

Notes: Why dense things sink: Pressure, Buoyancy, and Weight

1. In the first picture on the right, which swimmer is experiencing the strongest water pressure?

B

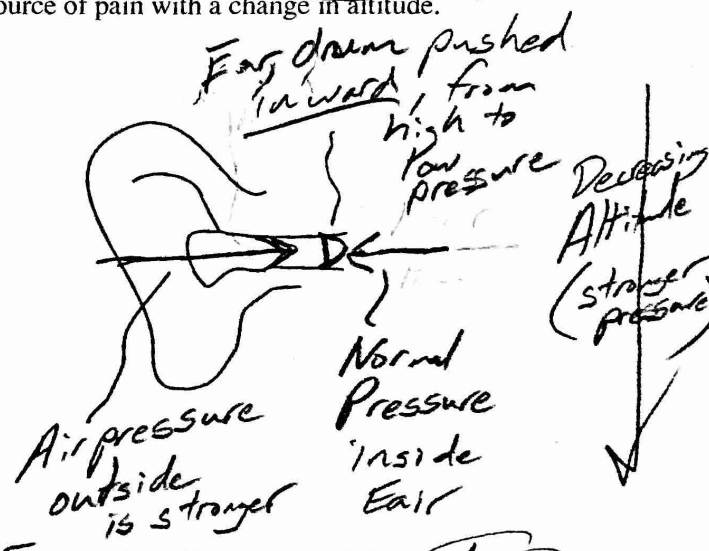
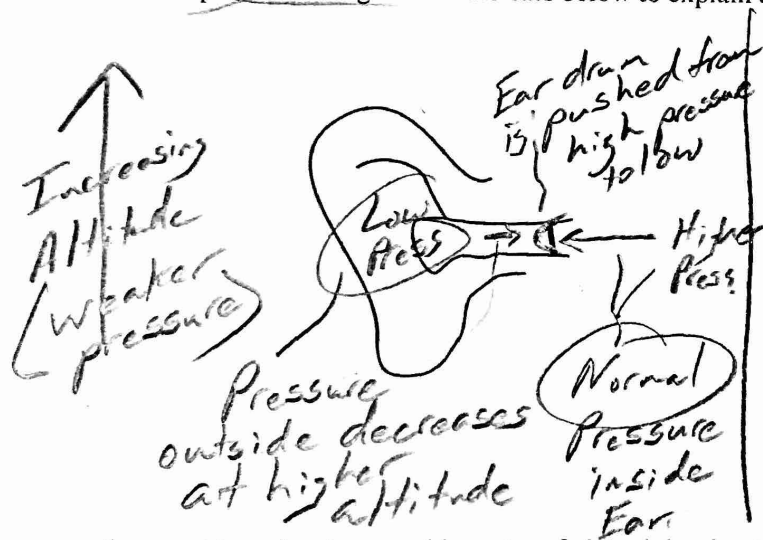
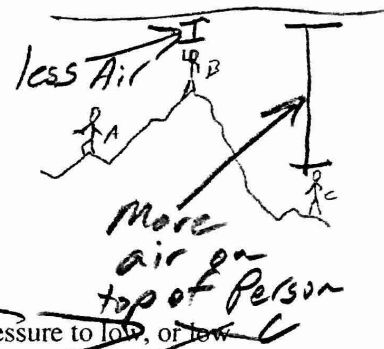
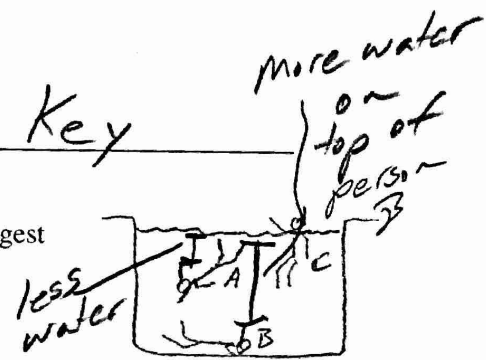
2. In the second picture on the right, who is experiencing the greatest air pressure?

C

3. Whether you're in air or water (or any other fluid), the origin of ambient pressure is the same. What creates the air pressure that we're feeling right now?

The weight of the air above us creates air pressure.  
The weight of water creates water pressure

4. When there is a pressure difference, in which direction do objects move? High pressure to low, or low pressure to high? Use the ears below to explain the source of pain with a change in altitude.



