

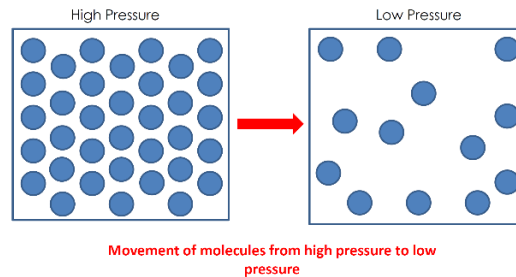
## 2025Q2

## AIR PRESSURE

It's time for another exciting Wind Study! This week, we're uncovering the secrets of air pressure and its role in generating wind that can be used for energy.

Atmospheric pressure is the weight of the air pressing down on everything on Earth. Atmospheric pressure is measured in pascals (PA), at sea level, the typical pressure is 101,325 Pa.

Atmospheric pressure is what creates wind and ultimately powers wind turbines. When there are both high and low-pressure areas, air molecules move from the high-pressure area to the low-pressure area to reach equilibrium or stability. This movement of air molecules is what we experience as wind. The strength of the wind depends on the difference between the high and low pressures—a greater difference results in stronger winds, while a smaller difference produces gentler winds.



How do you measure air pressure? With a barometer! A barometer contains a column of mercury that rises or falls as atmospheric pressure changes. But if you don't have a barometer, you can calculate air pressure using an equation:

$$P_h = P_0 e^{-gMh/RT}$$

$P_h$  = pressure at height (Pa)

$P_0$  = sea level pressure (Pa)

$M$  = molar mass of air (kg/mol)

$g$  = acceleration due to gravity ( $m/s^2$ )

$h$  = height (m)

$R$  = ideal gas constant (J/mol\*K)

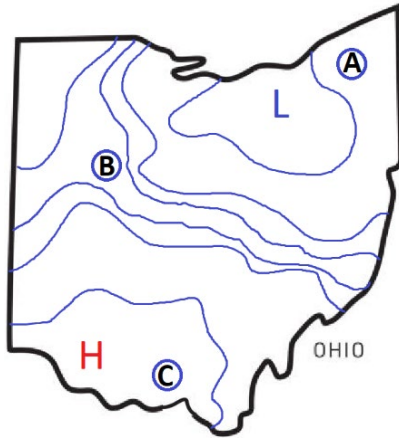
$T$  = temperature at altitude. (K)

Maps are used to visualize and analyze pressure over large areas. Isobars are lines on a map that are used to show areas of equal atmospheric pressure. When isobars are close together, it indicates a significant change in atmospheric pressure over a small area, which often leads to strong winds. "H" and "L" are used on maps to show regions of high- and low-pressure systems. The isobars closest to the "H" have the highest pressure and decrease as they become farther away from and closer to the "L" regions.

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## AIR PRESSURE

**Level 1:** Below is a map of high and low pressure for a specific day in Ohio. Using your understanding of air pressure, determine which region will likely experience the most wind. Explain why.



**Level 2:** Two wind turbines, A and B, were built at sea level. The air pressure (Pa) was recorded twice yesterday. Turbine B's hub reaches 50 meters in the sky, but Turbine A is taller. The morning temperature was 288.70 Kelvin, and it dropped to 278.15 Kelvin at night. Using the table and information provided determine the missing values.

<u>Turbine A</u>	<u>Variable</u>	<u>Turbine B</u>
?	h	50 m
100063.6 Pa	P <sub>1</sub>	?
100015.3 Pa	P <sub>2</sub>	100732.4 Pa
288.70 K	T <sub>1</sub>	288.70 K
278.15 K	T <sub>2</sub>	278.15 K
101352.9 Pa	P <sub>0</sub>	101352.9 Pa
8.314 J/mol*K	R	8.314 J/mol*K
9.8 m/s <sup>2</sup>	g	9.8 m/s <sup>2</sup>
0.0289 kg/mol	M	0.0289 kg/mol