Worksheet 3.1 – Density and Pressure

Show ALL WORK including knowns and steps taken to solve the problem!

Substance	ρ(kg/m^3)	Substance	ρ(kg/m^3)
Ice	0.917×10^3	Water	1.00×10^3
Aluminum	2.70×10^3	Salt Water	1.025×10^3
Iron	7.86×10^3	Glycerin	1.26×10^3
Copper	8.92×10^3	Ethyl Alcohol	0.806×10^3
Silver	10.5×10^3	Benzene	0.879×10^3
Lead	11.3×10^3	Mercury	13.6×10^3
Gold	19.3×10^3	Air	1.29
Platinum	21.4×10^3	Oxygen	1.43
Uranium	18.7×10^3	Hydrogen	8.99×10^{-2}
Brass	8.7×10^3	Helium	1.79×10^{-1}

"I've been under a lot of pressure."

1. Suppose you have one cubic meter of gold, two cubic meters of silver, and six cubic meters of aluminum. Rank them by mass, from largest to smallest.
   a. Gold, Aluminum, Silver
   b. Silver, Gold, Aluminum
   c. Aluminum, Gold, Silver
   d. Silver, Aluminum, Gold

2. What is the mass of a solid iron wrecking ball with a radius of 18 cm?

3. Substance A has a density of 3 g/cm^3 and substance B has a density of 4 g/cm^3. In order to obtain equal masses of these substances, the ratio of the volume of A to the volume of B will be equal to…

   a. 1:3 b. 4:3 c. 3:4 d. 1:4 e. 1:2

4. A waterbed has the following dimensions 2.00 m x 2.00 m and 30.0 cm deep.
   a. Find its weight.
   b. Find the pressure that the waterbed exerts on the floor.

5. The density of the salt water in the Dead Sea is extremely high (1.240×10^3 kg/m^3) due to the high concentration of salt. So high in fact it becomes extremely easy to float!
   a. What hydrostatic pressure exists at a depth of 30.0 m beneath the Dead Sea?
   b. At what depth will the hydrostatic pressure be 100.0 kPa?

6. The Titanic was found in 1985 lying at the bottom of the North Atlantic at a depth of 4 kilometers. What is the pressure at this depth?

7. Calculate the force exerted on an eardrum that has a cross-sectional area of 5.0×10^{-5} m^2, when the swimmer is at the bottom of a freshwater pool 6.0 m deep.

8. Four acrobats of mass 66.0 kg, 68.0 kg, 63.0 kg and 55.0 kg for a tower of humans! Each acrobat stands on the shoulders of another acrobat with the 68.0 kg acrobat at the bottom.
   a. Find the normal force acting on the 68.0 kg acrobat.
   b. Find the pressure the acrobats exert on the ground if each of the acrobats shoes are approximately 415 cm^2.
   c. The 55.0 kg acrobat is shifted to the bottom and the human tower is reformed! Calculate the pressure exerted on the floor.

9. A car lift is used at a local garage; compressed air exerts a force on a small circular piston having a radius of 4.00 cm. This pressure is transmitted across an incompressible liquid to the second circular piston that is 16.0 cm.
   a. What force must be exerted on the small piston in order to lift a car with a mass of 2360 kg? (Neglect the weight of the pistons)
   b. What air pressure will produce a force of this size?

Answers:

1. B
2. 190 kg
3. B ($3 = \frac{M_a}{V_a}\,;\, 4 = \frac{M_b}{V_b}\,;\, 3V_a = 4V_b\,;\, \frac{V_a}{V_b} = \frac{4}{3}$)
4. a. 1.18×10^4 N b. 2.95×10^3 Pa
5. a. 365 kPa b. 8.2 m
6. P = 4.01×10^7 Pa
7. Pressure = 5.88×10^4 Pa ; Force = 2.9 N
8. a. 2470 N b.
9. a. 1450 N ; b. 1.84×10^5 Pa OR 184 kPa