

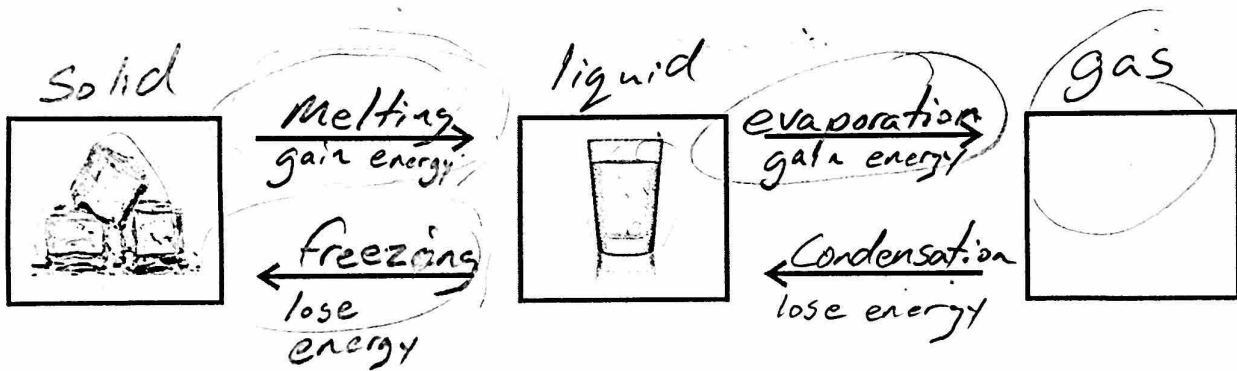
States of Matter (a.k.a. phases of matter)

**Solid phase:** Particles are locked in place, touching one another, vibrating. Hotter solids vibrate more violently.

**Liquid phase:** Particles are touching one another, but sliding and bumping around and changing positions; flowing. Hotter liquid particles slide and bump around faster.

**Gas phase:** Particles are flying free, but occasionally bumping into one another. Hotter gas particles fly faster.

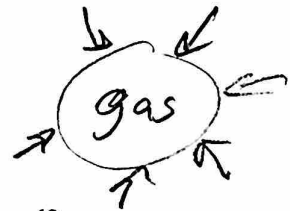
1. Label the liquid water, solid water, and gaseous water (water vapor) in the diagram below.
2. Label the arrows with their names (melt, evaporate, condense, freeze).
3. Label the arrows with the required change in energy (energy gain, energy loss)



Quick Review:

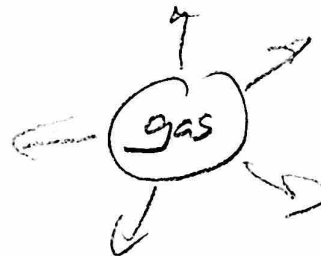
4. What happens to the temperature of a gas when the gas is compressed?

*Increases*

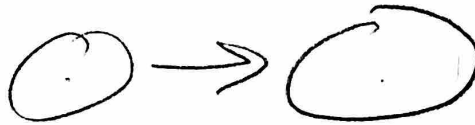


5. What happens to the temperature of a gas when the gas is allowed to expand?

*Decrease*



## Cloud formation at The Equator



*The Equator is one of the rainiest parts of the world. At the Equator, the Sun's rays warm the ocean's surface as well as the air near the ocean's surface. Explain how this warming of the ocean and the air above it causes cloud formation at the equator.*

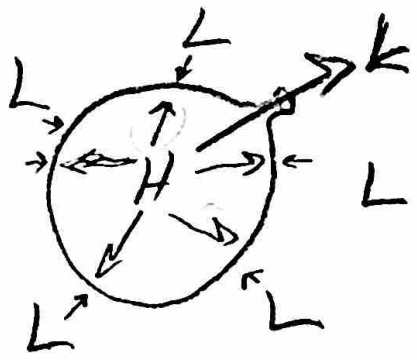
The warmth at the ocean's surface transfers heat to the ocean water, causing the speed of water and air molecules to increase (increase or decrease). Eventually, the water molecules have gained enough energy to evaporate (evaporate or condense). Their state of matter turns from liquid (solid, liquid, or gas) to gas (solid, liquid, or gas), and they leave the ocean to become an invisible part of the warm air near the ocean's surface.

