CAPA 9

What is the pressure 147m beneath the surface of the ocean? Take the density of sea water to be 1.06E+3kg/m^3 and the atmospheric pressure at sea level to be 101kPa.

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An iron block appears to be 212N lighter in water than in air. Find the volume of the block.

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How much does the block weigh in air (assume that the density of iron is 7870kg/m^3)?

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A 42.1cm thick layer of oil (density 900.0kg/m^3) floats on a 139.2cm thick layer of water. What is the absolute pressure at the bottom of the water layer?

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The four tires of an automobile are inflated to a gauge pressure of 180.3 kPa. Each tire has an area of 0.0400m^2 in contact with the ground. Determine the weight of the automobile.

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The spring of a pressure gauge has a force constant of 845N/m, and the piston attached has a diameter of 1.88cm. When the gauge is lowered into water, at what depth does the piston move in by 0.562cm from its position at the surface?

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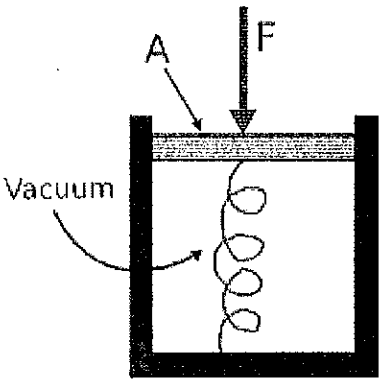

What is the height of a barometer composed of a fluid with a density of 811.0kg/m^3 at atmospheric pressure?

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What volume of water has the same mass as 4.15m^3 of ethyl alcohol, if the density of ethyl alcohol is 790.0kg/m^3?

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If this volume of water is in a cubic tank, what is the pressure at the bottom?

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A rectangular window in a house has dimensions 3.10m x 1.80m. As a storm passes by, the air pressure outside drops to 0.928atm while the pressure inside the house remains 1.00atm. What is the magnitude of the net force pushing on the window? Take atmospheric pressure to be 101kPa

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Apple juice has a density of 1053kg/m^3. In order to suck some juice up a straw to a height of 3.65cm, what minimum gauge pressure must be produced in a person's lungs?

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A shot (a spherical object thrown in 'shot put') hangs from a spring balance. The balance registers that in air the shot weighs 28.0N and that in water it weighs 18.7N. When the shot is submerged in a mystery fluid, it weighs 25.4N. What is the density of the mystery fluid?

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An object hangs from a spring balance. The balance registers 38.7N in air, 21.4N when this object is immersed in water, and 27.2N when the object is immersed in another liquid of unknown density. What is

the density of that other liquid.

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Blaise Pascal duplicated Torricelli's barometer using a red Bordeaux wine of density 955.1kg/m^3, as the working liquid. What is the height of a wine column in a barometer for normal atmospheric pressure?

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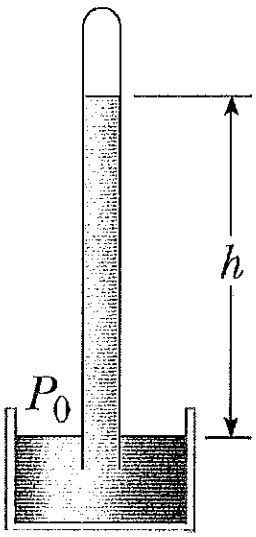

Calculate the absolute pressure at an ocean depth of 998m. Assume the density of seawater is 1024kg/m^3

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At this depth, what force must the frame around a circular submarine porthole having a diameter of 85.7cm exert to counter balance the force exerted by the water?

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A styrofoam slab has a thickness of 17.9cm and a density of 543kg/m^3. When a 45.1kg is resting on it, the slab floats in fresh water with its top at the same level as the water's surface. Find the area of the slab.

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Submit All

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Physics 1A03
Assignment 9

1. $P_{tot} = P_{air} + P_{water}$

$P_{water} = \rho \cdot g \cdot h$
$= (1.06 \times 10^3 kg/m^3)(9.8 m/s^2)(14.7 m)$
$= 1527 kPa$

$P_{tot} = 101 kPa + 1527 kPa$
$= 1628 kPa$

2. a) 212 N lighter in water → 212 N buoyancy force. How much does is the mass of the water causing this force?

$212 N = ma$
$m = \frac{212 N}{9.8 m/s^2}$
$= 21.6 kg$

$V = \frac{m}{\rho}$
$= \frac{21.6 kg}{1000 kg/m^3}$
$= 0.0216 m^3$

which is equal to the volume of the iron block.

