ESS 100 (Stapleton)
Meteorology Handout 1

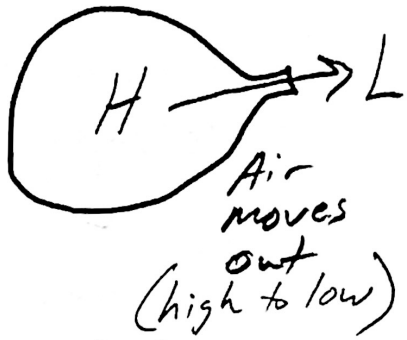
Name: Key

Notes: Wind, Atmospheric Pressure, and Buoyancy

Pressure Differences Create Winds

1. The picture on the right shows an inflated balloon. Label the air in and around the balloon to show where the air pressure is higher (H) and where it is lower (L).

2. Use an arrow to show how the air will move when the valve (hole) of the balloon is allowed to open.



3. Another name for moving air is horizontally wind.

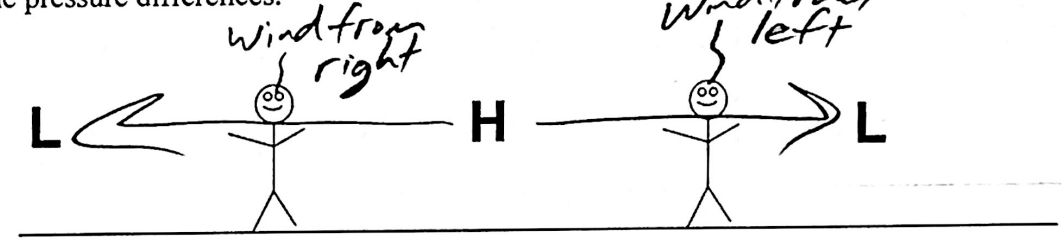
4. On the Earth, air moves because of differences in pressure. Does air move from low pressure to high pressure or from high pressure to low pressure?

High pressure to low pressure

5. Restate the information from above. Explain what causes wind, and explain what determines the direction of wind.

- Wind is caused by pressure differences at the Earth's surface.
- Wind blows horizontally from high pressure to low pressure

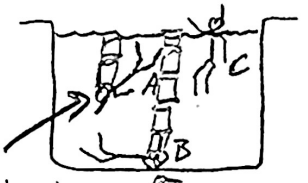
6. The diagram below shows areas of high pressure and low pressure. See if you can determine which person experiences a wind blowing from the left? Draw the winds that will be created by the pressure differences.



Atmospheric Air Pressure (pressure in the air around us)

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

B (Because B has the most water above them)



8. What causes the water pressure you feel when you dive?

Pressure is caused by the weight of the water above you.

2 Buckets of water above

1½ buckets of water above

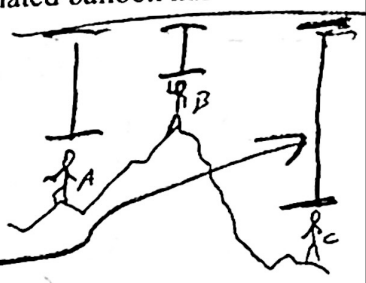
9. Does air have weight? Explain how you know.

Yes. Our atmosphere doesn't float away. Earth's gravity pulls it in.