Another effect of this increasing warmth near the ocean's surface is that the volume of the air that is heating at the Earth's surface begins to increase (increase or decrease). This change in volume causes the air's density to decrease (increase or decrease). This density change causes the air to rise (rise or sink).

As the rising air gets higher, it encounters lower (higher or lower) air pressure, because there is less (more or less) air above it. This change in air pressure causes the volume of the rising air to expand (expand or shrink). This expansion (expansion or compression) of the air causes the temperature of the air to decrease (increase or decrease). This new change in the temperature of the air causes the speed of the air molecules to decrease (increase or decrease). The change in molecular motion causes the water molecules to change phase (state) again from gas (solid, liquid, or gas) to liquid (solid, liquid, or gas). When this happens, tiny droplets of water form around specs of dust, creating clouds. At first the droplets are too small and light to fall to the ground. They fall so slowly that even gentle updrafts keep pushing them back up. Eventually, when enough individual droplets come together, they become big enough to fall fast enough to make it to the ground as rain.

Notes: Wind + Atmospheric Pressure

1.



2. ✓

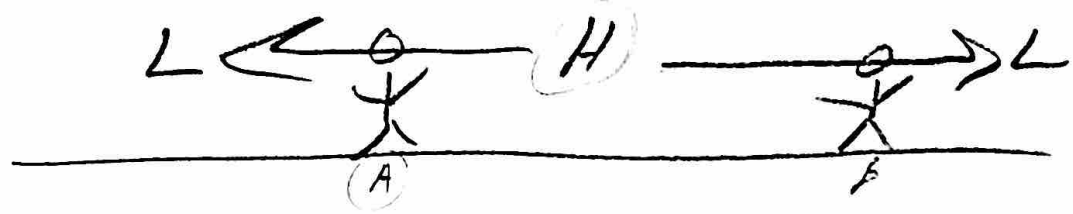


3. Moving air = Wind

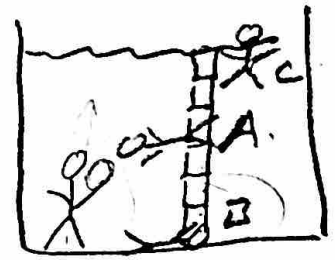
4. Air moves from High pressure to low.

5. Wind is caused by differences in air pressure. Wind blows from high to low pressure.

6.



