Physics 05-02 Pressure and Depth *Name:* _____

Pressure

Molecules of fluid sometimes _____ with _____ of container.

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

- P = _____
- F = Force _____ to surface
- A = _____ of surface

Unit: N/m^2 = Pa (pascal)

- 1 Pa is _____ so we usually use _____ or _____

In a _____ the pressure is exerted _____ to _____ surfaces
A _____ fluid _____ produce a force _____ to a surface since it is not _____ parallel to surface

You are drinking a juice box. In the process you suck all the juice and air out of the box. The top of the box is 7.5 cm by 5 cm. If the air pressure is 1.013×10^5 Pa, how much force is acting on the top of the box?

Would the force of the side of the box be more or less than the top?

The force that squashes the juice box is from the _____ of all the ai

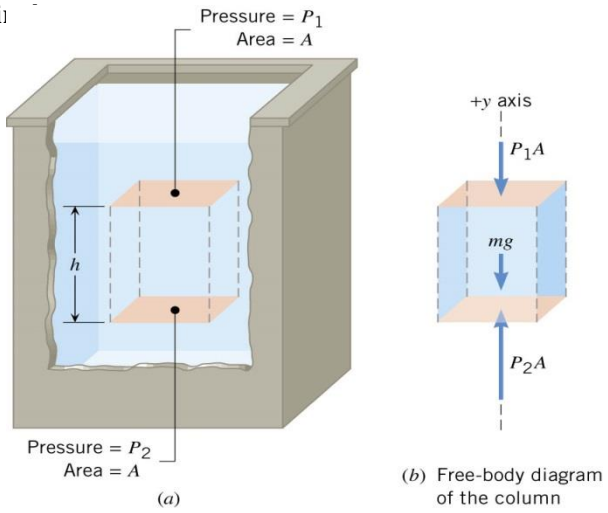
Atmospheric Pressure at Sea Level

1.013×10^5 Pa = 1 atmosphere (1 atm)

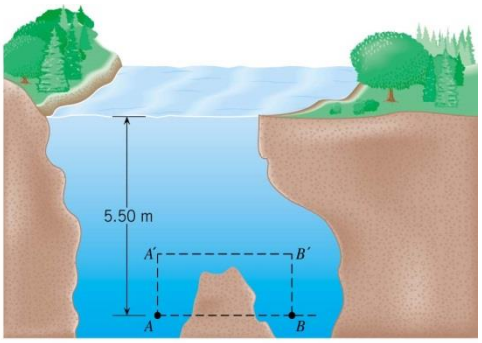
Pressure Varies with Depth

- The column of static fluid experiences several _____ forces
- Since the fluid is not moving, it is in equilibrium and _____
- If the pressure is known at a depth, the pressure lower down can be found by adding _____
- This assumes ρ is _____ with depth
- This is a good estimate for _____, but not for _____ unless h is small

$$P_2 = P_1 + \rho g h$$



Would Hoover Dam need to be just as strong if the entire lake behind the dam was reduced to an inch of water behind the dam, but the same depth as the lake?



What is the total pressure at points A and B?

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Homework

1. How is pressure related to the sharpness of a knife and its ability to cut?
2. Why is force exerted by static fluids always perpendicular to a surface?
3. Toe dancing (as in ballet) is much harder on toes than normal dancing or walking. Explain in terms of pressure.
4. Atmospheric pressure exerts a large force (equal to the weight of the atmosphere above your body—about 10 tons) on the top of your body when you are lying on the beach sunbathing. Why are you able to get up?
5. As a woman walks, her entire weight is momentarily placed on one heel of her high-heeled shoes. Calculate the pressure exerted on the floor by the heel if it has an area of 1.50 cm^2 and the woman's mass is 55.0 kg. Express the pressure in Pa. (In the early days of commercial flight, women were not allowed to wear high-heeled shoes because aircraft floors were too thin to withstand such large pressures.) (OpenStax 11.11) $\mathbf{3.59 \times 10^6\ Pa}$
6. Nail tips exert tremendous pressures when they are hit by hammers because they exert a large force over a small area. What force must be exerted on a nail with a circular tip of 1.00 mm diameter to create a pressure of 3.00×10^9 N/m^2? (OpenStax 11.13) $\mathbf{2.36 \times 10^3\ N}$
7. What depth of mercury creates a pressure of 1.00 atm? (OpenStax 11.14) **0.760 m**
8. The greatest ocean depths on the Earth are found in the Marianas Trench near the Philippines. Calculate the pressure due to the ocean at the bottom of this trench, given its depth is 11.0 km and assuming the density of seawater is constant all the way down. (OpenStax 11.15) $\mathbf{1.10 \times 10^8\ Pa}$
9. Verify that the SI unit of ρgh is N/m^2. (OpenStax 11.16) **work**
10. Water towers store water above the level of consumers for times of heavy use, eliminating the need for high-speed pumps. How high above a user must the water level be to create a gauge pressure of 3.00×10^5 N/m^2? (OpenStax 11.17) **30.6 m**
11. What pressure is exerted on the bottom of a 0.500-m-wide by 0.900-m-long gas tank that can hold 50.0 kg of gasoline by the weight of the gasoline in it when it is full? (OpenStax 11.20) $\mathbf{1.09 \times 10^3\ N/m^2}$
12. The left side of the heart creates a pressure of 120 mmHg by exerting a force directly on the blood over an effective area of 15.0 cm^2. What force does it exert to accomplish this? (OpenStax 11.22) **24.0 N**
13. The human lungs can function satisfactorily up to a limit where the pressure difference between the outside and inside of the lungs is one-twentieth of an atmosphere. If a diver uses a snorkel for breathing, how far below the water can she swim? Assume the diver is in salt water whose density is 1025 kg/m^3? (Cutnell 11.24) **0.50 m**