10. Just to prove that air has weight, an empty balloon has a mass of 3 g. An inflated balloon has a mass of 3.5 g.

11. The picture on the right shows three mountain climbers. Who is experiencing the greatest air pressure?

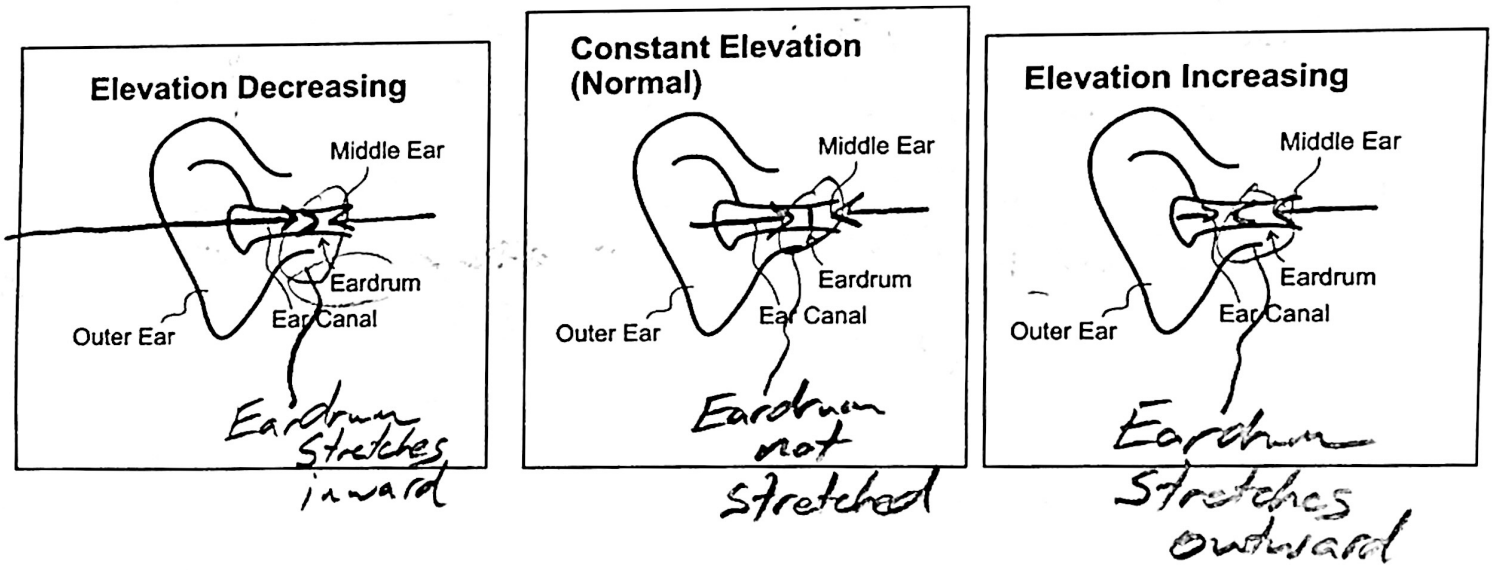
C



12. Explain why that person feels more air pressure.

C has the most air above them, so that air has the most weight

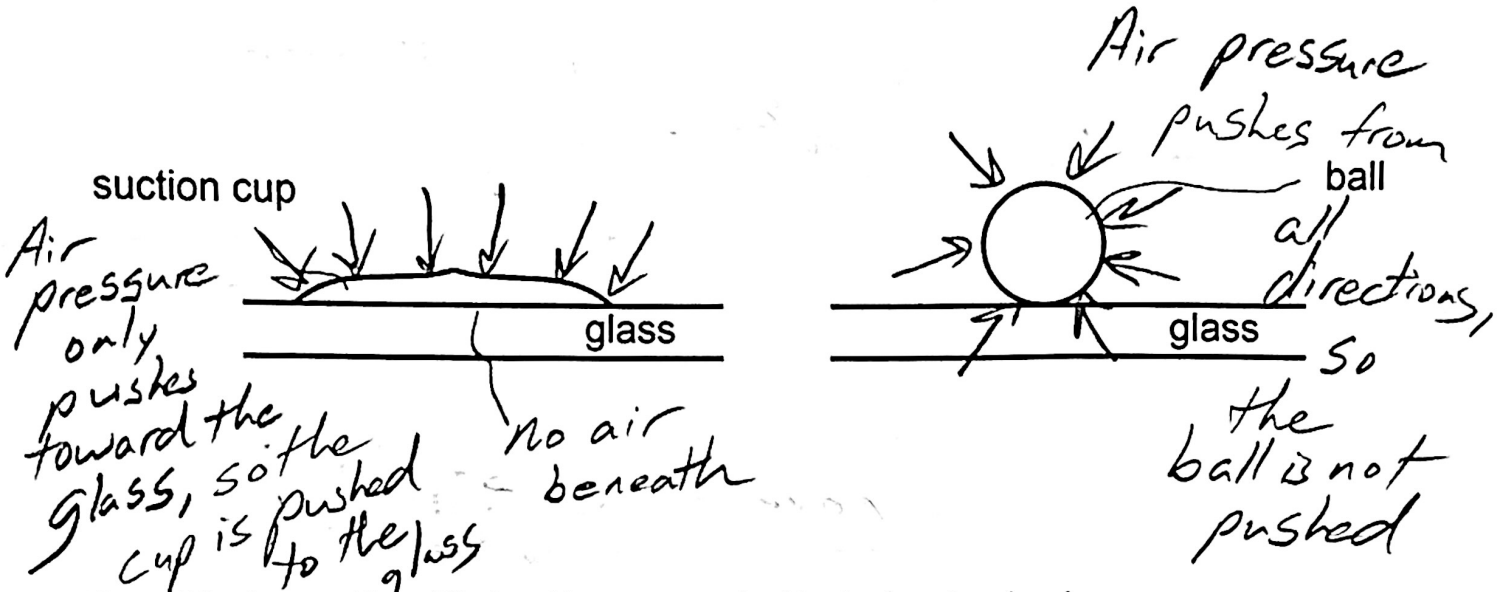
13. Show/explain why our ear drums hurt when we rapidly descend or rise to different elevations.



14. We are close to sea level. At sea level, the weight of the air above us creates an average air pressure of 14.7 psi

