Read 9.4

Next H.W Available

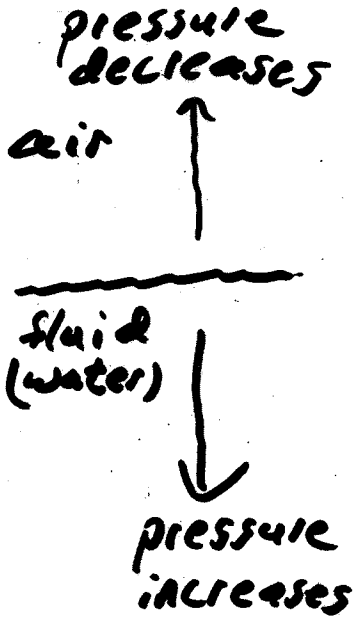
Office hours 11:30-12:30

Review

Density "rho" $\rho = \frac{m}{V}$

Pressure $P = \frac{F}{A}$

Pascal's Principle $\frac{F_2}{A_2} = \frac{F_1}{A_1}$



(A)

Interactive Question

Diving in a swimming pool, you let out a stream of bubbles. As the bubbles rise towards the surface do they increase in diameter, decrease in diameter, or stay the same size?

A) increase

B) decrease

C) stay the same

Problem: A balloon has a volume of 15 m^3 on the surface of the Earth where the pressure is 1 atm. If the balloon rises up to a point where the pressure is 0.22 atm, what is the volume of the balloon?

$$P_1 V_1 = P_2 V_2$$

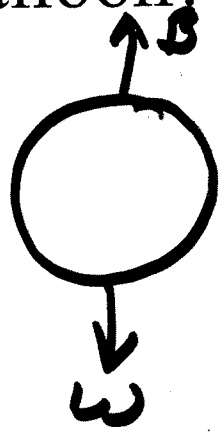
$$V_2 = \frac{P_1 V_1}{P_2}$$

$$V_2 = \frac{1\ \text{atm} \cdot 15\ m^3}{.22\ \text{atm}} = 68\ m^3$$

Problem:

(a) What is the buoyant force on a balloon filled with 1.0 m^3 helium at sea level?

(b) What is the gravitational force (weight) on the same balloon?



ρ_f (air) = 1.29 kg/m³

ρ_{He} = .179 kg/m³

$V_f = V_{obj} = 1\,m^3$

$B = \rho_{air} V_{air} g = (1.29\,kg/m^3)(1\,m^3)(9.8\,m/s^2)$

$= \underline{12.6\,N}$

$\rho = \frac{m}{V}$

$m = \rho V$

$w = mg = \rho_{He} V_{He} g$

$= (.179\,kg/m^3)(1\,m^3)(9.8\,m/s^2) = \underline{1.75\,N}$

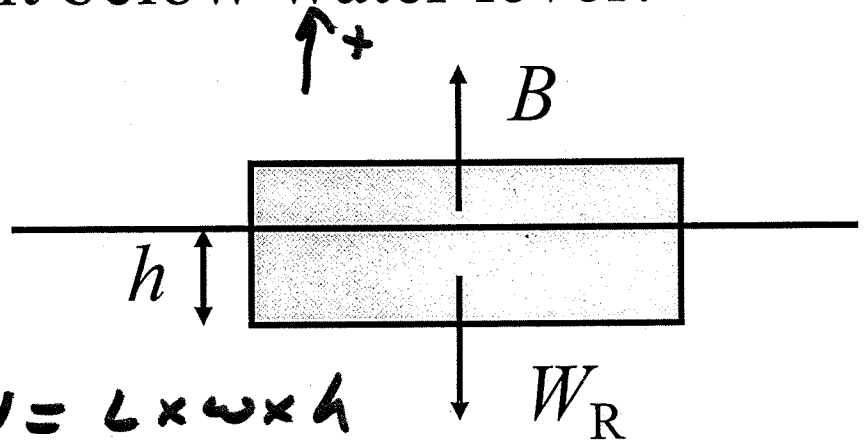
D

Interactive Question

According to Archimedes' principle, the buoyant force

A) is always equal to the weight of the object
B) is always greater than the weight of the object
C) is always less than the weight of the object
D) is equal to the weight of the displaced fluid
E) is less than the weight of the displaced fluid if the object sinks

Problem: A raft is made of wood having a density of 600 kg/m^3. Its surface area is 5.7 m^2, and its volume is 0.60 m^3. How deep does the raft sit below water level?



$F_{net} = ma$

$B - w_R = 0$

$B = w_R$

$B = w_w$

$w_w = w_R$

$m_w g = m_R g$

$\rho_w V_w = \rho_R V_R$

$\rho_w A_r h = \rho_R V_R$

$V = L \times w \times h$

$V = A \times h$

$\rho_{water} = 1\ g/cm^3$

$1000\ kg/m^3$

$$h = \frac{\rho_R V_R}{\rho_w A_R} = \frac{(600\ kg/m^3)(.6\ m^3)}{(1000\ kg/m^3)(5.7\ m^2)} = .063\ m$$

D

Interactive Question

Icebergs, which are made of fresh water, float with 10% of their mass above the ocean, which is made of salt water. From this fact we can conclude that

A) salt water is 10% as dense as fresh water

B) salt water is 90% as dense as fresh water

C) fresh water is 10% as dense as salt water

D) fresh water is 90% as dense as salt water

E) None of the above