7. Experience most water pressure

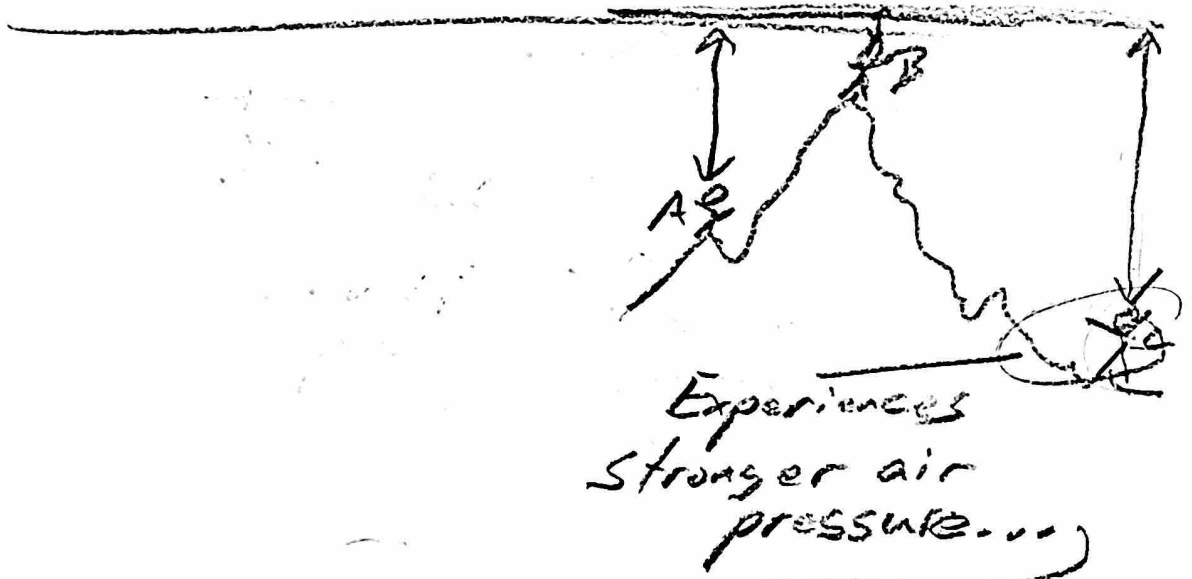


8. Water pressure is caused by the weight of the water on top of you. (water is heavy!)

9. Air has weight because it has mass.

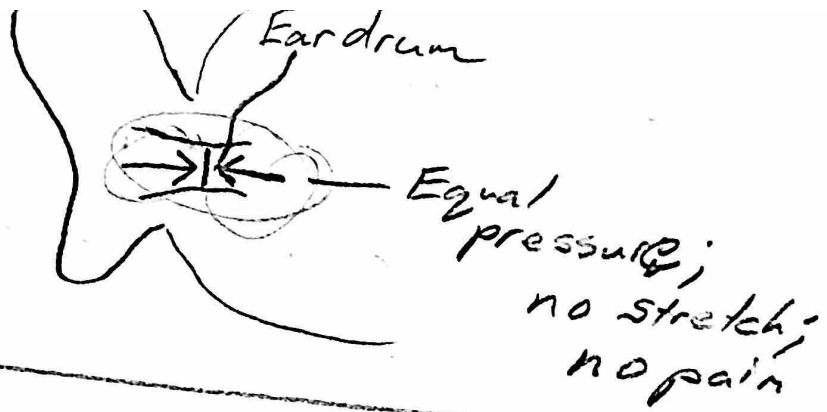
10. ~~Empty balloon~~  $\rightarrow$  3.0g  
Balloon filled with air  $\rightarrow$  3.5g  
Therefore, air has weight

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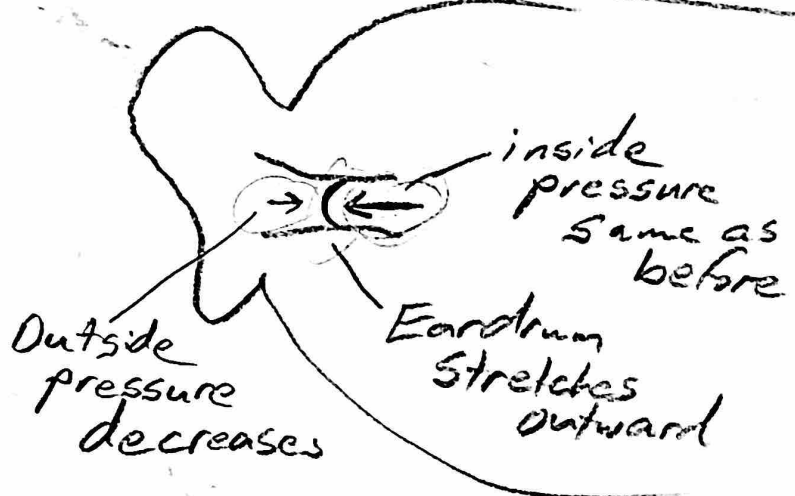


12.  $\rightarrow$  ... because <sup>person</sup> C has the most air on top of him/her. And because that air has weight!