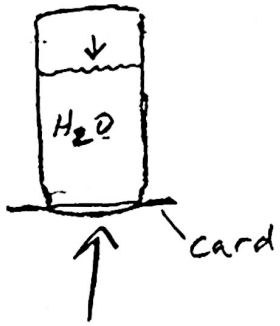
15. "psi" stands for pounds per square inch

16. Explain/show why a suction cup sticks to a glass surface and why a ball does not.



17. What happens if you fill a jar with water, cover it with a laminated card, and then turn the jar upside down? Explain why.

Air pressure pushes from all directions -- even up from below, keeping the card in place.



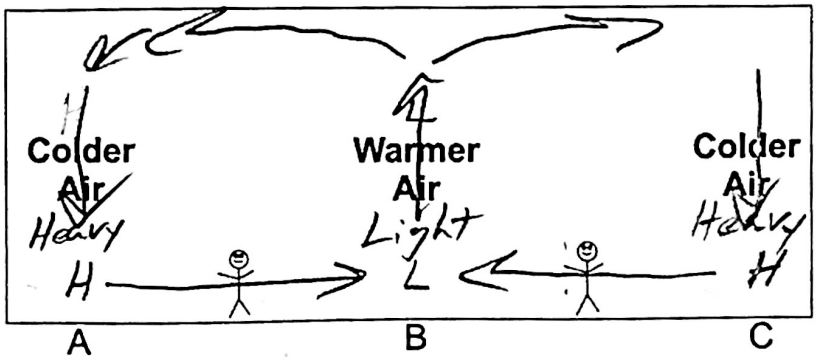
Winds Caused by Temperature Differences

18. Quick review… what causes atmospheric air pressure (pressure in the air around us)?

The weight of the air above us causes air pressure.

