Forces and Planetary Winds

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🦠 Introduction

What is wind? Is it a thing? Is it energy? Maybe you have considered these questions while outside on an especially windy day. What we think of commonly as wind is more specifically **atmospheric wind**, movements of air caused by differences in pressure between locations within our atmosphere. In this lesson, you'll learn about another kind of wind and apply your knowledge of Newton's Laws to understand how this kind of wind works and why it is important.

🦠 What To Do

Answer the analysis questions below, reading the Bite when instructed.

🦠 Analysis Questions

All of us living on Earth have experienced atmospheric winds—movements of air caused by differences in pressure between locations within our atmosphere. If you've ever witnessed the Aurora Borealis or "Northern Lights" light up the night sky, you may know that our sun also produces a stellar wind. **Stellar winds** are movements of charged particles flowing from a star's surface outward through the solar system. But did you know that planets can also produce winds that flow through a solar system, so-called **planetary winds**?

1. Match each of the following terms to the correct description.

A. Planetary winds   1. Charged particles that flow from a star's surface

B. Atmospheric winds   2. Movement of particles from a planet through a solar system

C. Stellar winds   3. Movements of gases inside a planet's atmosphere

STOP & read **Science Bite:**
Planets Pass Gas, Too

2. WASP-107b is an example of what astronomers call "hot Jupiter" planets.

    a. How is WASP-107b similar to Jupiter?

    b. How is WASP-107b different from Jupiter?

c. Mercury is the planet in our solar system closest to the sun. It is small, dense, and rocky with almost no atmosphere. During its day, the temperature on Mercury can reach 427°C (801°F).

   i. How is WASP-107b similar to Mercury?

   ii. How is WASP-107b different from Mercury?

3. Use Newton's Law of Universal Gravitation and the information in the table below to calculate the gravitational force of attraction WASP-107b exerts on a helium atom located at the outer edge of its atmosphere.

Quantity	Value
Mass of helium atom	6.65×10^{-27} kg
Mass of WASP-107b	2.28×10^{26} kg
Radius of WASP-107b	6.99×10^{7} m

4. How does the magnitude and direction of the force of attraction WASP-107b exerts on a helium atom compare to the magnitude and direction of the force attraction the same helium atom exerts on WASP-107b? Justify your response using physical principles.

5. A student claims "Newton's Law of Universal Gravitation contains a squared term. Jupiter is about 10 times more massive than WASP-107b, and 10 squared equals 100. So the force of attraction between Jupiter and a helium atom would be about 100 times greater than the force of attraction between WASP-107b and a helium atom." Do you agree or disagree with the student's claim? Justify your response.

6. Do you think humans could live on WASP-107b? Why or why not?

7. Use evidence and reasoning to explain why a planetary wind is more likely to be composed mostly of helium than mostly of oxygen.

8. **Connect to the Big Question.** How could the methods scientists used in this research be used to investigate whether there are other planets in the universe inhabited by humanlike beings?