Bernoulli's principle

The Bernoulli Principle states that an increase in the speed of a fluid results in an immediate reduction in pressure or potential energy of that fluid.

Put simply, a moving fluid has less pressure than if that fluid was not moving. This relationship was derived by Daniel Bernoulli, who was a Swiss mathematician and physicist. This is a form of the basic law of the conservation of energy.

Why is it important? This principle is used in many engineering applications, but it's power is no more visible than when we see aircraft zipping across the sky. The Bernoulli principle is the reason these very heavy machines can stay seemingly floating in the air. Aircraft wings are designed to slow the air that passes below the wing and speed up the air moving across the top. The result is that the air on the top of the wing is at lower pressure and the air under the wing is at higher pressure. The wing experiences a pushing up from below and a sucking up from above. The results are a large force on the wing lifting the vehicle. When this force is equal to the weight of the plane, the plane can fly at a constant altitude.

You might be asking "Why does this work with air when air is a gas?"

Air is a gas. But it is also a **fluid**. In physics, a fluid is considered anything that can readily conform to the shape of the container it is placed in. When you put liquid in a cup, it fills the cup completely up to the surface of the liquid. If the cup is empty, air fills the entire cup without any gaps. By contrast, if I drop a spoon (a solid) into the cup, it retains its shape and does not conform to the shape of the cup. Often we will use the term fluid in the same way as we use liquid. But if you talk to a physicist, you need to make sure you have your terminology correct.

Don't believe all of this? **Let's test it out.**

You will need a strip of paper about 6 inches long and about 1 to 2 inches wide. Roll the paper to create a curve so when the paper is placed on a flat surface it forms an arch.

Place the paper on a flat surface so it forms a smooth arch.

What would happen if you blow air under this arch? Looking at it, it is tempting to think that it will just blow away as the air pushes on it. But, because you know the Bernoulli principle, you might have a different guess. Blow a big puff of air so that the airstream is directed under the arch.

What happened to the paper? Did it blow away?

The paper is flattened down on to the table. The fast moving air has reduced its pressure and sucked the paper to the table. You have demonstrated Bernoulli's principle and can now explain how airplanes fly!