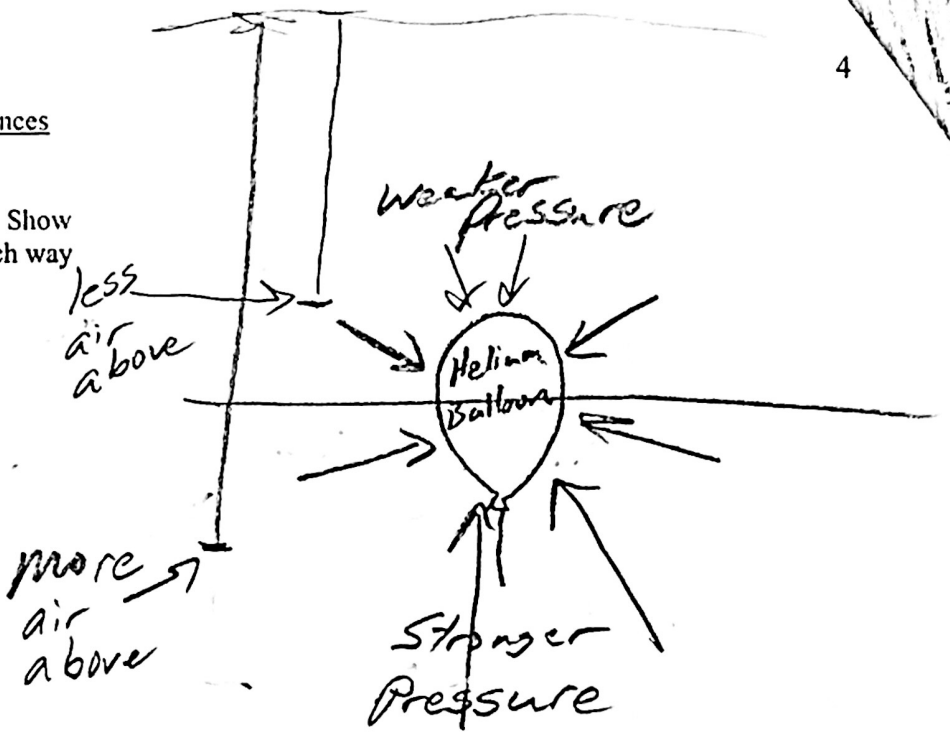
19-22. After your experience with plate tectonics, you should be able to draw the air currents that will form in the diagram below. But now we will figure out convection currents and winds using different reasoning.

19. Label each air mass "heavy" or "light."
20. Use the weight of the air to determine the amount of pressure beneath each air mass. Label each region below an air mass with either an H (high pressure) or an L (low pressure).
21. Use arrows to draw the winds that will be produced by these pressure differences.
22. Now use your knowledge of currents to fill in the rest of the currents in the diagram.



Buoyancy Is Caused by Pressure Differences

23. A helium balloon floats upward. Show and explain how it "knows" which way to go.

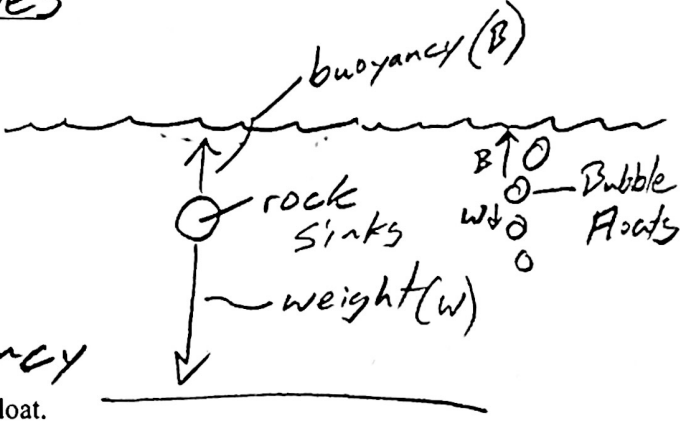


24. The upward force of pressure (that makes some things float) is called buoyancy.

25. Does everything around us experience buoyancy? yes

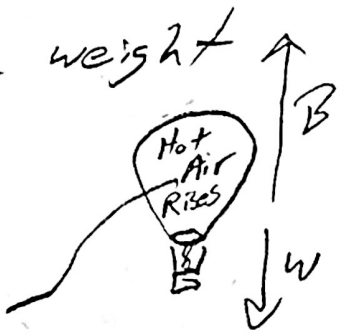
26. Why don't most things float?

