Name___________________

A New Way to Understand ΔP with Depth

Specific Notes:

A) The point here is to see that the equation $\Delta P + \rho_{liq} g \Delta y = 0$ can be interpreted as an energy conservation equation, with the primary distinctions being: 1) we are talking about energy densities, and 2) the Δ's refer to changes in spatial position, not changes over time. The point is subtle enough that most students will flounder with the question and it might be best to do this as a whole-class discussion and answer #2 for them. If you do this, be sure and do something to help give the concept meaning—have them give examples. Or, use the example of swimming to the bottom of the pool. When students analyze it, they could be thinking that the person has to move down there (which implies "final and initial") instead of comparing the point where the person is to a point below. This may seem trivial, but it will come back to haunt students, and if you make a big deal of it now, you can always say, "Remember that whole discussion about…"

B) **Observe:** We have to decrease pressure in our mouth to get the water to come up. Have them watch each others' cheeks—they draw in when the pressure is decreased. This may confuse them a bit, because they may think they are decreasing the volume in their mouth so the pressure should be increasing—have them think about where the air in their mouth has gone (their lungs).

For the second question, the pressure just under the surface outside the straw is about equal to atmospheric pressure.

For the third question, the pressure in the air above the liquid inside the straw is slightly less than atmospheric pressure. It may help to ask them, "Well, what would happen if it were slightly greater?" They usually can imagine that it would push the water down below the outside water level. Actually, they might be able to try this with the straw (be prepared for bubbles and splashing, though).

Analyze:

Point b has higher pressure because you have decreased the gravitational potential energy density. Point c is just a little higher, and point d is lower, using the same reasoning as for point b.

The diagrams should have a circle for Pressure and one for PE_g/vol and they should have arrows indicating the direction of change for each system. We do not always use the diagrams; however, some students really find them useful for this Unit, so we will give them some practice and the option of drawing energy-system diagrams to explain changes in the steady-state fluid relationships.

Note that unlike PE_g/vol and KE/vol, the indicator for pressure is simply "pressure" since pressure can be measured directly (it is an observeable quantity).