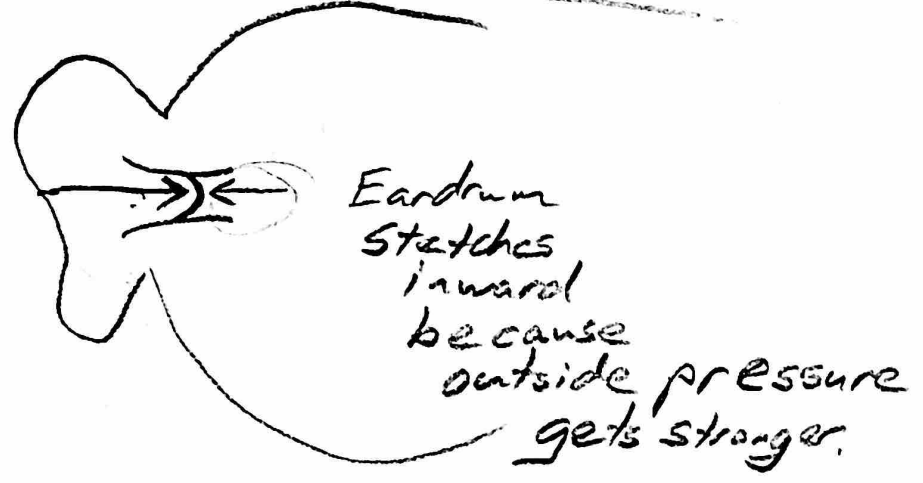
Normal  
Conditions



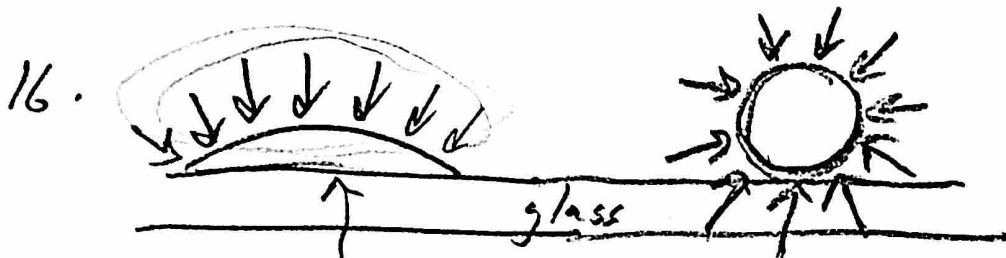
Ascending  
(rising)



Descending  
(downhill)

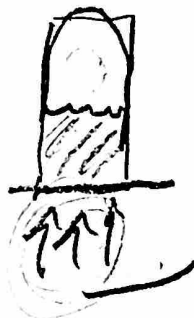


14. Average air pressure at  
 + 15 Sea level = 14.7 psi  
 ↑ ↑ ↑ inch  
 pounds per square

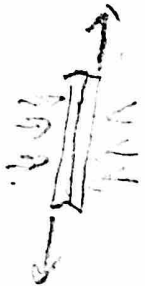


No air  
 beneath suction cup,  
 so air pressure only  
 pushes it toward  
 the surface (so it  
 sticks)

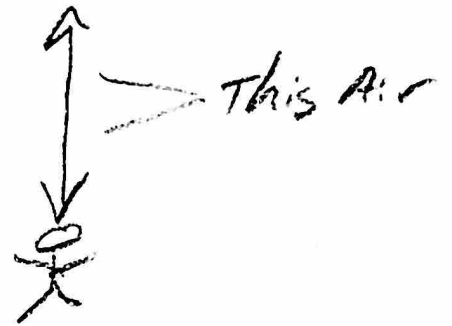
17.