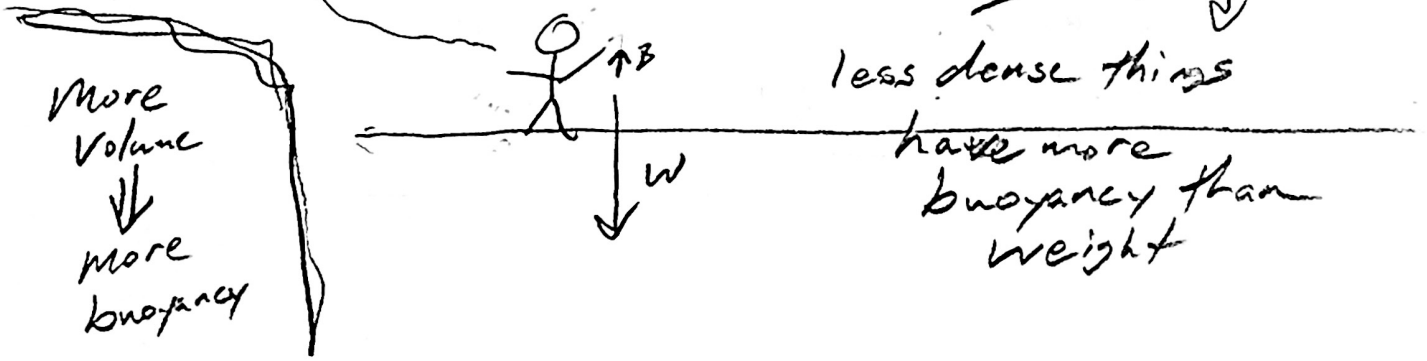
Most things have stronger weight than buoyancy



27. Explain why denser things sink and less dense things float.

Denser things have more weight than buoyancy.





Winds and Pressure Practice Questions

1. What causes wind?
Differences in pressure on Earth's surface.

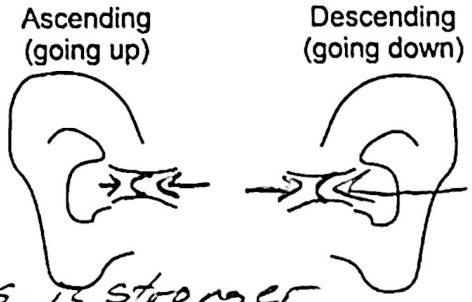
2. What determines the direction in which wind will blow?
Winds blow from higher pressure to lower pressure

3. Use arrows to show how the winds will blow in the diagram below.

4. What causes atmospheric pressure (the pressure in the air around us)?
The weight of the air above us

5. Where is air pressure stronger – at high altitudes or at low altitudes? Why?
Low altitudes, because there is more air stacked on top of us.

6. On the diagram to the right, show what happens to your eardrums when you rapidly go up or down in altitude.

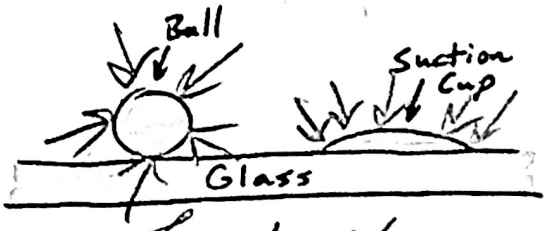


7. Explain why your eardrums are affected in this way.
Ascending: the pressure around us decreases, so the pressure in our heads is stronger
Descending: the pressure around us increases, so the pressure in our heads is weaker.

