

Fluids Review

1. Two substances mercury with a density 13600 kg/m^3 and alcohol with a density 0.8 g/cm^3 are selected for an experiment. If the experiment requires equal masses of each liquid, what is the ratio of alcohol volume to the mercury volume?
 (A) 1/15 (B) 1/17 (C) 1/13 (D) 1/10 (E) 17/1

$\rho = \frac{m}{V}$
 $m = \rho V$
 *did you convert g/cm^3 to kg/m^3 ?

2. 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

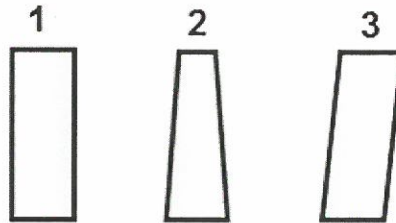
$P = \frac{F}{A} = \frac{1}{2}$

3. There are two round tables in the physics classroom: one with the radius of 50 cm the other with a radius of 150 cm. What is the relationship between the two forces applied on the tabletops by the atmospheric pressure?
 (A) $F_1/F_2 = 1/3$ (B) $F_1/F_2 = 1/9$ (C) $F_1/F_2 = 3/1$ (D) $F_1/F_2 = 9/1$ (E) $F_1/F_2 = 1/6$

$P = \frac{F}{A} = \frac{F}{\pi r^2} = \frac{(1)}{(3)^2} = \frac{1}{9}$

4. 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) $P_1 = P_2 = P_3$



$P = P_0 + \rho gh$

5. What is the difference between the pressure on the bottom of a pool and the pressure on the water surface?

- (A) ρgh (B) $\rho g/h$ (C) ρ/gh (D) gh/ρ (E) zero

$P = P_0 + \rho gh$

6. A boy swims a lake and initially dives 0.5 m beneath the surface. When he dives 1 m beneath the surface, how does the absolute pressure change?

- (A) It doubles
 (B) It quadruples
 (C) It cut to a half
 (D) It slightly increases
 (E) It slightly decreases

$P_{atm} = 1.0 \times 10^5 \text{ Pa} \left(\frac{1 \text{ kPa}}{10^3 \text{ Pa}} \right) = 100 \text{ kPa}$

7. 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

gauge $P_2 - P_1 = P_g$
 $P_2 = P_1 + P_g$

$= 100 \text{ kPa} + 220 \text{ kPa}$

8. 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? ($\rho_{aluminum} = 2700 \text{ kg/m}^3$, $\rho_{iron} = 7800 \text{ kg/m}^3$, $\rho_{lead} = 11300 \text{ kg/m}^3$)

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

$F_B = \rho_{water} g V$

same volume
 same F_B

(They're using $1.01 \times 10^5 \text{ Pa}$)

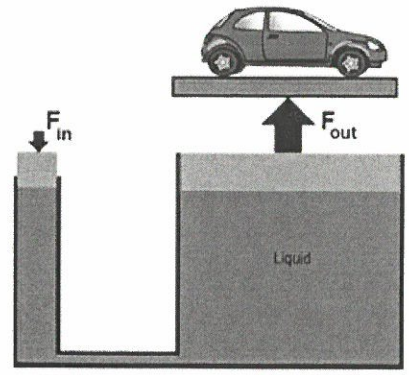
9.

10x radius squared is 100x the force

$$\frac{F}{A} = \frac{F}{A} \quad \frac{F}{\pi r^2} = \frac{F}{\pi r^2}$$

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

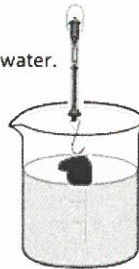


10.

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

$$F_B = F_g - F_t \quad F_B = 3.5\text{N} - 2.0\text{N} = 1.5\text{N}$$

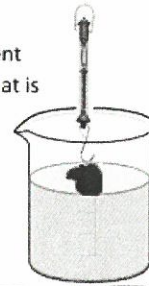


11.

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 50 cm³, 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

$$\rho_w = 1000 \text{ kg/m}^3 \quad 50 \text{ cm}^3 \left(\frac{1 \text{ m}^3}{100^3 \text{ cm}^3} \right) = 5 \times 10^{-5} \text{ m}^3$$

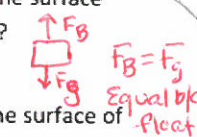


air $F_t = F_g$
water $F_t = F_g - F_B$

12.

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



$$\Delta F_t = F_t - F_g + F_B = F_B = \rho_w V_w g = (1000 \frac{\text{kg}}{\text{m}^3}) \times 5 \times 10^{-5} \text{ m}^3 \times 10 \frac{\text{m}}{\text{s}^2}$$

13.

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) 500 cm³ (B) 400 cm³ (C) 300 cm³ (D) 600 cm³ (E) 900 cm³

$$F_g = F_B = 9 \text{ N}$$

$$F_B = \rho g V$$

$$V = \frac{F_B}{\rho g} = \frac{9}{(1000)(10)} = 0.0009 \text{ m}^3$$

convert m³ to cm³

14.

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?

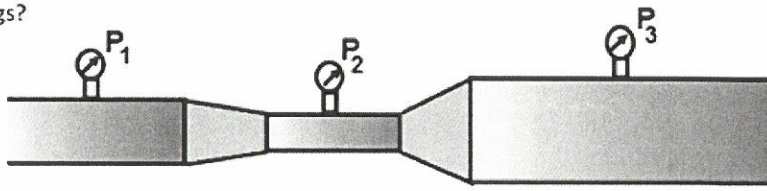
- (A) 16 m/s (B) 12 m/s (C) 8 m/s (D) 4 m/s (E) 2 m/s

$$A_1 v_1 = A_2 v_2 \quad \pi r_1^2 v_1 = \pi r_2^2 v_2 \quad v_2 = \frac{r_1^2 v_1}{r_2^2} = \frac{(1)^2 (16)}{(2)^2} = 4$$

15.

Venturi tubes have three sections with different radii. Which of the following is true about manometer readings?

- (A) P₁ > P₂ > P₃
(B) P₁ < P₂ < P₃
(C) P₂ < P₁ < P₃
(D) P₁ < P₂ > P₃
(E) P₃ = P₂ = P₁



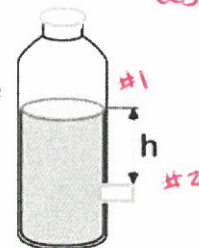
$$A_1 v_1 = A_2 v_2 = A_3 v_3 \quad \text{so } v_2 > v_1 > v_3 \quad \text{as } v \uparrow P \downarrow \text{ so } P_2 < P_1 < P_3$$

16.

An open bottle is filled with a liquid which is flowing out through a spigot located at the distance h below the surface of the liquid. What is the velocity of the liquid leaving the bottle?

- (A) v = √gh (B) 2gh (C) 4gh (D) ρgh (E) √2gh

$$P + \frac{1}{2} \rho v^2 + \rho gh = P + \frac{1}{2} \rho v^2 + \rho gh$$



Answers:

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