中華基督教會基全小學
CCC Kei Tsun Primary School
2026 一月號

STEAM 全創號 FRONTIER

科學小挑戰

你知道飛機為甚麼能飛上天空嗎？飛行的三大原理是：升力、阻力與重力。這些力量互相影響，決定飛機是否能夠起飛、飛行與降落。

– 試比較以下兩張機翼剖面圖，哪一種設計能產生更大升力？



圖A



圖B

圖A：平直翼面

圖B：上彎下平翼面

想一想：氣流經過不同形狀的翼面時，速度與壓力會有甚麼變化？

讓我再給你多些資料吧！

有聽過伯努利定律嗎？這是飛機能產生升力的關鍵原理之一。

瑞士物理學家丹尼爾·伯努利於1738年提出，在流體力學中，對於一條穩定、不可壓縮、無黏性的流線，流體的總能量（動能、位能、壓力能）保持不變。

$$\frac{1}{2}\rho v^2 + \rho g h + p = \text{constant}$$

也就是當液體流速越快時（動能增加），壓力便會減少；反之，當液體流速越慢時（動能減少），壓力便會增加，這就是著名的伯努利定律。

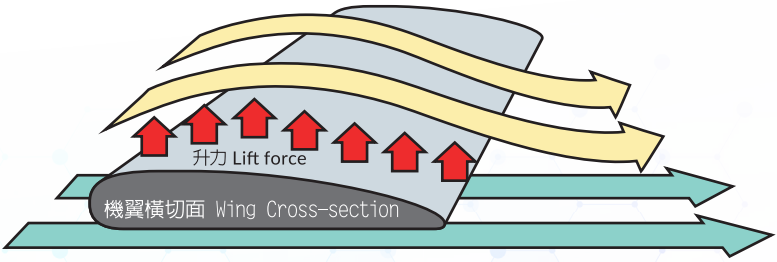
簡單理解：流體流得快的地方壓力低，流得慢的地方壓力高。

In other words, when a fluid flows faster (kinetic energy increases), its pressure decreases; conversely, when a fluid flows slower (kinetic energy decreases), its pressure increases. This is the famous Bernoulli's principle.

Simply put: Where a fluid flows faster, the pressure is lower; where it flows slower, the pressure is higher.

答案解說 Answer Explanation

速度較快 壓力較小 Higher speed, lower pressure.



速度較慢 壓力較大 Lower speed, higher pressure.

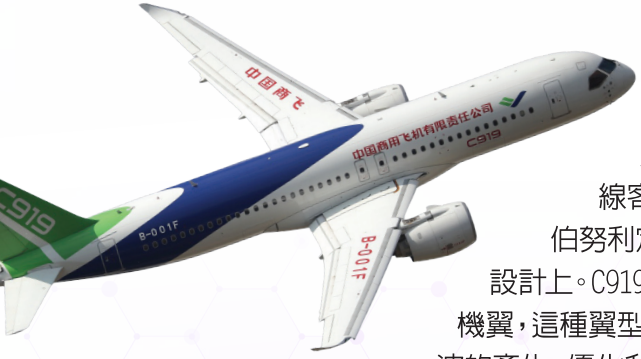
機翼上方表面弧度較大，空氣流速快，壓力較小；機翼下方表面較平，空氣流速慢，壓力較大。上下的壓力差形成「升力」，即向上推的力量，讓飛機能飛起來。

How Wings Create Lift - The curved top of a wing makes air move faster, lowering pressure above. The flatter bottom keeps air slower, creating higher pressure below. This difference pushes the wing upward — that's lift!



其實在日常生活中也能找到伯努利定律的身影。我們只需要準備一張長條形紙條，捏住紙條一端，讓它自然下垂。然後在紙條上方用力吹氣，你會發現紙條會向上飄起！這個原理就是上方空氣流速快，壓力變小，下方空氣壓力將紙條推向上，這就是伯努利效應的簡單演示。

Try It Yourself - Hold a strip of paper and blow over it. The paper will rise — just like a wing! Fast air above means lower pressure, and higher pressure below lifts the paper. This is Bernoulli's principle in action.



C919客機是中國首款按照國際適航標準研製的大型幹線客機，它的飛行原理深度應用了伯努利定律，尤其體現在其先進的機翼設計上。C919 特別採用了自主研發的超臨界機翼，這種翼型頂部較平、後部下撓，能推遲激波的產生，優化升力。而且與傳統翼型相比，超臨界機翼能顯著減少高速飛行時的阻力，提升 C919 的燃油效率和經濟性。截至2026年，C919 已進入大規模商業營運與產量提升階段，代表中國在大型民航客機領域打破西方壟斷，擁有航空自主能力。

C919 & Modern Wing Design - China's C919 passenger jet uses a supercritical wing — flatter on top and curved beneath. This design delays shock waves, reduces drag, and improves fuel efficiency. By 2026, the C919 is already flying commercially, marking China's achievement in advanced aviation technology.

C919杜拜航展中東首秀影片
C919 Airliner Flies at the Dubai Airshow

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January 2026 Edition

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Science Challenge

Do you know why airplanes can fly? The three main principles of flight are: lift, drag, and gravity. These forces interact with each other, determining whether an airplane can take off, fly, and land.

Compare the following two wing cross section designs. Which one can generate greater lift?



Image A



Image B

Image A: Flat wing surface
Image B: Curved upper surface, flat lower surface

Think about it: How do airflow speed and pressure change as air passes over differently shaped wing surfaces?

(Hint: According to Bernoulli's Principle, faster-moving air results in lower pressure.)