_2 < P_3$
(C) $P_1 < P_2 > P_3$
(D) $P_1 > P_2 < P_3$
(E) $P_1 = P_2 = P_3$
- What is the gauge pressure at the bottom of a pool 3 m deep?
(A) 30 Pa (B) 300 Pa (C) 3000 Pa (D) $30,000 \text{ Pa}$ (E) $300,000 \text{ Pa}$

7. Which of the following scientists invented a mercury barometer?
- (A) Blaise Pascal
 (B) Evangelist Torricelli
 (C) Amedeo Avogadro
 (D) Robert Brown
 (E) James Joule
8. A car driver measures a tire pressure of 220 kPa. What is the absolute pressure in the tire?
- (A) 321 kPa (B) 119 kPa (C) 0 kPa (D) 101 kPa (E) 220 kPa



9. In a hydraulic lift the small piston has an area of 2 cm^2 and large piston has an area of 80 cm^2 . What is the mechanical advantage of the hydraulic lift?
- (A) 40 (B) 4 (C) 2 (D) 1 (E) 20



10. A hydraulic lift is used to lift a car. The small piston has a radius of 5 cm and the large piston has a radius of 50 cm. If a driver applies a force of 88 N to the small piston, what is the weight of the car the large piston can support?
- (A) 880 N (B) 88 N (C) 8800 N (D) 8.8 N
 (E) 88000 N

11. Three blocks of equal volume are completely submerged into water. The blocks made of different materials: aluminum, iron and lead. Which of the following is the correct statement about the buoyant force on each block? ($\rho_{\text{aluminum}} = 2700 \text{ kg/m}^3$, $\rho_{\text{iron}} = 7800 \text{ kg/m}^3$, $\rho_{\text{lead}} = 11300 \text{ kg/m}^3$)

- (A) $F_{\text{aluminum}} > F_{\text{iron}} > F_{\text{lead}}$
(B) $F_{\text{aluminum}} < F_{\text{iron}} < F_{\text{lead}}$
(C) $F_{\text{aluminum}} < F_{\text{iron}} > F_{\text{lead}}$
(D) $F_{\text{aluminum}} = F_{\text{iron}} = F_{\text{lead}}$
(E) $F_{\text{aluminum}} > F_{\text{iron}} < F_{\text{lead}}$



12. A piece of iron has a weight of 3.5 N when it is in air and 2.0 N when it is submerged into water. What is the buoyant force on the piece of iron?

- (A) 3.5 N (B) 2.0 N (C) 1.5 N (D) 1.0 N (E) 0.5 N



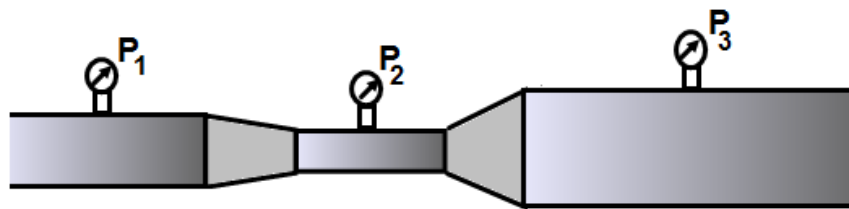
13. Physics students use a spring scale to measure the weight of a piece of lead. The experiment was performed two times one in air the other in water. If the volume of lead is 0.0005 m^3 , what is the difference between two readings on the scale?

- (A) 0.5 N (B) 5.0 N (C) 50 N (D) 500 N (E) 0 N

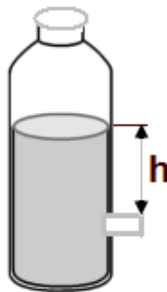
14. A wooden block with a weight of 7.5 N is placed on water. When the block floats on the surface of water it is partially submerged in water. What is the weight of the displaced water?

- (A) 5.0 N (B) 5.5 N (C) 6.0 N (D) 7.0 N (E) 7.5 N

15. An object with a density of 800 kg/m^3 floats on water. What portion of the object is submerged?
 (A) $1/16$ (B) $1/8$ (C) $1/4$ (D) $2/5$ (E) $4/5$
16. A wooden block with a weight of 9 N is placed on water. When the block floats on the surface of water it is partially submerged in water. What is the volume of the displaced water?
 (A) $5 \times 10^{-4} \text{ m}^3$ (B) $4 \times 10^{-4} \text{ m}^3$ (C) $3 \times 10^{-4} \text{ m}^3$ (D) $6 \times 10^{-4} \text{ m}^3$ (E) $9 \times 10^{-4} \text{ m}^3$
17. Water flows at a constant speed of 16 m/s through narrow section of the pipe. What is the speed of water in the section of the pipe where its radius is twice of the initial radius?
 (A) 16 m/s (B) 12 m/s (C) 8 m/s (D) 4 m/s (E) 2 m/s



18. Venturi tubes have three sections with different radii. Which of the following is true about manometer readings?
 (A) $P_1 > P_2 > P_3$
 (B) $P_1 < P_2 < P_3$
 (C) $P_2 < P_1 < P_3$
 (D) $P_1 < P_2 > P_3$
 (E) $P_3 = P_2 = P_1$
19. Water flows through a horizontal pipe at a speed of 5 m/s and pressure $5 \times 10^5 \text{ Pa}$. The pipe narrows and the water speed goes up to a 25 m/s . What is the pressure in the narrow section of the pipe?
 (A) $2 \times 10^5 \text{ Pa}$ (B) $4 \times 10^5 \text{ Pa}$ (C) $8 \times 10^5 \text{ Pa}$ (D) $8.25 \times 10^5 \text{ Pa}$ (E) $11.5 \times 10^5 \text{ Pa}$



20. An open bottle is filled with a liquid which is flowing out through a spigot located at the distance 0.5 m below the surface of the liquid. What is the velocity of the liquid leaving the bottle?
 (A) 0.7 m/s (B) 2.2 m/s (C) 3.13 m/s (D) 9.8 m/s (E) 19.6 m/s

Answers

1. D
2. C
3. D
4. B
5. E
6. D
7. B
8. A
9. A
10. C
11. D
12. C
13. B
14. E
15. E
16. E
17. D
18. C
19. A
20. B