8. What does "psi" stand for?
pounds per square inch

9. What is the average air pressure at sea level (approximately)?
a. 1.5psi (b. 15psi) c. 150psi d. 1,500psi
14.7psi

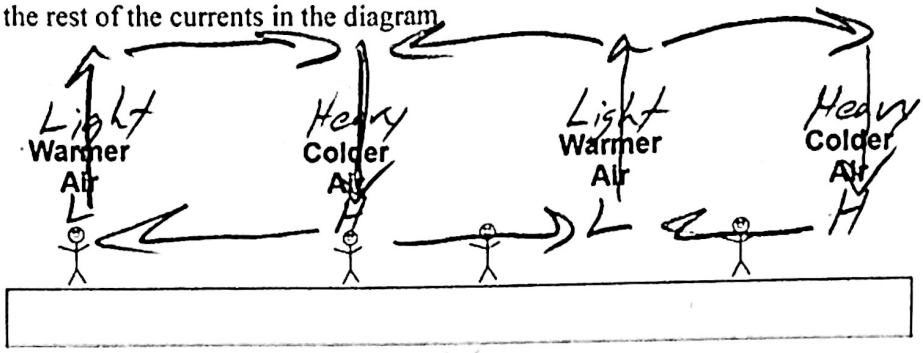
10. Use the diagram on the right to show/explain why a suction cup sticks to glass, but a ball doesn't.



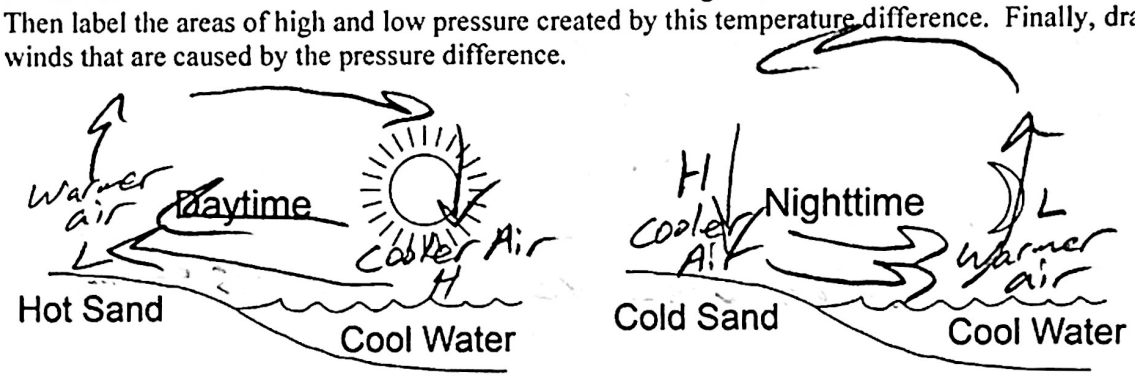
The suction cup doesn't have air between it and the glass, so it only gets pushed toward the glass.

The ball is pushed from every side, so the forces cancel.

11. In the diagram below…
    a. Label the "heavy" and "light" air masses
    b. Below the air masses, label the areas of low (L) and high (H) pressure.
    c. Use arrows to draw the winds that will be produced by these pressure differences.
    d. Fill in the rest of the currents in the diagram



12. At the beach, people often notice that the wind changes direction at night. This is because the sand gets hot during the day and cools off rapidly at night. This causes the air above the sand to also heat up during the day and cool off at night. During the day, the air above the sand is hotter than the water, but at night the air above the water is warmer than the sand. In each diagram, label the "warmer air" and "cooler air." Then label the areas of high and low pressure created by this temperature difference. Finally, draw the winds that are caused by the pressure difference.



13. Mountain peaks heat up and cool off much more quickly than valleys. This is because the peaks have more surface area exposed to the air around them. In the mornings, mountain peaks heat up faster than valleys, and in the evenings, mountain peaks cool off faster than valleys. This results in winds. In the diagrams, show the air temperature (warm or cool), pressure (high or low), and wind direction(s).