b) $m = dV$
$= (7870 kg/m^3)(0.0216 m^3)$
$= 170.0 kg$

$F = ma$
$= (170.0 kg)(9.8 m/s^2)$
$= 1666.0 N$

3. $p_{tot} = p_{air} + p_{oil} + p_{water}$ $\quad p_{air} = 101\,kPa$

$p_{oil} = \rho g h$

$= (900\,kg/m^3)(9.8\,m/s^2)(0.421\,m)$

$= 3713.7\,Pa$

$p_{water} = (1000\,kg/m^3)(9.8\,m/s^2)(1.392\,m)$

$= 13641.6\,Pa$

$p_{tot} = 101\,kPa + 3.71\,kPa + 13.64\,kPa$

$= 118.4\,kPa$

4. $p = \frac{F}{A}$

$A = 4 \cdot 0.0400\,m^2$

$= 0.16\,m^2$

$F = p \cdot A$

$= (180.3\,kPa)(0.16\,m^2)$

$= 28.8\,kN$

5. $k = 845\,N/m$ $\quad r = 0.0188\,m$ $\quad x = 0.00562\,m$

$A = \pi \left(\frac{d}{2}\right)^2$

$= \pi (0.0188\,m/2)^2$

$= 0.000278\,m^2$

$p = \frac{F}{A} = \rho \cdot g h$ $\qquad F = kx$

$= (845\,N/m)(0.00562\,m)$

$\rho g h = \frac{F}{A}$

$h = \frac{F}{\rho g \cdot A}$

$= \frac{(845\,N/m)(0.00562\,m)}{(1000\,kg/m^3)(9.8\,m/s^2)(0.0011\,m^2)}$

$= 1.75\,m$

6. $p = \rho \cdot g \cdot h$

$h = \frac{p}{\rho \cdot g}$

$= \frac{101.3\ kPa}{(811.0\ kg/m^3)(9.8\ m/s^2)}$

$= 12.75\ m$

7. a) $m = \rho \cdot v$

$= (790.0\ kg/m^3)(4.15\ m^3)$

$= 3278.5\ kg$

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

$= \frac{3278.5\ kg}{1000\ kg/m^3}$

$= 3.28\ m^3$

b) cubic tank: $v = h \times h \times h$

$\sqrt[3]{v} = h$

$p = \rho \cdot g \cdot h$

$= \rho \cdot g \cdot \sqrt[3]{v}$

$= (1000\ kg/m^3)(9.8\ m/s^2)(\sqrt[3]{3.28\ m^3})$

$= 14.6\ kPa$

$p_{tot} = 101\ kPa + 14.6\ kPa$

$= 116.0\ kPa$

8. $\Delta p = 1.00\,atm - 0.928\,atm$

$= 0.072\,atm \cdot \frac{101.3\,kPa}{1\,atm}$

$= 7.29\,kPa$

$p = \frac{F}{a}$

$F = p \cdot a$

$= (7.28\,kPa)(3.1\,m \cdot 1.80\,m)$

$= 40.7\,kN$

9. $p = -\rho \cdot g \cdot h$

$= -(1053\,kg/m^3)(9.8\,m/s^2)(0.0365\,m)$

$= -376.7\,Pa$

10. Δ weight in water: $28.0N - 16.7N$

$F_w = 9.3N$

Δ weight in fluid: $28.0N - 25.4N$

$F_f = 2.6N$

shot displaces same volume in both

$v = \frac{m}{\rho} = \frac{F \cdot a}{\rho}$

$\frac{F_w \cdot a}{\rho_w} = \frac{F_f \cdot a}{\rho_f}$

$\rho_f = \frac{F_f}{F_w} \cdot \rho_w$

$= \frac{2.6N}{9.3N} \cdot 1000\,kg/m^3 = 279.6\,kg/m^3$

11. Same as 10:

$$\rho_f = \frac{\Delta \text{weight}_f}{\Delta \text{weight}_w} \cdot \rho_w$$

$$= \frac{(38.7N - 27.2N)}{(38.7N - 21.4N)} \cdot 1000 \text{ kg} \cdot m^3$$

$$= 664.7 \text{ kg}/m^3$$

12. $p = \rho \cdot g \cdot h$

$$h = \frac{p}{\rho \cdot g}$$

$$= \frac{101.3 \text{ kPa}}{(955.1 \text{ kg}/m^3)(9.8 m/s^2)}$$

$$= 10.8 m$$

13. a) $p_{water} = \rho \cdot g \cdot h$

$$= (1024 \text{ kg}/m^3)(9.8 m/s^2)(998 m)$$

$$= 10015.1 \text{ kPa}$$

$$p_{tot} = p_{air} + p_{water}$$

$$= 101.3 \text{ kPa} + 10015.1 \text{ kPa}$$

$$= 10116 \text{ kPa}$$

b) $a = \pi (\frac{d}{2})^2$

$$= \pi (0.857 m/2)^2$$

$$= 0.58 m^2$$

$$F = p \cdot a$$

$$= (10116 \text{ kPa})(0.58 m^2)$$

$$= 5.9 \times 10^6 N$$

14. $m_{tot} = m_{obj} + m_{styro}$

$m_{styro} = A \cdot h \cdot \rho_s$ $\rightarrow \begin{bmatrix} m = v \cdot \rho \\ v = A \cdot h \end{bmatrix}$

$F = m_{tot} g$

$= g(m_{obj} + A \cdot h \cdot \rho_s)$

This is equal to the buoyant force, which is:

$F = m_{water} \cdot a$

$= g(m_{water})$

$= g(A \cdot h \cdot \rho_w)$

So:

$g(m_{obj} + A \cdot h \cdot \rho_s) = g(A \cdot h \cdot \rho_w)$

$A = \frac{m}{h(\rho_w - \rho_s)}$

$= \frac{45.1\,kg}{(0.179m)(1000kg/m^3 - 543kg/m^3)}$

$= 0.55m^2$