5. At sea level, one cubic meter of air weighs about 2.5 pounds and has a mass of about 1 kg.

6. Atmospheric Pressure (average air pressure at sea level) = 14.7 psi

≈ 1 brick

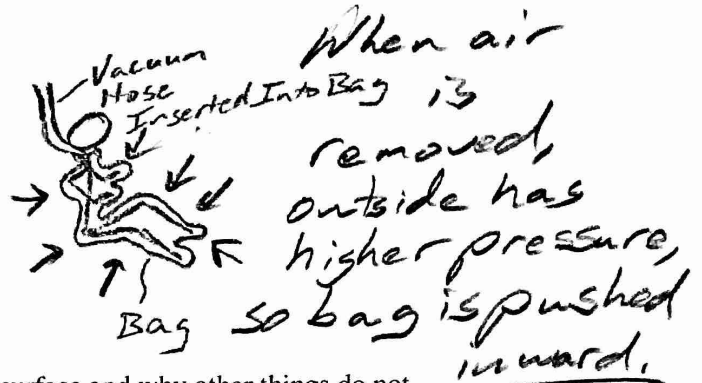
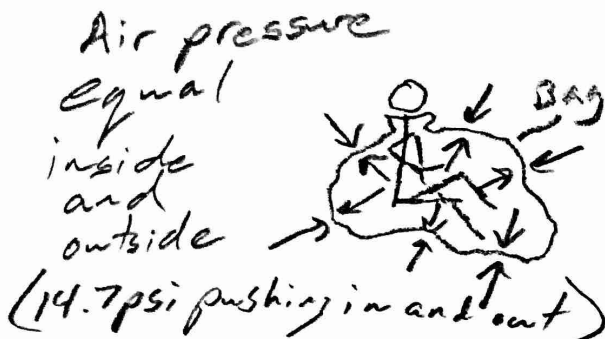
7. "psi" stands for pounds per square inch

8. So, at sea level, every square inch of the Earth has about 14.7 pounds of air stacked above it.

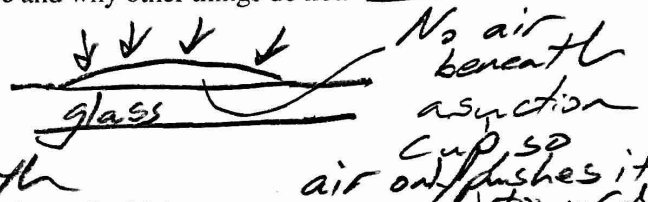
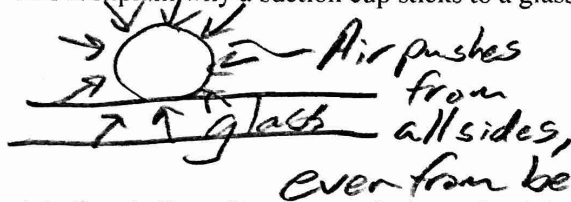
9. According to sources, an average human has about  $1.8\text{m}^2$  ( $\approx 2,800\text{in}^2$ ) of skin. If you consider the force of air pressure pushing on that many square inches, what total force (in pounds) is pushing against an average human's skin?

41,160 pounds

10. The two people on the right are inside trash bags. One has a vacuum hose inserted in the bag. The other does not. Use arrows to show how the sensation of vacuum packing is caused by air pressure pushing inward from the outside of the bag.

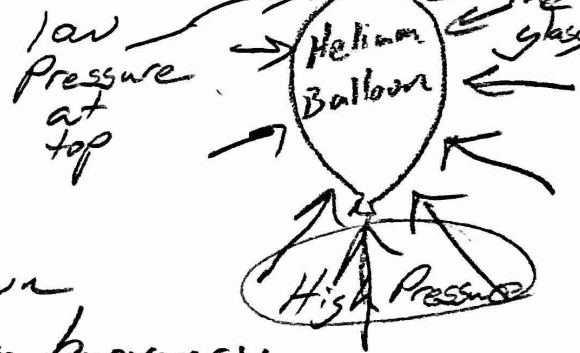


11. Show/explain why a suction cup sticks to a glass surface and why other things do not.



12. A helium balloon floats upward. Show/explain how it "knows" which way to go. [Hint: it's the same as ear drums.]

Pressure is stronger at lower altitudes, so the high pressure below the balloon overpowers the low pressure pushing down.



13. The name for the pressure difference that pushes objects upward is buoyancy.

14. Whether an object is in water or air, buoyancy (caused by pressure) pushes everything upward, against gravity. Explain why.

Objects are pushed from high pressure to low pressure, and lower elevations always have higher pressure.

15. If pressure pushes everything upward, then why do dense objects sink?

Dense objects have more weight than buoyancy. Gravity pulls them down more than pressure pushes them up.

16. Why don't we float like helium balloons?

Buoyancy is pushing us upward, so it does make us feel slightly lighter, but we are too heavy to be lifted by it.