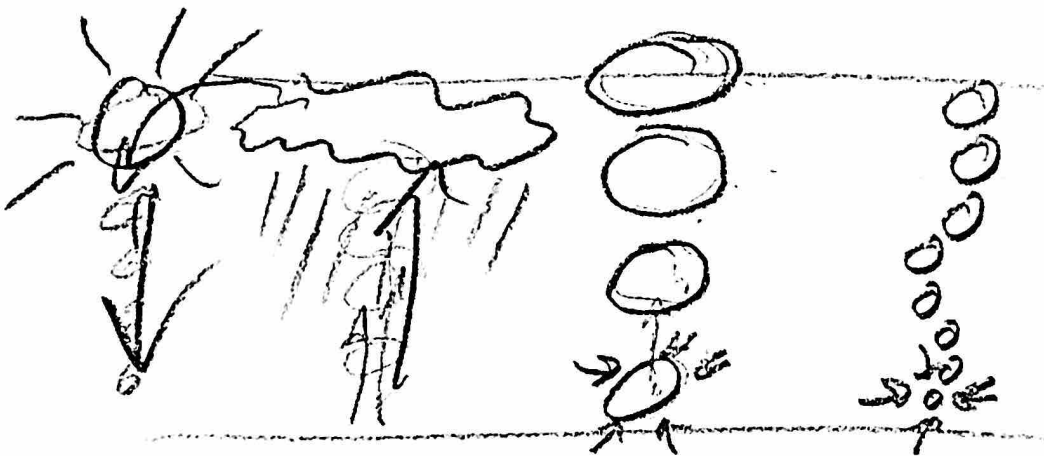
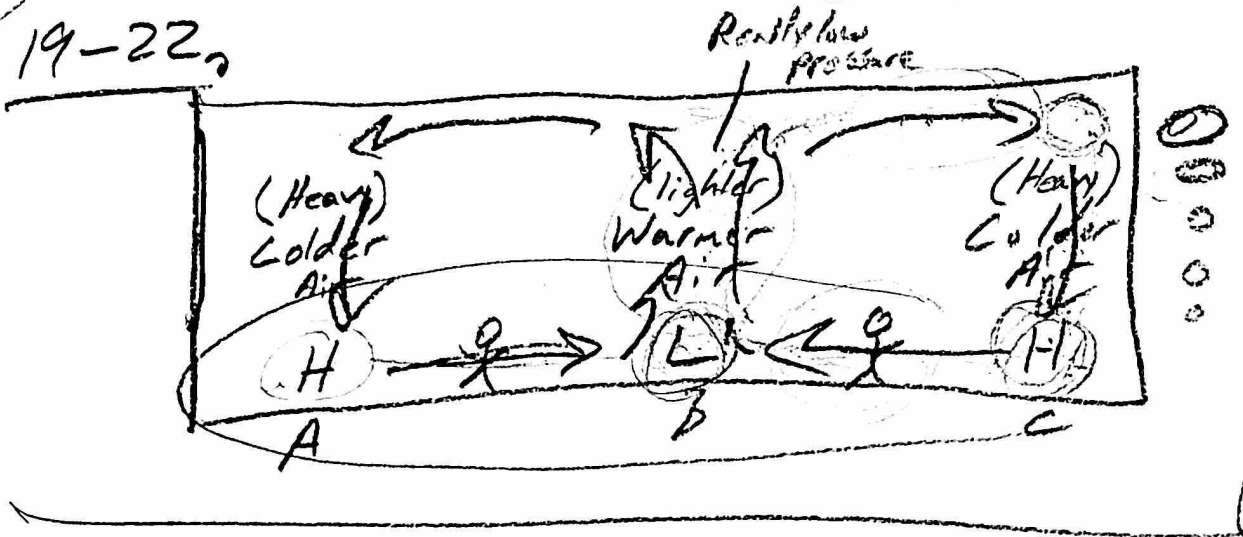
Air  
 pressure pushes  
 the card up, preventing  
 the water  
 from falling



