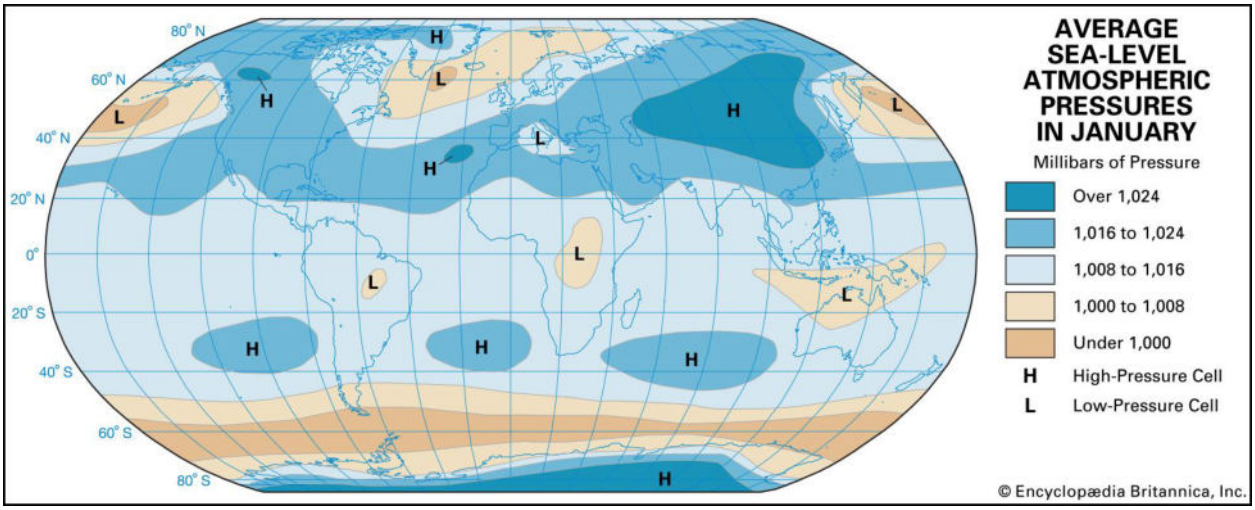
Pressure Systems and the Wind

Virtual Investigation

Air pressure systems - highs and lows - are produced by rising (lows) and sinking (highs) air masses. Air masses rise when they are heated. The most intense solar heating of Earth's surface occurs along the equator. This is why on the graphic below you see low pressure systems all along (or near) the equator.



This rising air expands due to the decrease in air pressure as the air mass rises in altitude. As it cools. This change in temperature due to a change in pressure is known as an **adiabatic** temperature change. As the air mass cools its density will increase and the air will begin to sink. This creates high pressure systems along or near the 30th parallel (30 degrees N or S of the equator). Other zones of low and high pressure continue as you move north or south, culminating with high pressure over both poles.

If air rising off the surface creates a low pressure system - this air must be replaced. The air sinking to the surface in a high pressure system rushes along the surface to replace the air rising from the surface in the low pressure system. These surface flows are our winds. The movement of the air is affected by the Earth's rotation. This influence is known as the Coriolis Effect. Winds are deflected to the right in the northern hemisphere and towards the left in the southern hemisphere. This deflection is the reason for the rotation that can be seen in the massive low pressure systems known as hurricanes. Watch this short video to learn more: https://www.youtube.com/watch?v=rdGtcZSFRLk. Turn on closed captioning and answer these questions as you watch the video:

1. Earth's constant rotation influences the way we view the trajectory of certain moving objects through what is called the ___.