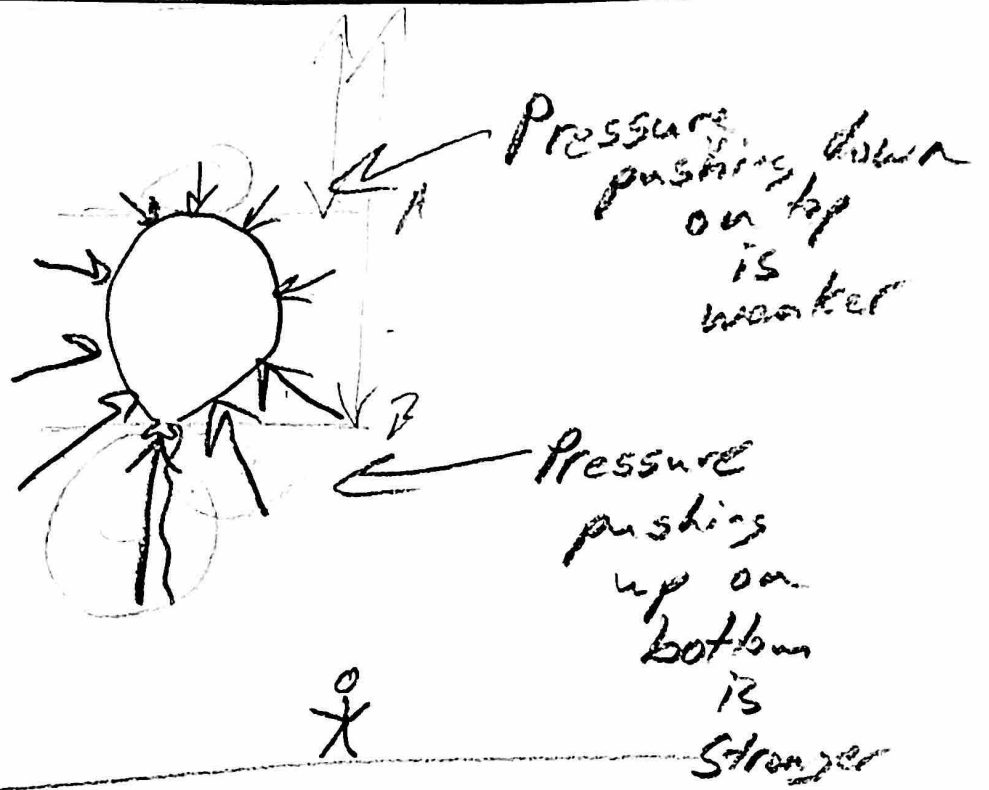
18. Atmospheric pressure is caused by the weight of the air above us



19-22



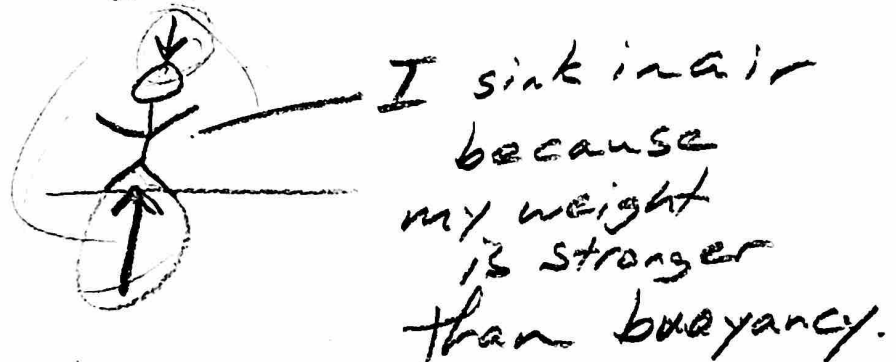
23.



24. This upward force is called buoyancy

25. Everything (in a fluid) experiences buoyancy.

26+27.



Dense things sink because they have more weight than buoyancy.