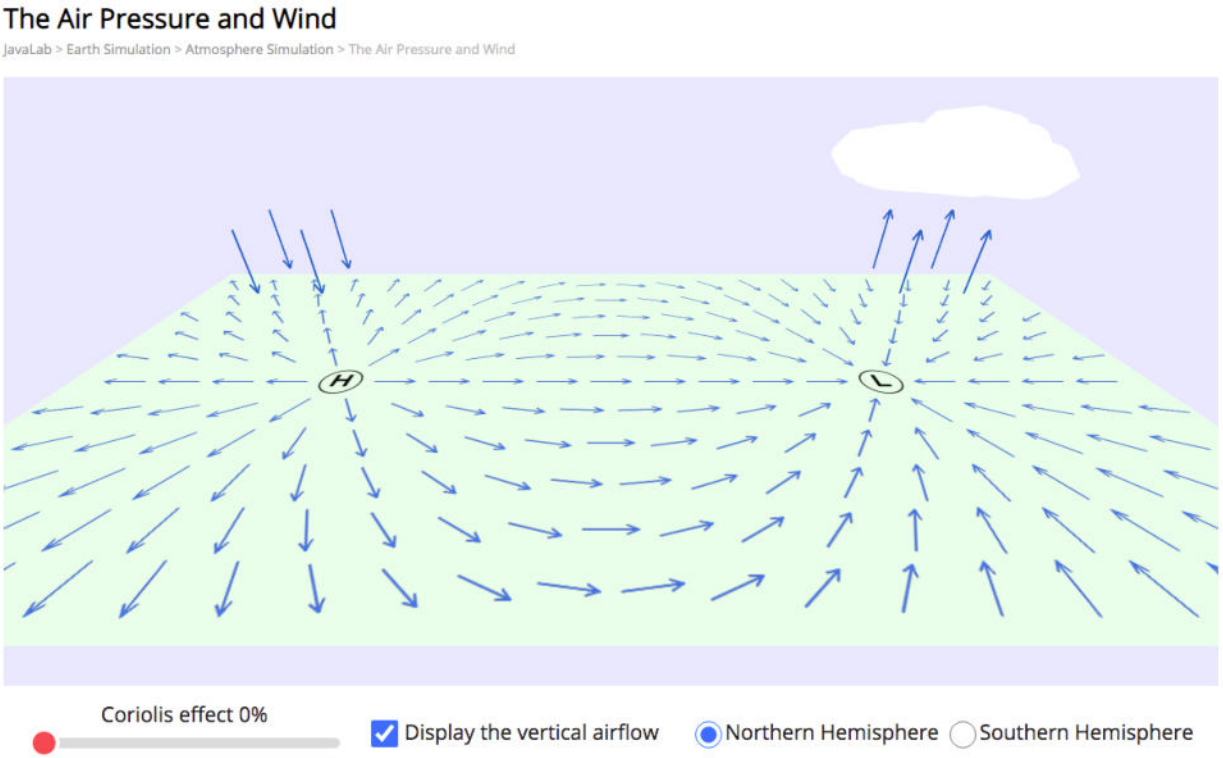
2. How fast does the Earth rotate at the equator?

3. Does it rotate faster or slower as you head north?

4. An object moving towards the north pole would appear to veer to the ___.
5. Do toilets flush water in opposite directions in the northern and southern hemispheres?
6. What did Hank call this idea?
7. What types of moving things are affected by the Coriolis Effect?
8. Which direction are winds deflected in the northern hemisphere? In the southern hemisphere?
9. So, weather systems in the northern hemisphere rotate _____.

You will be using an online app to explore highs and lows more. Go to this URL: https://javalab.org/en/air_pressure_en/

After you click the button to display the vertical airflow, you will see this on your screen:



You are given a high pressure system and a low pressure system. Arrows indicate the direction of air movement. The default settings are for the northern hemisphere and a Coriolis effect of 0%.

ANSWER THESE QUESTIONS BEFORE MOVING ON

1. What is the direction of vertical air movement in a low pressure system?

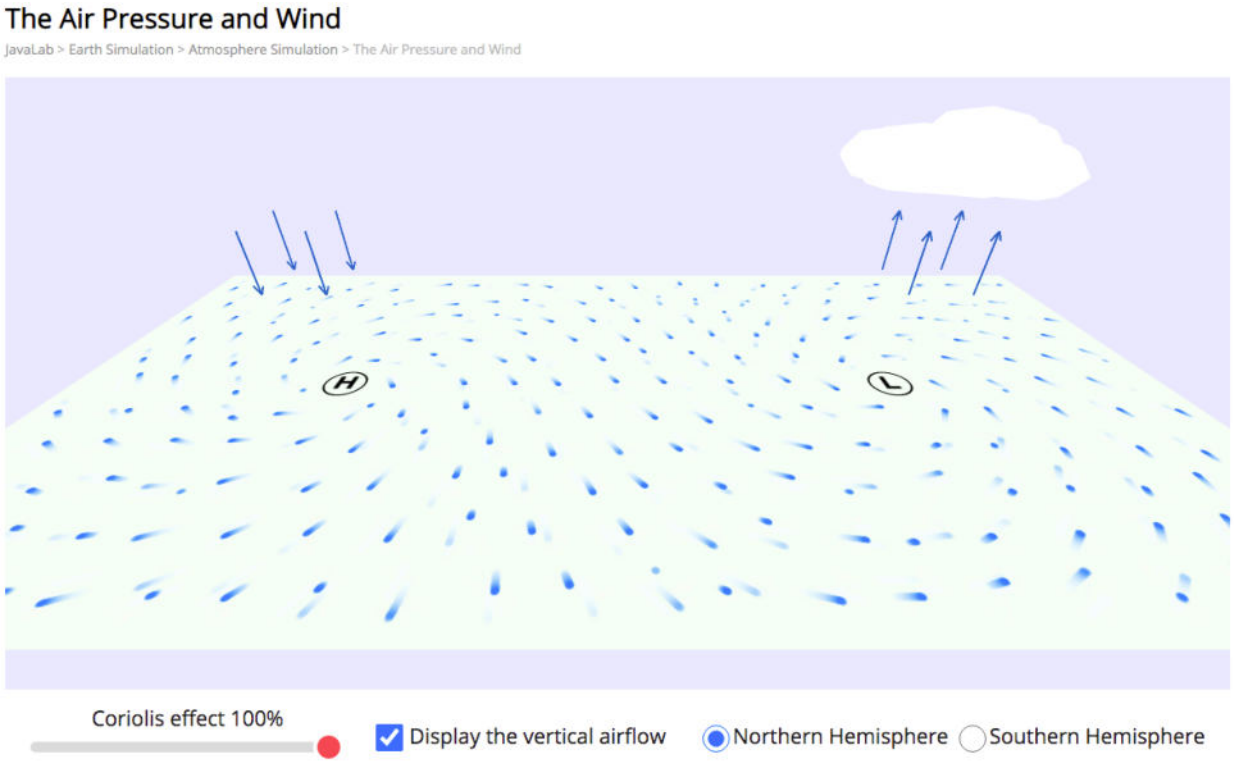
2. What is the direction of vertical air movement in a high pressure system?

3. Describe the surface flow of air between a low pressure system and a high pressure system.

4. Why do you think there is a cloud above the low pressure system but not above the high pressure system?

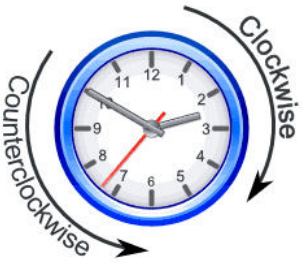
Now set the Coriolis effect to 100% by sliding the red dot to the right. Wait several minutes for the blue and red arrows to disappear.

You should see rotating blue dots swirling around the center of both pressure systems. They move very slowly, so you will have to watch for some time to really get a good sense of the rotation of air around these pressure systems.



FURTHER QUESTIONS

5. Does air flow clockwise or counterclockwise around the center of a low pressure system?



6. Does air flow clockwise or counterclockwise around the center of a high pressure system?

7. Summarize the movements of air at high and low pressure systems - both vertical flows and horizontal flows.